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# 2024 Independent Assessment of Carbon Pricing Systems

CANADIAN CLIMATE INSTITUTE
L'INSTITUT CLIMATIQUE DU CANADA

# About this report

In summer 2023, Environment and Climate Change Canada (ECCC) contracted the Canadian Climate Institute (the Institute) to conduct a second independent assessment of the effectiveness and stringency of carbon pricing systems across Canada. The Institute conducted a similar assessment in 2020–21.

ECCC consulted provinces and territories to define the initial scope of the assessment. The Institute and ECCC then agreed on the final scope, and the Institute developed a work plan to deliver the project.

The Institute conducted its work between summer 2023 and fall 2024. During that time, the Institute conducted multiple rounds of engagement with the federal government and the governments of every province and territory, to ensure that the information presented in the assessment is accurate and to test the reasonableness of the Institute's findings. The Institute also engaged several peer reviewers and consulted external experts. Any errors in the assessment are attributable to the Institute.

This report was submitted to the Government of Canada and it represents the findings of the Institute's independent assessment. This assessment does not include policy recommendations. The Institute has published its recommendations for modernizing carbon pricing systems in a separate summary report.



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# Summary

This report evaluates the effectiveness and stringency of carbon pricing systems in Canada as they stand in 2024. It updates and expands upon a similar assessment conducted in 2020–21.

The current report, called the 2024 Independent Assessment of Carbon Pricing Systems (2024 Independent Assessment), is part of the Government of Canada's commitment to conduct an interim review of the minimum criteria that apply to all carbon pricing systems across the country, known as the federal benchmark. In the federal government's own words, the goal of the interim review is to "confirm that the benchmark criteria are sufficient to continue ensuring that pricing stringency is aligned across Canada." Our mandate is to inform the interim review.

We assess carbon pricing systems through a series of indicators that provide insight into the emissions that carbon pricing covers, the stringency of the systems, the emissions reductions that they are expected to deliver, and the implications of carbon pricing for competitiveness. We find that:

- **Carbon pricing is effective.** Systems fulfil their primary purpose of reducing emissions, led by industrial carbon pricing systems, which we call *large-emitter trading systems*. Under existing policies, carbon pricing is projected to deliver between a third and a half of all emissions reductions attributable to climate policies in 2030.
- **Systems have harmonized since our last assessment.** Due in part to the requirements of the federal benchmark, we see greater alignment in coverage and stringency in 2024 than at the time of our last assessment in 2020–21, even though some governments have introduced temporary exemptions for certain heating fuels.
- **Some systems are at risk of becoming less effective in the future.** We find that the stringency—and therefore the effectiveness and alignment of carbon pricing systems—could erode in some jurisdictions by 2030. These systems may need to be strengthened to ensure that they can continue to function as intended.
- **Systems are mitigating competitiveness impacts.** Carbon pricing, especially large-emitter trading systems, have been designed to minimize negative competitiveness impacts. Systems are generally effective at containing costs, which other policies and subsidies further offset. Recognizing that small and medium-sized enterprises (SMEs) face different challenges compared to large emitters, the report explores the financial pressures on SMEs and the impact of revenue recycling.

- **Opacity threatens effectiveness.** In general, there are limited public data that illustrate the functioning of credit markets or that provide facility-level information, such as facility-specific performance standards. Greater transparency, particularly with respect to compliance data and credit prices, would provide more certainty and support market function.

While Canada's carbon pricing systems are making significant progress in reducing emissions and are more harmonized than in our previous assessment, challenges remain. Ensuring stringency, continuing to mitigate competitiveness impacts, and improving transparency are critical areas for ongoing and future policy development.

# 1 Introduction

In summer 2023, Environment and Climate Change Canada (ECCC) contracted the Canadian Climate Institute (the Institute) to conduct a second independent assessment of the effectiveness and stringency of carbon pricing systems across Canada.[1]

The purpose of this report, the 2024 Independent Assessment of Carbon Pricing Systems (2024 Independent Assessment), is to inform the Government of Canada's interim review of the federal carbon pricing benchmark. The federal government has committed to conducting this review by 2026. Its goal is to confirm that the federal benchmark criteria are sufficient to ensure that the stringency of carbon pricing systems is aligned across Canada in 2027–30.

This report on the effectiveness and stringency of carbon pricing is one of three analyses commissioned by the federal government as part of the interim review. The Government of Canada is also commissioning assessments of the impacts of carbon pricing on vulnerable populations, and of the impacts of carbon pricing on Indigenous communities. Those assessments are not being conducted by the Institute.

The mandate of the 2024 Independent Assessment is to evaluate the effectiveness and stringency of carbon pricing systems while considering their impacts on competitiveness. To deliver on this mandate, the Institute and its research partners conducted a detailed review of carbon pricing systems across Canada. We reviewed the legislation, regulations, and standards associated with each carbon pricing system, and verified our understanding of these systems with the federal, provincial, and territorial governments. We also interviewed a series of independent experts. Governments and experts were then invited to review and comment on drafts of the report.

The 2024 Independent Assessment contains the following elements:

- An update to the analysis of the 2020 assessment, including:
  - An overview of the changes to carbon pricing systems since the last assessment.
  - Updated indicators of sound program design, focusing on the coverage and stringency of carbon pricing systems.

1 The Institute also conducted the first independent expert assessment of carbon pricing systems for ECCC in 2020–21, referred to here as the 2020 Independent Assessment (Sawyer et al. 2021).

- New analysis focused on anticipated emissions reductions attributable to carbon pricing systems.
- A consideration of how other climate policies affect the effectiveness and stringency of carbon pricing.

An analysis of the competitiveness implications of carbon pricing, both for large emitters and small and medium-sized enterprises.

Readers should consider the following important points about the scope of this assessment:

- The 2024 Independent Assessment evaluates the carbon pricing systems that exist in Canada in 2024 using emissions data for 2021, which was the latest available when we conducted our analysis.[2] The lag in emissions reporting in Canada is a challenge for any evaluation of climate policy, even more so for this assessment, since Canada's carbon pricing systems have all undergone changes since 2021. Moreover, several carbon pricing systems that exist today have only recently come into effect, including a new system in British Columbia in April 2024. The analysis in this report accounts for these differences in several ways, as described later in the document.
- As we noted in the 2020 Independent Assessment, there is likely no optimal time to assess Canada's carbon pricing systems. The Canadian climate policy landscape is constantly shifting, and national emissions data are always lagging. Given these challenges, it is important to conduct assessments early in the policy development cycle, and to conduct them regularly.
- Finally, this assessment does not evaluate whether provincial or territorial carbon pricing systems meet the stringency requirements of the federal benchmark.

The report is structured as follows:

**SECTION 2** summarizes the history of carbon pricing in Canada and describes the carbon pricing systems that exist across the country.

**SECTION 3** explains the analytical approach of this assessment and describes the modelling that informs the analysis.

**SECTION 4** assesses the coverage and stringency of carbon pricing systems as they stand in 2024.

**SECTION 5** projects the impact of carbon pricing on emissions in 2030.

**SECTION 6** discusses how carbon pricing systems have been designed to protect the competitiveness of large emitters, as well as the risks facing the effectiveness and stringency of these systems.

**SECTION 7** explores the impact of carbon pricing on small and medium-sized enterprises.

**SECTION 8** presents the conclusions of this report.

2 Emissions data for 2022 were published while the analysis was nearing completion, too late to be included in the report.

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# Carbon pricing in Canada

## 2.1 Context

The 2016 Pan-Canadian Framework on Clean Growth and Climate Change established that carbon pricing would be a pillar of Canada's efforts to reduce greenhouse gas emissions. But it is not the only pillar. Across the federation, at all orders of government, there are hundreds of policies aimed at reducing greenhouse gas emissions (Canadian Climate Policy Partnership 2024).

Heterogeneity is a natural feature of climate policy within the Canadian federation. The country contains many jurisdictions that must each make their own policy choices, and their emissions come from an array of sources, requiring differentiated policies. The 2020 Independent Assessment distinguished between four classes of emissions-reducing policies: regulations, incentives, innovation programs, and carbon pricing. All governments in Canada have adopted different mixes of these policies. Given this range of policies, overlap is also an inevitable—and sometimes desirable—feature of climate policy architecture, particularly where economy-wide carbon pricing exists.

Though a full survey of Canadian climate policies is beyond the scope of the current assessment, it is worth noting some of the major developments since the last assessment.

The 2020 Independent Assessment was conducted at a transitional moment in Canadian climate policy. It was published in the months after the Government of Canada announced its strengthened climate plan, *A Healthy Environment and a Healthy Economy*, and shortly before the federal government legislated its commitment to achieve net-zero emissions in Canada by 2050 and announced its updated carbon pricing benchmark.

Since that time, Canadian climate policy has continued to evolve.

At the federal level, the government issued a new climate plan, the *2030 Emissions Reduction Plan*, in March 2022. In December 2023, the government issued its first report on progress toward Canada's 2030 target. Provinces and territories have also outlined new climate commitments and measures to fulfill them. Nine have stated at least an intention to achieve net zero. Furthermore, six provinces—Alberta, British Columbia, New Brunswick, Nova Scotia, Prince Edward Island, and Quebec—have adopted new or revised climate policy frameworks.[3]

3 British Columbia, Manitoba, New Brunswick, Newfoundland and Labrador, Nova Scotia, Quebec, and Yukon have committed to achieving net-zero emissions by 2050. Alberta has stated that it aspires to do the same. Prince Edward Island aims to achieve net-zero emissions by 2040.

## 2.2 The emergence of pan-Canadian carbon pricing

Canada-wide carbon pricing is still a relatively recent development. At the time of writing, national carbon pricing is five years old, with all jurisdictions being required to have a price on carbon as of 2019. The 2024 Independent Assessment refers to this arrangement of federal, provincial, and territorial carbon pricing systems as *the pan-Canadian approach*. This approach has been many years in the making.

Before broad-based carbon pricing was applied at a national level, it was part of the climate policy architecture in four provinces.[4] In 2007, Alberta and Quebec became the first jurisdictions to adopt carbon pricing systems; Alberta with a tradeable intensity standard for large industrial emitters,[5] and Quebec with a carbon levy that later became a cap-and-trade system (Government of Alberta 2018; Government of Quebec 2007a). British Columbia adopted an economy-wide carbon tax in 2008 (Government of British Columbia 2024a). Then, in 2015, Ontario committed to introducing a cap-and-trade system, which entered into force in 2017 but was repealed one year later (International Carbon Action Partnership 2018).

The move toward a national approach to carbon pricing began in the wake of the 2015 Paris Agreement. In March 2016, Canada's First Ministers issued the *Vancouver Declaration on clean growth and climate change*, which committed to a collaborative approach between provincial, territorial, and federal governments to reduce emissions. It also recognized the need for "fair and flexible approaches" from jurisdictions in reducing greenhouse gas emissions, given the diversity of provincial and territorial economies. Governments struck a series of working groups to report on policies that governments could adopt. The Working Group on Carbon Pricing Mechanisms delivered its final report in October 2016, outlining principles for a pan-Canadian approach to carbon pricing.

Based on the findings of the working group, in October 2016, the federal government outlined its own principles for a pan-Canadian approach to carbon pricing (Environment and Climate Change Canada 2016a). The key federal principles are as follows:

- Carbon pricing should be flexible and recognize carbon pricing policies already implemented or in development by provinces and territories.
- Carbon pricing should be applied to a broad set of emission sources across the economy.
- Carbon pricing policies should be introduced in a timely manner to minimize investment into assets that could become stranded and maximize cumulative emissions reductions.
- Carbon price increases should occur in a predictable and gradual way to limit economic impacts.
- Reporting on carbon pricing policies should be consistent, regular, transparent, and

4 Other provinces considered or proposed carbon pricing systems but did not adopt them.

5 Alberta subsequently replaced this system, the *Specified Gas Emitters Regulation*, with the *Carbon Competitiveness Incentive Regulation*, and developed a provincial carbon tax for covered fuels. See Figure 2 for a timeline of these changes.

verifiable.

- Carbon pricing policies should minimize competitiveness impacts and carbon leakage, particularly for trade-exposed sectors.
- Carbon pricing policies should include revenue recycling to avoid a disproportionate burden on vulnerable groups and Indigenous Peoples.

Along with these principles, the federal government also established the first carbon pricing benchmark, which sets minimum standards for the stringency of provincial and territorial carbon pricing systems. The federal benchmark is intended to reflect the principles. According to the Government of Canada,

> Its goal is to ensure that carbon pricing applies to a broad set of emission sources throughout Canada with increasing stringency over time to reduce [greenhouse gas] emissions at lowest cost to business and consumers and to support innovation and clean growth (Environment and Climate Change Canada 2016a).

The first federal benchmark outlined seven requirements for Canadian carbon pricing systems. Among other things, it recognized the validity of both price- and quantity-based approaches and required a common scope of emissions coverage as well as legislated increases in stringency. It also confirmed that the federal government would introduce its own carbon pricing system, known as the backstop, in any jurisdiction that did not meet the federal benchmark.

These developments paved the way for the *Pan-Canadian Framework on Clean Growth and Climate Change*, adopted in December 2016, in which most First Ministers affirmed that a national price on carbon pollution would be the first of four pillars of Canadian climate policy. The Government of Canada subsequently gave legal force to the federal benchmark and backstop through the *Greenhouse Gas Pollution Pricing Act* and its associated regulations. Under the Act, carbon pricing went into effect across the whole federation over the course of 2019.

## 2.3 The federal carbon pricing benchmark

Because federal, provincial, and territorial governments share jurisdiction over climate policy, pan-Canadian carbon pricing leaves room for all orders of government to take the initiative. Before the move to pan-Canadian carbon pricing, some jurisdictions developed their own systems. Under the *Greenhouse Gas Pollution Pricing Act*, all carbon pricing systems must meet the minimum stringency criteria of the federal benchmark.[6] Where jurisdictions do not meet the *federal benchmark*, the Government of Canada applies a federally developed carbon pricing system known as *the backstop*.

Although this assessment does not compare carbon pricing systems to the federal bench-

6 In a 2021 decision on the validity of the *Greenhouse Gas Pollution Pricing Act*, the Supreme Court of Canada ruled in favour of the law, finding that the federal government has the authority to set minimum national standards of greenhouse gas price stringency to reduce emissions.

mark, it is worth reviewing the minimum criteria that apply today. At the time of the 2020 Independent Assessment, the federal government required carbon pricing systems to meet the minimum stringency criteria of the benchmark it established in 2016. That is the benchmark described in the preceding section.

In August 2021, the federal government published an updated carbon pricing benchmark that applies from 2023 to 2030 (Environment and Climate Change Canada 2021b). Among other things, it requires jurisdictions to:

- Implement either an explicit, price-based carbon pricing system, or a cap-and-trade system.
- Where explicit, price-based systems exist, meet the minimum national price on carbon pollution, which was set at $65 per tonne in 2023 and rises by $15 each year to $170 per tonne in 2030.[7] At the time of writing in 2024, the price was $80 per tonne. Cap-and-trade systems must set declining emissions caps until 2030 that, at a minimum, reduce emissions to the same level that would be projected under an explicit price-based system.
- Apply a carbon price or cap to an equivalent percentage of greenhouse gas emissions from combustion sources as would be covered by the federal backstop. Output-based pricing systems and sectors that receive free allocations under cap-and-trade must also cover industrial process emissions.
- Not implement measures that directly offset, reduce, or negate the price signal sent by the carbon price or emissions caps, such as point-of-sale rebates.
- Only apply output-based pricing systems and free allocations where sectors are at risk of carbon leakage and negative competitiveness impacts from carbon pricing. Fuel distributors must not receive free allocations.[8]
- Where offset credits may be used for compliance, only allow credits that represent real, additional, quantified, unique, verified, and permanent emissions reductions.
- Publish regular, transparent reports on the features, outcomes, and impacts of carbon pricing systems. They should publish compliance information and market data where it "could enhance accountability."

The 2024 Independent Assessment assesses carbon pricing systems that were in place in Canada in that year. The federal government had assessed all these systems in 2022 (whether already in place or proposed) to determine whether they met the requirements of the updated federal benchmark. Some systems have undergone revisions since the federal assessment.

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7 The federal price schedule is not indexed to inflation, implying that the carbon price is rising at a fixed rate minus the rate of inflation.

8 In the 2020 Independent Assessment, we identified both practices—point-of-sale rebates and free allocations to fuel distributors—as significant risks to the effectiveness of carbon pricing systems.

## 2.4 The two components of carbon prices in Canada

Given that carbon pricing was first developed at a provincial level in Canada, and that the pan-Canadian approach to carbon pricing is intended to be flexible, it is not surprising that jurisdictions have adopted various approaches to pricing carbon. Nonetheless, there are also similarities between jurisdictions. One important similarity is that the carbon price in every jurisdiction contains two components:

- **A price on the carbon content of fuels** such as gasoline, diesel, and natural gas. This price is sometimes referred to as the *consumer carbon price*, though fuel distributors are the entities that are legally required to pay. The cost is typically then passed on at the point of sale—for example, at the gasoline pump.

  Carbon prices on fuels apply largely to emissions from fuels used by households, large institutional emitters like universities and hospitals, and small and medium-sized enterprises. In Canada, these carbon prices do not apply to emissions from certain fuels used for agriculture or fishing, or to some fuel use in Northern and remote communities. This carbon price also excludes fuels used by large emitters, including industrial facilities and most electricity generators. Instead, such emissions are covered by carbon pricing systems for large emitters.

- **A price on emissions from large emitters**, such as industrial facilities in the cement, chemicals, electricity, mining, oil and gas, pulp and paper, and metal manufacturing sectors. It is sometimes called the *industrial carbon price*. Carbon pricing can create a heightened competitiveness risk for large emitters that have emissions-intensive operations but are price takers in international markets where not all competitors face carbon costs. These emitters are known as emissions-intensive and trade-exposed, or EITE. One of the key design considerations for large-emitter carbon pricing is to minimize the risk that facilities will move to jurisdictions with less stringent controls on emissions—a phenomenon called carbon leakage—while maintaining an incentive to reduce emissions.[9]

  Large-emitter systems apply a price to the quantity of greenhouse gases emitted relative to a regulated limit. In cap-and-trade systems, the limit is an absolute, system-wide emissions cap, while in hybrid systems (see Section 2.5 below), the limit is typically expressed in terms of emissions intensity. If the facility emits less than the limit, it can generate credits that can be sold or banked for future compliance. If the facility exceeds the limit, it has multiple options to comply with the policy, such as reducing emissions, buying credits from another facility, obtaining approved offset credits, or paying the carbon price to the government.

  By pricing emissions relative to a limit, large-emitter systems reduce the average cost of emissions to a fraction of the carbon charge. Because these systems create

9 Electricity producers are an exception to this rule, since most electricity generation is not internationally traded and faces little risk of carbon leakage. Instead, electricity is covered by large-emitter carbon pricing to reduce cost pressures on electricity rates.

markets for tradeable emissions credits, we call them *large-emitter trading systems* (LETS).[10]

Every jurisdiction in Canada has a carbon price on fuels and a carbon price for large emitters (though Quebec is unique in pricing both through the same cap-and-trade market). Since these prices work differently, we retain the distinction throughout this report.

## 2.5 The three categories of carbon pricing systems in Canada

Canadian jurisdictions have adopted a range of carbon pricing systems. These systems all contain the two elements described above, but they can be further classified into three categories depending on how they incentivize emissions reductions.

***Price-based systems*** apply a carbon charge or tax on the carbon content of fossil fuels. Most carbon prices on fuels in Canada are price-based systems, such as the federal fuel charge or the British Columbia carbon tax. In contrast, few jurisdictions apply a purely price-based system to large emitters. Currently, the Northwest Territories carbon tax is the only example of a purely price-based system that applies to large emitters. Most jurisdictions instead use a hybrid approach to price these emissions, as this section details.

***Quantity-based systems*** are also known as *cap-and-trade systems,* since they set a limit—or cap—on covered emissions and create a market for tradeable emissions permits. Quebec is currently the only Canadian jurisdiction with a cap-and-trade system. The following is a general explanation of cap-and-trade systems; we describe the specifics of Quebec's cap-and-trade system in Section 2.6.5.

In cap-and-trade systems, regulated emitters must obtain permits for their emissions (here called allowances), and the regulator caps the number of permits at a level that is less than the expected quantity of emissions in the system. The cap thereby creates scarcity that drives demand for credits. The cap declines over time to incentivize continued emissions reductions.

Cap-and-trade systems can apply to both fuel distributors and large emitters. To reduce the risk of carbon leakage, large emitters receive free emissions units, known as free allowances. Each facility's compliance obligation—the quantity of emissions it must cover with allowances—is equal to its total covered emissions, but free allocation reduces the quantity of allowances that a facility might have to buy at the market price and therefore reduces the average cost of emissions. The level of free allocation may be based on a facility's or sector's emissions intensity and level of trade exposure. The quantity of free allowances generally declines over time.

The regulator may auction a portion of cap-and-trade allowances. The allowances are traded in a market designed by the regulator. The carbon price in the market is a function of various elements, including the level of the cap, abatement costs, and future expectations

10 For the sake of simplicity, elsewhere in this report we group the Northwest Territories' carbon tax for large emitters with large-emitter trading systems. However, the Northwest Territories' carbon tax for industry does not involve tradeable emissions credits.

about carbon costs and market conditions. Other design features, including banking (the retention of allowances), credit reserves, auction price floors and ceilings, and limits on the use and age of credits, also affect market function.

***Hybrid systems*** mix elements of price- and quantity-based carbon pricing to contain costs for large emitters. Most carbon pricing systems for large emitters in Canada are hybrid systems.[11]

Hybrid systems pair a fixed carbon price (the price-based element) with an emissions limit (the quantity-based element). Facilities are only liable for the carbon price if they exceed this limit. However, rather than imposing an absolute cap on a system-wide emissions, hybrid systems set performance standards (called *benchmarks* in this report) that incentivize facilities to reduce their emissions intensity.

The benchmark functions like free allocation by reducing the quantity of emissions that facilities must cover with purchased credits. Unlike in cap-and-trade systems, there is no limit on the quantity of credits that may be issued in these systems. Instead, facilities can obtain credits by outperforming the benchmark, through trading for credits or offsets, or by paying the fixed carbon price to the government. In theory, a system is designed to maintain demand for credits such that they trade at a cost that approaches the fixed carbon price.[12]

Hybrid systems set various kinds of performance standards, or benchmarks. Some benchmarks are based on the average emissions intensity for a given sector or product, thereby holding a group of facilities to a common standard. In some systems, emitters have facility-specific performance standards, requiring emitters to outperform their own emissions intensity relative to a reference year (usually historical). In the electricity sector, it is common for benchmarks to vary depending on the fuel used to generate electricity. Regulators may adjust benchmarks to account for the trade exposure or emissions intensity of a facility or sector.

Typically, benchmarks decline over time to maintain the price signal. As with other large-emitter systems, hybrid systems provide various compliance flexibility mechanisms to contain costs, including allowing emitters to bank credits and use offset credits. We describe compliance flexibility mechanisms in Section 6.1.

## 2.6 Overview of carbon pricing systems in Canada

This section summarizes each of the carbon pricing systems that exist in Canada. The summaries describe how each system covers or exempts sources of emissions, how it prices those emissions, and how carbon pricing proceeds are used.

11 For clarity, the *hybrid system* described here is unrelated to the same term that is used in the federal benchmark criteria. In this report, *hybrid system* has the definition given above, which we retain from the 2020 Independent Assessment. In the federal benchmark, *hybrid system* means a price-based system that combines a carbon levy on fuels with an output-based pricing system.

12 The federal benchmark requires provincial and territorial hybrid systems to maintain a marginal price signal at or above the minimum national price. The relevant indicator is that systems must demonstrate—through modelling—that the demand for tradeable credits exceeds the supply in a given year.

Carbon pricing systems in Canada are diverse and constantly in flux. In the 2020 Independent Assessment, we described five groupings of carbon pricing systems that existed across the country, combining different carbon pricing instruments developed by different orders of government. In 2024, we still see five groupings of carbon pricing systems, though the groups and their members have changed (Figure 1).

The descriptions below focus on carbon pricing systems that exist in 2024. The timeline in Figure 2 illustrates the systems that have been adopted over time in Canadian provinces and territories. It distinguishes between carbon prices on fuels and carbon prices for large emitters, here called *large-emitter trading systems* (LETS).

Figure 1:
## Groupings of carbon pricing systems across Canada

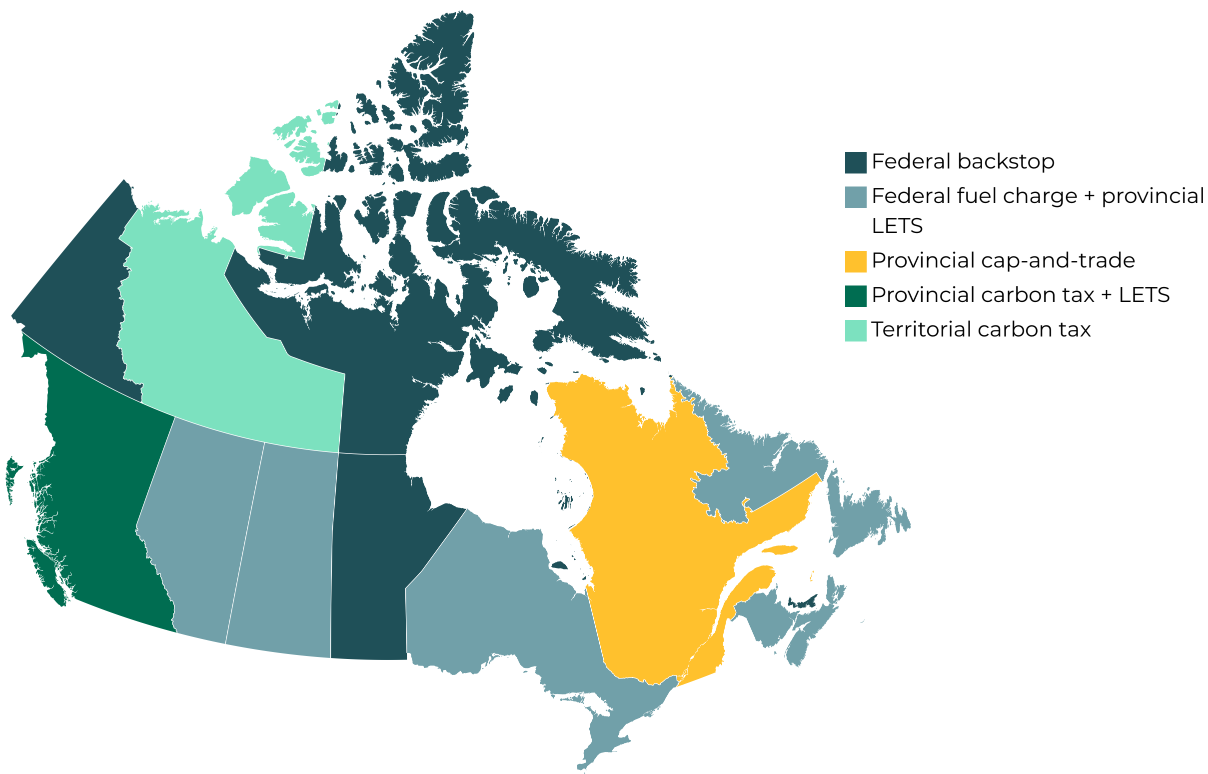
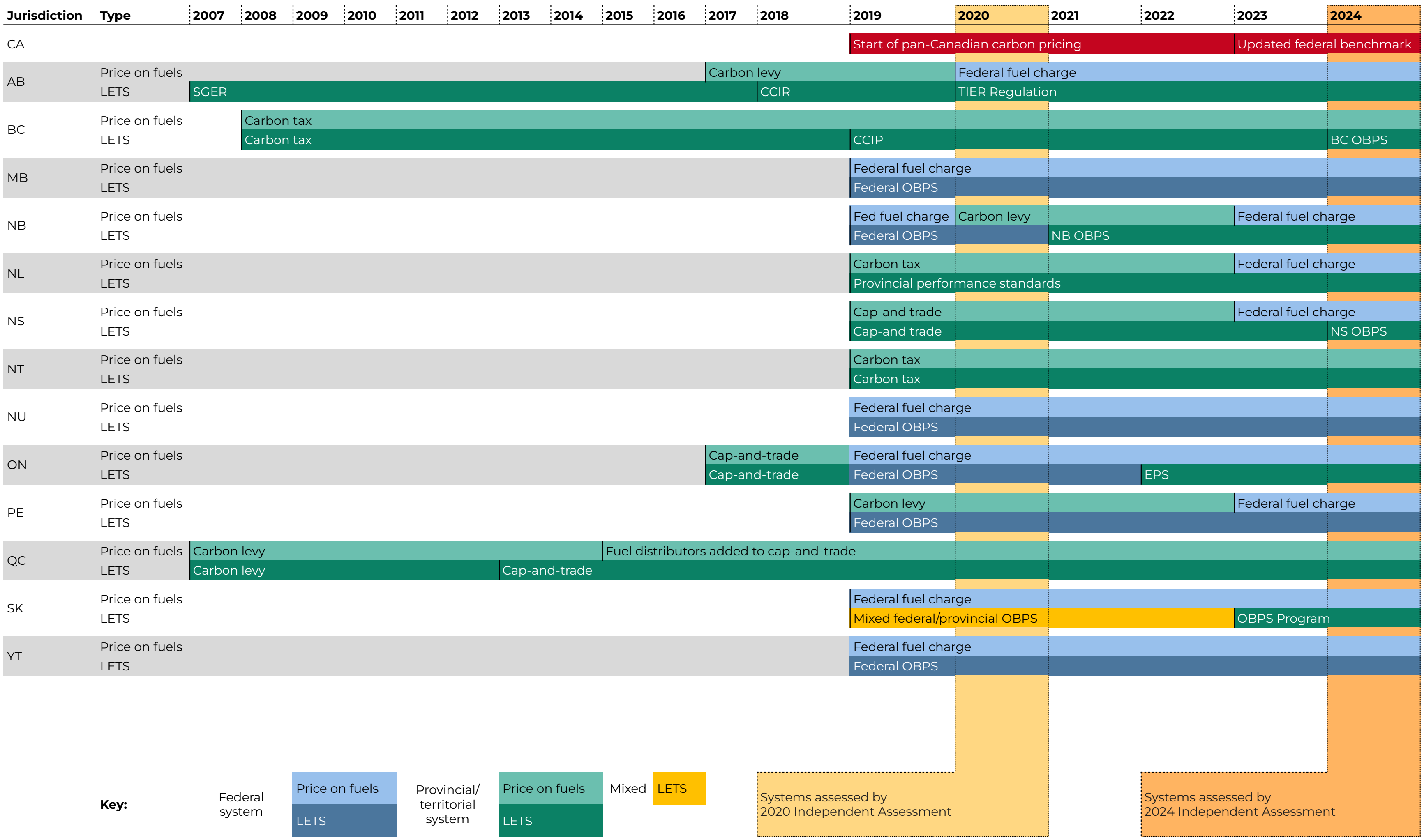


Figure 2:

# Timeline of carbon pricing systems in Canada




Note: In Alberta, SGER refers to the *Specified Gas Emitters Regulation* and CCIR refers to the *Carbon Competitiveness Incentive Regulation*. In British Columbia, CCIP refers to the *CleanBC Industrial Incentive Program*, OBPS means *Output-based Pricing System*, except in Saskatchewan, where OBPS Program refers to the Output-based Performance Standards Program. In Ontario, EPS refers to the *Emissions Performance Standards* program

### 2.6.1 Federal backstop

The federal backstop follows the bifurcated approach to pricing emissions that was described above. The backstop has two components: a carbon price on fuels known as the fuel charge, and a large-emitter trading system known as the Output-Based Pricing System (OBPS) (Government of Canada 2019; Government of Canada 2018; Statutes of Canada 2018).

The federal fuel charge applies a levy on fuels based on their carbon content.[13] Fuel distributors are responsible for paying the fuel charge, but can pass on the cost to the purchaser.

There are several exemptions from the fuel charge. It does not apply to fuels used by large emitters that are registered under industrial carbon pricing systems, including the federal OBPS. The fuel charge exempts gasoline or diesel used by fishers or farmers, fuel used as a raw material in an industrial process, or fuel used by remote power plants. For fuels consumed in commercial road and rail transportation, the charge applies only to fuel that is used within a backstop jurisdiction. For fuels used in commercial marine and air transportation, the charge applies only to journeys that take place within the same backstop jurisdiction.[14] Greenhouse operators are relieved of 80 per cent of the fuel charge rate on natural gas and propane used for greenhouse operations.

In fall 2023, the federal government temporarily exempted light fuel oil used for building heat from the fuel charge.[15] The exemption will be in effect from November 9, 2023, to April 1, 2027 (Canada Revenue Agency 2021).

The federal government returns fuel charge proceeds to their jurisdiction of origin through various programs. Where jurisdictions request the fuel charge, they can also request to have the proceeds transferred to the government. In Nunavut and Yukon, the revenues are returned directly to the territorial government. In all other jurisdictions where the fuel charge applies, the government returns proceeds through the following federal programming (Environment and Climate Change Canada 2022b):

- The Canada Carbon Rebate,[16] a tax-free, quarterly payment issued to individuals and families. The amounts vary by province. It consists of a base amount, plus a supplement for residents of rural and remote areas that corresponds to a 20 per cent top-up. As of 2024, this rebate will account for approximately 93 per cent of fuel charge proceeds.
- A tax credit for farmers that returns a share of the fuel charge that they pay on natural gas and propane.
- Co-developed programs that return proceeds to Indigenous governments. For the period from April 2020 to April 2024, the Government of Canada has committed to provide Indigenous governments with 1 per cent of proceeds collected. After April 2024, Indigenous governments will receive 2 per cent of the proceeds. The federal

13 Schedule 2 of the *Greenhouse Gas Pollution Pricing Act* lists the fuels and their charge rates.

14 As described below, there are additional exemptions for aviation fuel in the territories.

15 In this context, light fuel oil refers to heating oil and diesel.

16 Previously called the Climate Action Incentive Payment.

government returned proceeds collected before April 2020 through other programming in backstop jurisdictions.

- The Canada Carbon Rebate for Small Business is a refundable tax credit that will return carbon pricing proceeds collected between 2019–20 and 2023–24 to eligible corporations with 499 or fewer employees that operate in backstop jurisdictions. As of 2024, this rebate will account for approximately 5 per cent of fuel charge proceeds.
- Some fuel charge proceeds for 2019–20 were returned through previous federal programs, including the Climate Action Incentive Fund and the Energy Manager Program.

The federal Output-Based Pricing System, or *federal OBPS* (to distinguish it from similar provincial pricing systems) applies to emissions from large emitters. Specifically, it applies to facilities from specified sectors that emit 50 kilotonnes (kt) of carbon dioxide equivalent ($CO_2$e) per year or more. Facilities that emit between 10 and 50 kt $CO_2$e per year, are from eligible sectors, and want to avoid the fuel charge can apply to opt into the program.

Most sectors covered by the federal OBPS have product-specific benchmarks that are uniform regardless of the facility's own emissions intensity. However, some sectors have facility-specific benchmarks. Furthermore, the electricity sector has benchmarks that vary depending on the fossil fuel used to generate the electricity, while gas-fired electricity has two benchmarks depending on the age of the facility.

Facilities with emissions that exceed their benchmark must pay the carbon price for their excess emissions and/or remit surplus credits, federal offset credits, or eligible provincial offset credits. Facilities that outperform their benchmark earn credits that they can trade or bank for future compliance.

As with the federal fuel charge, jurisdictions that request the federal OBPS can opt to have proceeds returned directly to the government. The federal government transfers OBPS revenues directly to Prince Edward Island, Nunavut, and Yukon. Elsewhere, the federal government recycles federal OBPS revenues back to the jurisdiction of origin through the Output-Based Pricing System Proceeds Fund, which has two streams:

- The Future Electricity Fund, which uses proceeds from the electricity sector to support clean electricity projects. The proceeds will be returned through agreements between the federal government and the jurisdiction of origin.
- The Decarbonization Incentive Program, an application-based program to fund decarbonization projects in all other sectors.

The Government of Canada made several changes to the federal backstop since the 2020 Independent Assessment. Other than the introduction of the exemption on light fuel oil used for heating, most of these changes accompanied the introduction of the updated federal benchmark in 2023.[17] The most notable changes include:

17 See Section 2.3 for a description of the updated federal benchmark. Some of the changes to the OBPS entered into force retroactively on January 1, 2023, as they were adopted by regulations introduced in November 2023.

- The implementation of a new carbon price schedule, with the price rising to $65 per tonne in 2023 and by $15 annually until 2030, when the price reaches $170 per tonne.
- The introduction of a 1–2 per cent annual tightening rate on all federal OBPS benchmarks (except electricity).
- Updated rates for the fuel charge and updated benchmarks for the federal OBPS based on revised global warming potentials of various gases, as well as new approaches to calculating some benchmarks.

The full federal backstop (fuel charge and OBPS) applies in two provinces and two territories: Manitoba, Prince Edward Island, Nunavut, and Yukon.

**Manitoba** has fallen under the backstop since the start of national carbon pricing in 2019, because the province has not designed a carbon pricing system that meets the federal benchmark. The federal government recycles the proceeds from carbon pricing in Manitoba through the mechanisms described above.

**Nunavut** has been under the federal backstop since 2019 at the request of the territorial government. The federal backstop is designed to accommodate some of the unique circumstances of the North, where there are generally fewer options to abate emissions.

In Nunavut, as in the other territories, the carbon price for aviation fuels is $0 per litre. Furthermore, the backstop contains a “remote power plant” exemption for public electricity generators that are not connected to the main North American grid. This provision exempts all electricity generation in Nunavut from the carbon price.

At the territory’s request, the federal government returns all carbon pricing proceeds to the Government of Nunavut to distribute. Nunavut uses remitted proceeds for:

- The Nunavut carbon credit, a quarterly cost-of-living payment administered by the Canada Revenue Agency.
- A Homeowner Fuel Rebate of $1,000, offered in 2023 and 2024.
- An increase to the basic personal amount for personal income tax in Nunavut from $13,325 to $16,000.
- An increase to the cost of living tax credit for all in-Nunavut workers, from $1,200 to $1,500.
- A reduction in the territorial corporation tax rate from 4 per cent to 3 per cent.
- Planned but yet-to-be-determined investments in low-carbon, energy-efficient technologies.

**Prince Edward Island** fell fully under the federal backstop in July 2023, when the federal fuel charge replaced the provincial carbon levy. The federal OBPS has applied in the province since 2019 at the province’s request. The federal government returns the proceeds from the fuel charge through the federal programs described above and remits proceeds from the federal OBPS to the Government of Prince Edward Island.

**Yukon** has been under the federal backstop since 2019 at the request of the territorial government. As in Nunavut, the backstop's exemptions for northern aviation fuels and remote power plants leave emissions from aviation and electricity generation uncovered in Yukon.

Yukon returns carbon pricing proceeds through the Yukon Carbon Rebate Program (Statutes of Yukon 2019). This program issues rebates to five categories of recipients: general businesses, mining businesses, Yukon individuals, municipal governments, and First Nations governments. Each category receives a pre-determined share of carbon pricing proceeds, with the goal of returning more proceeds to recipients than they pay in carbon levies. The territorial government, federal government, and visitors to Yukon do not receive rebates (Government of Yukon 2023).

### 2.6.2 Federal fuel charge and provincial large-emitter trading system

Six provinces combine the federal fuel charge with a provincial large-emitter trading system.

This section focuses on the design features of provincial LETS, since the fuel charge applies in the same way in each of the following jurisdictions. The federal government returns fuel charge proceeds to these provinces through the programs described in Section 2.6.1.

**Alberta** has been under the federal fuel charge since January 2020, after the province eliminated its carbon levy on fuels in May 2019.

Alberta's LETS is called the Technology Innovation and Emissions Reduction Regulation (TIER). It entered into force in January 2020,[18] replacing the previous provincial LETS, the Carbon Competitiveness Incentive Regulation, which itself replaced the Specified Gas Emitters Regulation (Government of Alberta 2019).

TIER automatically applies to facilities that emit more than 100 kt $CO_2e$ per year or facilities that import more than 10 kt of hydrogen annually. Facilities with emissions of at least 2 kt $CO_2e$ per year can opt in if they are deemed EITE, while any facility can opt in (and be exempted from the fuel charge) if it competes directly with a TIER facility.

TIER calculates compliance emissions using both facility-specific benchmarks, based on historical emissions intensity, and product-based "high-performance benchmarks." Most facilities can choose to be regulated under either type of benchmark, but electricity, heat, and hydrogen facilities must use the high-performance benchmarks. TIER permits facilities to request revised benchmarks under various circumstances. In addition, if compliance costs exceed 3 per cent of a facility's sales or 10 per cent of its profit, the facility can apply for relief from TIER's Compliance Cost Containment Program.

Facilities that do not meet their benchmark can meet their compliance obligation by using banked credits, purchasing credits from other facilities, obtaining provincial offsets, or paying into the TIER Fund at the carbon price, which matches the national price that rises to $170 per tonne in 2030.

18 The rules of the current system are laid out in the TIER Regulation and associated standards published by the Government of Alberta.

Proceeds from TIER are used for various purposes, including funding industrial emissions reductions, infrastructure spending, and debt reduction. As of 2024, in any year when TIER revenue exceeds $100 million, 25 per cent of the excess amount will be directed to the Alberta Carbon Capture Incentive Program (Government of Alberta 2024a).

Alberta modified TIER in several ways since the 2020 Independent Assessment, including by adopting the revised national price schedule; increasing the scope of covered emissions; and introducing new tightening rates, a revised opt-in threshold, and new compliance mechanisms such as carbon sequestration credits.

**New Brunswick** had the federal fuel charge applied in July 2023, replacing the provincial carbon levy. The federal fuel charge had previously applied in the province from April 2019 to November 2020.[19]

New Brunswick prices emissions from industrial facilities using a provincial OBPS that came into force in January 2021. This system applies to industrial facilities with emissions of more than 50 kt $CO_2$e per year, while facilities with emissions of at least 10 kt $CO_2$e per year can opt into the system.

Facility-specific benchmarks govern most facilities, except electricity generators. Some highly EITE facilities and certain facilities that use biomass for a large share of their energy are eligible for adjustment factors that loosen their applicable benchmarks. There are also provisions for facilities to request revised benchmarks.

Facilities that do not meet their benchmark must compensate with earned or traded performance credits, purchased fund credits, or provincial offsets. However, there is currently no process to earn offsets in New Brunswick.

Proceeds from the New Brunswick OBPS are allocated to the provincial Climate Change Fund, which can be used for various purposes, including emissions-reducing projects.

**Newfoundland and Labrador** had the federal fuel charge applied in July 2023, replacing the provincial carbon tax. Industrial emissions have been priced under a provincial LETS since 2019.

Newfoundland and Labrador's LETS applies to facilities that emit 25 kt $CO_2$e per year or more. Facilities with emissions of at least 15 kt $CO_2$e per year can apply to opt in (Government of Newfoundland and Labrador 2018; Statutes of Newfoundland and Labrador 2016).

Facilities in Newfoundland and Labrador's system are subject to facility-specific benchmarks. The system also contains a fixed crediting schedule for the thermal oil-fired Holyrood Generating Station. Facilities can meet their compliance obligation using performance credits or by buying fund credits from the government at the scheduled carbon price.

Starting in 2022, all onshore facilities must meet at least 20 per cent of their compliance obligation either through direct emissions reductions on-site or by buying fund credits at four times the carbon price.  This last measure is intended to incentivize facilities to achieve

19 The 2020 Independent Assessment evaluated New Brunswick's provincial carbon levy.

a minimum share of their compliance obligation by abating on-site emissions, rather than by solely submitting credits at the carbon price.[20]

Proceeds from the Newfoundland and Labrador LETS are deposited into the Newfoundland and Labrador Greenhouse Gas Reduction Fund. The fund must be used to support emissions-reducing projects and to cover the administrative costs of the fund.

**Nova Scotia** adopted a provincial OBPS in January 2023 and had the federal fuel charge applied in July 2023. These measures replaced the province's previous cap-and-trade system.

The Nova Scotia OBPS applies to facilities that emit 50 kt $CO_2e$ per year or more, while facilities that emit at least 10 kt $CO_2e$ per year can opt in (Government of Nova Scotia 2023a; Government of Nova Scotia 2023b; Government of Nova Scotia 2024; Statutes of Nova Scotia 1994).

Facility-specific benchmarks govern most facilities, with different tightening rates depending on whether a facility is considered EITE. Like the federal backstop, the Nova Scotia OBPS has electricity sector benchmarks that vary depending on fuel type, and, for gas-fired electricity, on the age of the facility.

Firms that do not meet their benchmark must compensate with earned or traded performance credits, purchased fund credits, or provincial offsets. However, there is currently no process to earn offsets in Nova Scotia.

Proceeds from the Nova Scotia OBPS are allocated to the provincial Climate Change Fund, which can be used for various purposes, including emissions-reducing projects.

**Ontario** has had the federal fuel charge since 2019. As of January 2022, the province has its own carbon pricing system for large emitters, known as the Emissions Performance Standards program.

The Emissions Performance Standards program applies to facilities from specified sectors that emit 50 kt $CO_2e$ per year or more. Facilities that emit between 10 and 50 kt $CO_2e$ per year can opt into the system if they are from eligible sectors (Government of Ontario 2022b; Statutes of Ontario 1990).

The Emissions Performance Standards program establishes six methodologies for establishing benchmarks. The standards contain facility- and product-specific benchmarks depending on the sector, while fossil-fuel-fired electricity and heat production have their own benchmarks. In response to the updated federal benchmark, Ontario applied a strengthened benchmark to fossil-fuel-fired electricity and added steeper tightening rates to all other benchmarks.

Facilities that do not meet their benchmark must compensate by paying for excess emissions at the carbon price or by supplying earned or traded performance credits. There are currently no offset provisions in Ontario's system.

20 The provision does not apply to offshore facilities. Offshore facilities are subject to annually declining flaring limits imposed by the Canada-Newfoundland and Labrador Offshore Petroleum Board.

The Emissions Performance Standards program allows covered facilities to apply for non-competitive grants that would refund an amount up to the total of their carbon charges, to use for emissions reduction projects.

**Saskatchewan** has had the federal fuel charge applied since 2019. After the federal government temporarily exempted home heating oil from the fuel charge, Saskatchewan stopped collecting the federal fuel charge on residential natural gas bills, as of January 2024. The province also applied a 60 per cent reduction to the fuel charge on electricity bills for residential customers who use electric heat, for the period from January 1, 2024, to April 30, 2024 (SaskEnergy n.d.; SaskPower n.d.). The federal government disputes the legality of these decisions.

From 2019 to 2022, Saskatchewan priced industrial emissions using a combination of the federal OBPS and the provincial Output-Based Performance Standards Program. As of January 2023, the Output-Based Performance Standards Program covers all large emitters and the federal OBPS no longer applies in Saskatchewan (Government of Saskatchewan 2024; Government of Saskatchewan 2023; Statutes of Saskatchewan 2018).

Saskatchewan's Output-Based Performance Standards Program applies to electricity facilities that emit 10 kt $CO_2e$ per year or more, and to all other facilities that emit 25 kt $CO_2e$ per year or more. Any facilities in an EITE sector that have emissions below those thresholds can opt in.

Large emitters in all sectors except electricity are subject to facility-specific benchmarks. As with the federal backstop, the Output-Based Performance Standards Program has electricity sector benchmarks that vary depending on fuel type, while natural gas has two benchmarks depending on the age of the facility. Saskatchewan's Output-Based Performance Standards Program also provides a product-specific benchmark for sold heat in the electricity sector.

Facilities that do not meet their benchmark must compensate by paying for excess emissions or submitting performance credits or carbon capture, utilization, and storage credits. There is not currently a relevant standard that would allow facilities to obtain offsets.

Proceeds from the Output-Based Performance Standards Program are directed to two funds. Until 2024, all funds were directed to the Saskatchewan Technology Fund. This fund allocates proceeds to emissions-reducing projects at regulated facilities through a competitive process. Under amendments that passed on March 19, 2024, funds from the electricity sector will thereafter be directed to a Small Modular Reactor Investment Fund. Proceeds from facilities outside the electricity sector will continue to be deposited into the Saskatchewan Technology Fund.

### 2.6.3 Carbon tax

The **Northwest Territories** is currently the only jurisdiction in Canada that prices emissions from both fuels and large emitters using a carbon tax. The system has been in effect since September 2019 (Government of Northwest Territories 2019; Statutes of the Northwest Territories 1988).

The carbon tax applies to combustion emissions from fuels at the same rates as the federal schedule.

The carbon tax exempts light fuel oil used for heating, fuel purchased by First Nations on reserves, aviation fuel, fuel purchased by visiting military forces, and fuel in small containers. Electric power producers receive a full point-of-sale rebate, to match the exemption for electricity that applies in the other territories.

Large emitters pay the carbon tax on purchased fuels like other consumers. However, they receive a rebate equal to 72 per cent of the carbon tax that would be paid on a facility-specific baseline quantity of diesel fuel. The facility's baseline is its average annual fuel consumption across the previous three years of operations before 2023.

Large emitters are those facilities identified as such by the Minister of Finance. The regulations specify four diamond mines in the territory that receive large-emitter treatment.[21] The territory will provide tax offsets for any new large emitters.

Of the remaining large-emitter carbon tax proceeds, 12 per cent is set aside in individual accounts for large emitters to use in emissions-reducing projects. However, no large emitter had used these funds as of March 2024.[22] All other proceeds are returned to general revenues (Government of Northwest Territories 2024).

The Northwest Territories carbon tax has been modified in two significant ways since the 2020 Independent Assessment.

First, in response to the updated federal benchmark, the Northwest Territories changed how it recycles carbon tax proceeds. The territory eliminated a point-of-sale rebate on heating fuel and replaced it with a regional addition to the quarterly Cost of Living Offset that is not tied directly to fuel consumption.[23] The territory will also provide unconditional grants to community governments equal to at least 10 per cent of net carbon tax revenues (Government of Northwest Territories n.d.).

The second change is the previously mentioned exemption for light fuel oil used for heating. This change came into effect in April 2024 to match the exemption in the federal fuel charge.

### 2.6.4 Carbon tax and large-emitter trading system

**British Columbia** combines a carbon tax for fuels with an output-based pricing system for large emitters. The carbon tax has been in place since 2008, while the province's OBPS entered into force in April 2024 when it replaced the carbon tax system for industry (Government of British Columbia 2008; Government of British Columbia 2024c; Statutes of British Columbia 2008; 2014).

The carbon tax applies to the same fuels as the federal fuel charge, with the addition of peat. B.C.'s carbon tax applies at the same rates as the federal fuel charge, except for light fuel oil, which B.C. taxes at a slightly lower rate because the province requires this fuel to have higher renewable content than is specified by federal regulations.

21 Of these four mines, the Snap Lake mine is closed and undergoing reclamation.

22 Confirmed with the Government of Northwest Territories.

23 The Cost of Living Offset contains two elements: a base payment and a regional payment that rises for residents who live in communities that consume more heating fuel.

The carbon tax exempts fuels that are purchased for use outside B.C.; used for non-combustion purposes in some industrial processes; used for interprovincial or international air, rail, or marine transport; purchased on First Nations land by First Nations people; purchased by visiting forces; or purchased in small containers. The tax does not apply to coloured gasoline or diesel purchased for farming. Commercial greenhouse growers receive an 80 per cent exemption from the tax on purchases of eligible natural gas and propane.

The Government of B.C. has used carbon tax proceeds to fund personal and business income tax reductions, tax credits for individuals and families, and CleanBC programming. As of 2024–25, all additional proceeds from carbon tax increases are being directed to the climate action tax credit, a quarterly, income-adjusted payment to low- and moderate-income individuals and families. The provincial government intends to broaden the eligibility of the tax credit each year so that 80 per cent of B.C. households will receive a credit by 2030 (Government of British Columbia 2024b).

Since April 2024, large emitters in B.C. are subject to the provincial OBPS. This system applies to facilities with annual emissions of 10 kt $CO_2$e per year or more, except for energy utilities, greenhouse growers, and facilities in the waste management and remediation sectors, which continue to be subject to the carbon tax. Facilities in other sectors can opt into the province's OBPS.

The B.C. OBPS primarily sets product-specific benchmarks, though there may be facility-specific benchmarks for new facilities that emit 100 kt $CO_2$e per year or more, such as some future liquefied natural gas facilities. New facilities can apply to be exempt from the B.C. OBPS while their benchmark is being established.

Facilities can comply with the policy by submitting compliance units—either performance credits or offsets—to cover a limited portion of their excess emissions. They must cover the remainder of any excess emissions by paying the carbon price. The share of excess emissions that compliance units can cover declines over time.

Some proceeds from the B.C. OBPS will be used to fund the CleanBC Industry Fund, which provides four streams of funding related to industrial decarbonization. The province has committed to conducting annual reviews of its OBPS.

### 2.6.5 Cap-and-trade system

**Quebec** is now the only province in Canada to price emissions using a cap-and-trade system. The *Système de plafonnement et échange de droits d'émission de gaz à effet de serre* (Cap-and-trade system for greenhouse gas emission allowances, or SPEDE) has been in place since 2013, with modifications. Since 2014, Quebec's SPEDE has been linked with California's cap-and-trade system through the Western Climate Initiative (WCI). The state of Washington is also considering joining the WCI.

SPEDE has annual emissions caps that decline every year until 2030. Since 2015, the system operates in three-year compliance periods. This combination of annual caps and compliance periods means that SPEDE effectively functions as a series of three-year carbon budgets.

The SPEDE applies to industrial establishments with emissions greater than 25 kt $CO_2$e per year, and fossil fuel distributors, which are responsible for the end-use emissions of fuels they sell to non-industrial purchasers. Industrial facilities with emissions of at least 10 kt $CO_2$e per year can opt into the system. The SPEDE also covers the emissions from electricity that is imported into Quebec. Facilities that are considered EITE receive free allowances. Energy producers, electricity generators, and fossil fuel distributors are ineligible for free allowances.[24]

The system exempts fuel used for air and marine navigation, fuel used as a raw material by fuel distributors, and fuel purchased in small containers.

Participants can meet their compliance obligation in four ways: purchasing allowances at joint auctions with California, purchasing emissions allowances from other participants, purchasing allowances at sales by mutual consent by the minister, or purchasing offset credits. Participants in the SPEDE can trade emissions allowances and offset credits with participants in the WCI system.

Official auctions take place four times a year. The price of emissions allowances is mainly determined by the market, though there is a minimum auction price. If the WCI system runs out of reserve allowances, the California Air Resources Board can hold an annual price ceiling sale. At the time of writing, the latest joint auction was in August 2024, and the median allowance price was $44.46, which is lower than the price in previous joint auctions in 2024.

Quebec allocates all proceeds from the SPEDE to the *Fonds d'électrification et de changement climatiques* (Electrification and climate change fund, or FECC), which is used to fund the province's climate change policies.

There have been two notable changes to the SPEDE since the 2020 Independent Assessment. First, Quebec updated its annual emissions caps to account for revised international standards for the global warming potentials of certain greenhouse gases. Second, the province adopted new rules for free allocation that entered into force in 2024.[25] At the time of writing, Quebec and California were reviewing the WCI system to ensure that their shared market remains effective at achieving emissions reduction targets (Government of Quebec n.d.).

24 Electricity producers may be eligible for some free allocation where they sell electricity at a price set by non-renewed, non-extended contracts signed before the creation of the cap-and-trade system in 2008.

25 The changes include a gradual reduction of free allocations in tandem with the system-wide emissions caps; an adjustment to the rate of reduction; and the consignment for auction of a portion of each facility's free allocations. The proceeds from the auctioned free allocations are then reserved for that facility to use on emissions reduction projects (Government of Quebec 2022).

3

# Assessing the effectiveness and stringency of carbon pricing systems

## 3.1 Conceptual approach

The primary goal of carbon pricing systems is to drive cost-effective emissions reductions aligned with emissions reduction targets. The challenge facing this assessment, and its predecessor, was how to determine to what extent carbon pricing is effective at meeting this goal.

The 2020 Independent Assessment evaluated carbon pricing systems through indicators of sound program design. This approach was guided by the understanding that effectiveness is a function of broad coverage of emission sources and the expectation of an increasingly stringent price signal. To that end, the 2020 assessment primarily evaluated systems according to the share of emissions that they cover in each jurisdiction, as well as the size of the financial rewards that carbon pricing creates for emissions reductions.

This assessment retains and updates many of the indicators from the 2020 assessment. Most of these indicators are presented in Section 4.

The 2024 Independent Assessment also expands on the approach of the 2020 assessment by estimating the projected emissions reductions in 2030 that can be attributed to carbon pricing. As the last assessment noted, emissions reductions are the primary metric of the effectiveness of carbon pricing. For the 2024 assessment, the Canadian Climate Institute commissioned Navius Research to conduct forward-looking economic modelling that assesses the impact of carbon pricing systems across Canada. Section 5.1 discusses the emissions reductions estimated in this modelling.

This assessment also considers other matters relevant to the effectiveness and stringency of carbon pricing.

One of the principal design considerations for carbon pricing systems is to minimize competitiveness impacts and the risk of carbon leakage. We assess carbon pricing systems against this criterion from two angles. First, Section 6 examines the function of large-emitter trading systems, considering their design features, the financial impacts of carbon pricing on large emitters, and the risks facing these systems. Second, Section 7 considers the impacts of carbon pricing on small and medium-sized enterprises.

A potential risk to carbon pricing systems is that they may interact with other climate policies in ways that make carbon pricing less effective. The discussion of this risk to LETS in Section 6.3 explores this issue.

## 3.2 Modelling and analysis

Two types of modelling informed this assessment.

**Modelling using historical data**: the Institute commissioned Stiebert Consulting to conduct bottom-up modelling, using historical economic and emissions data, to provide quantitative indicators of the coverage and stringency of carbon pricing systems in 2024. This analysis used emissions estimates for 2021 from the 2023 National Inventory Report (NIR), which was the latest available when we conducted our analysis. We discuss the methods and uncertainties associated with this analysis where we discuss the relevant indicators.

**Forward-looking emissions projections to 2030**: the Institute also commissioned Navius Research to conduct modelling to assess various outcomes of carbon pricing systems. Using its integrated economy-wide model, Navius Research modelled the implications of carbon pricing by simulating various scenarios with and without carbon pricing systems in place and then comparing the differences between the scenarios. This modelling is described in greater detail in Section 5.

Navius Research also drafted a modelling report that provides a more detailed discussion of the modelling analysis, including its associated uncertainties. The Annex to this report presents the Navius modelling report.

4

# Effectiveness of carbon pricing systems in 2024

In this section, we look at the effectiveness of carbon pricing systems in 2024 using historical data to assess their covered emissions and stringency.

## 4.1 Coverage indicators: Which emissions does carbon pricing cover?

*Coverage* refers to the share of emissions sources to which carbon pricing applies. Coverage is an important factor in assessing the effectiveness of carbon pricing, because coverage determines where the price signal is transmitted in the economy. All else being equal, broader coverage makes carbon pricing more effective. More uniform coverage also mitigates the risk of adverse competitiveness impacts or situations where jurisdictions face pressure to reduce coverage to match their peers.

To compare coverage across jurisdictions, we present two indicators:

- The quantity of emissions valued by the price incentive, which represents **coverage compared to the total emissions** in a jurisdiction.
- **The coverage standard**, which compares coverage in each jurisdiction against an imagined common standard that controls for the differing emissions profiles across Canada. The standard excludes emissions sources that are never covered by carbon pricing and assumes that all other sources should be covered to the level of the highest coverage observed in any carbon pricing system in Canada. In this sense, the coverage standard represents the total emissions that could be covered across Canada.

Our emissions coverage assumptions are based on input and data from the federal, provincial, and territorial governments, supplemented with emissions data from the NIR, facility-level emissions data from the federal Greenhouse Gas Reporting Program, and information about opt-in that some jurisdictions provided. Jurisdictions informed us that for confidentiality reasons, they were unable to share most facility-level data about the emissions covered under their systems.

There are several challenges facing any coverage analysis of Canada's carbon pricing systems, including misaligned, missing, or lagging data:

- First, Canada's emissions data are divided into categories that do not correspond exactly to the emissions covered by different carbon pricing systems. Therefore, we made assumptions about the quantity of covered emissions, including exemptions, in each

NIR emissions category, and about the fraction of these emissions that are covered by carbon prices on fuels or carbon prices for large emitters. For example: carbon prices on fuels apply to flights within a jurisdiction and not between jurisdictions, but domestic aviation emissions data in the NIR include both types of flights. In this case, we estimated coverage based on aviation data supplied by governments.

- Second, the systems we examine and the emissions data that are available are not perfectly aligned. This assessment estimates the coverage of carbon pricing systems in 2024 using emissions data from 2021. In effect, our coverage analysis indicates that 2024 systems cover a certain percentage of the emissions mix of each jurisdiction, as that mix existed in 2021. It is true that the mix of emissions in each jurisdiction changes slightly year over year, and that these changes affect the proportion of emissions that is covered or uncovered by carbon pricing. However, the effect is small. Likewise, the effects of the COVID-19 pandemic also mean that 2021 was not a typical example of Canada's emissions profile, but the differences do not alter our findings about coverage. We discuss this point more in Section 4.1.3.

  As we noted earlier, there is likely no optimal time to assess carbon pricing systems. National emissions data are published with a two-year lag and Canada's carbon pricing systems are a moving target, undergoing almost continuous change. To assess 2024 carbon pricing systems with 2024 emissions data would mean waiting until 2026, the year by which the federal government has committed to conclude its interim review.

- Third, the quality of emissions data for the territories poses a challenge. Canada's NIR is missing data for some emissions sources in the territories. For example, the Greenhouse Gas Reporting Program records some mining emissions in Nunavut that are missing from the NIR. Given the small size of territorial emissions, the data gaps and inaccuracies in the NIR make it proportionally harder to generate accurate estimates of coverage and other indicators.

To address these challenges and minimize the uncertainty in our estimates, we transmitted our assumptions and estimates to each jurisdiction for validation. We adjusted our assumptions where appropriate.

Our coverage estimates in this report are not directly comparable to the coverage estimates in the 2020 Independent Assessment. Readers of our last report should note that in this report, any emissions that are eligible for a full point-of-sale rebate on the carbon price are treated as uncovered emissions. This approach marks a departure from the 2020 assessment but aligns more closely with the federal government's method for assessing coverage under the federal benchmark.[26]

26 Because of the measures that Saskatchewan has taken to remove the fuel charge from natural gas used for residential building heat, we have treated those emissions as uncovered in our analysis in this section of the report, which focuses on systems as they exist in 2024. However, in our projections that model emissions out to 2030, we treat these emissions as covered. Because the federal fuel charge is supposed to cover these emissions, we have assumed that Saskatchewan's exemptions will only be temporary.

### 4.1.1 Coverage measured against total emissions

Covered emissions are the emissions valued by the price incentive, or the emissions sources that have an opportunity cost. An emitter can avoid the cost by reducing the quantity of covered emissions through abatement. This indicator measures emissions valued by the price incentive against total emissions in each jurisdiction, to illustrate the extent to which carbon pricing applies to emissions across Canada.

To develop this indicator, we conducted a detailed review of the carbon pricing systems across Canada to identify covered, partially covered, and exempt emissions sources in each jurisdiction. We then mapped these emissions onto the 61 different emission categories in the NIR to determine the quantity of emissions valued by the price incentive in each jurisdiction. This analysis allows us to categorize all of Canada's emissions into the following categories:

- **Emissions covered by carbon prices on fuels** are those covered under a fuel charge, a carbon tax for non-large emitters, or by provisions for fuel distributors under a cap-and-trade system. Covered fuels represent just over 34 per cent of Canada's emissions.
- **Emissions covered by large-emitter trading systems** include energy and industrial process emissions, and they account for just over 42 per cent of Canada's emissions.
- **Total covered emissions** represents the sum of emissions covered by carbon prices on fuels and LETS. Today's carbon pricing systems cover 77 per cent of the emissions accounted for in Canada's 2023 NIR, where the total excludes land use, land-use change, and forestry (LULUCF) emissions.
- **Exempt fuels** means the quantity of emissions that might be covered by a carbon price on fuels but that are exempted from carbon pricing in some but not all jurisdictions. These emissions could theoretically be covered, since at least one other jurisdiction does not exempt these emissions from carbon pricing. For example, many jurisdictions—but not all—exempt gasoline and diesel used in agriculture. These exempt fuels account for 4 per cent of Canada's emissions.
- **Emissions exempted by large-emitter trading systems** means the quantity of industrial emissions that are exempted in some but not all jurisdictions. These emissions could theoretically be covered, since LETS cover some of the same sources of emissions in other jurisdictions. Exempt LETS emissions represent 11 per cent of Canada's emissions.
- **Never-covered emissions** are those to which no carbon pricing system in Canada applies, representing 9 per cent of national emissions. These are largely non-energy agriculture and waste emissions. Carbon pricing does not cover LULUCF emissions, but these emissions are counted separately in Canada's emissions inventory and are not counted as part of Canada's total emissions.[27]

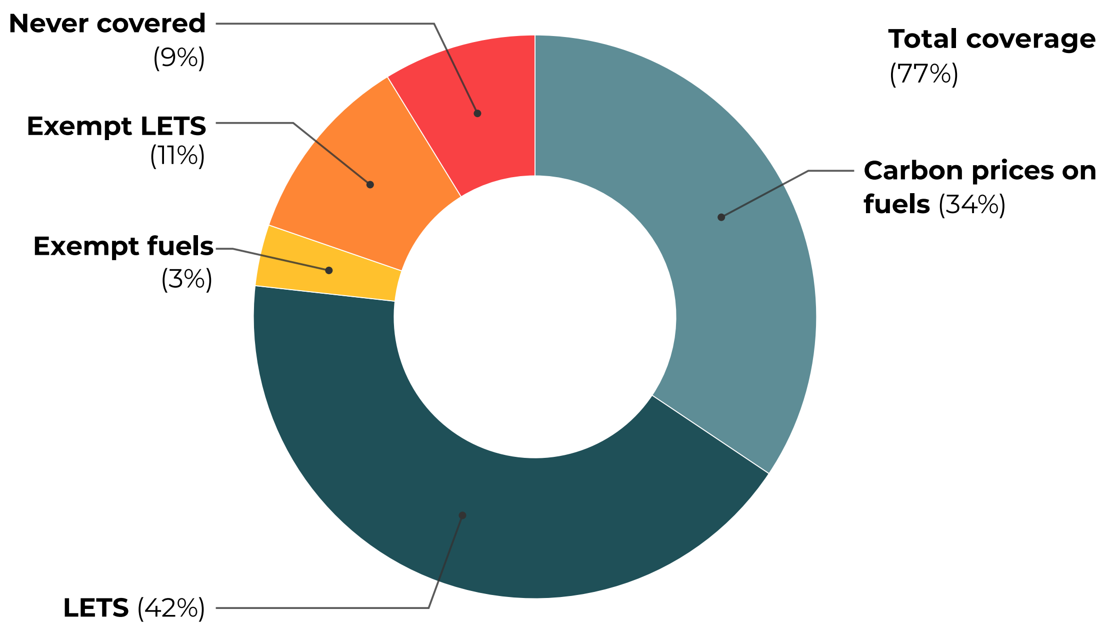
27 Offset protocols largely target never-covered and LULUCF emissions because they are difficult to price. In some carbon pricing systems, facilities can use offset credits to meet their compliance requirements. However, because the quantity of offsets available in a system does not affect the actual compliance requirements, we do not consider the emissions reductions associated with offsets when calculating the emissions covered by carbon pricing. Because offsets help reduce the cost of compliance, we do consider them in our analysis of costs.

Figure 3 illustrates the categories of emissions valued and not valued by the price incentive.

Figure 3:

## Emissions covered by carbon pricing in Canada

Share of national emissions covered and uncovered by carbon pricing (%)




Note: Based on modelling that applies 2024 policy design to historical emissios data for 2021.

Total coverage is 77 per cent of Canada's emissions, which appears greater than the sum of carbon prices on fuels and LETS due to rounding.

Carbon pricing covers varying quantities of emissions across Canada. The combination of different carbon pricing systems and emissions profiles means that the emissions valued by the price incentive vary from 41 per cent to 84 per cent, depending on the jurisdiction.

For each jurisdiction, we calculate the quantity of emissions valued by the price incentive as follows:

$$SE_i = \frac{CE_i}{TE_i}$$

Where:

$SE_i$ = Share of emissions covered in each jurisdiction, *i*.

CEi = Covered emissions in each jurisdiction, i.

TEi = Total emissions in each jurisdiction, i (not including LULUCF).

Table 1 breaks down each jurisdiction's emissions into the categories of covered and uncovered emissions described above.

Table 1:

## Covered emissions by jurisdiction

| Jurisdiction | Emissions in 2021 (kt) | Covered emissions (%) | | | Uncovered emissions (%) | | | |
|---|---|---|---|---|---|---|---|---|
| | | Carbon price on fuels | LETS | Total covered | Exempt fuels | Exempt LETS | Never covered | Total uncovered |
| CA | 670,428 | 34% | 42% | 77% | 4% | 11% | 9% | 23% |
| AB | 256,149 | 16% | 62% | 78% | 1% | 14% | 7% | 22% |
| BC | 59,436 | 55% | 28% | 84% | 4% | 7% | 5% | 16% |
| MB | 20,702 | 44% | 10% | 54% | 7% | 10% | 29% | 46% |
| NB | 11,869 | 32% | 52% | 84% | 4% | 7% | 5% | 16% |
| NL | 8,336 | 39% | 39% | 78% | 11% | 9% | 2% | 22% |
| NS | 14,600 | 36% | 43% | 79% | 12% | 5% | 3% | 21% |
| NT | 1,287 | 39% | 32% | 72% | 16% | 12% | 0% | 28% |
| NU | 626 | 28% | 14% | 41% | 51% | 8% | 1% | 59% |
| ON | 150,562 | 54% | 27% | 81% | 3% | 9% | 7% | 19% |
| PE | 1,627 | 48% | 6% | 53% | 18% | 6% | 23% | 47% |
| QC | 77,478 | 52% | 27% | 79% | 2% | 8% | 11% | 21% |
| SK | 67,107 | 18% | 44% | 62% | 10% | 11% | 17% | 38% |
| YT | 650 | 78% | 1% | 79% | 6% | 14% | 1% | 21% |

Note: Based on modelling that applies 2024 policy design to historical emissions data for 2021.

As noted above, where systems exempt fuel uses from carbon pricing, or issue a full point-of-sale rebate, we count those emissions as uncovered. Table 2 presents a list of exempted fuels by jurisdiction.[28]

28 The federal exemption for light fuel oil used for building heat applies from November 9, 2023, to April 1, 2027.

Table 2:

## Exemptions from carbon prices on fuels by jurisdiction

| Jurisdiction | Exemption type | Emissions NIR category | Total category emissions (kt) | Exempt (kt) | Exempt (%) |
|---|---|---|---|---|---|
| AB | Light fuel oil heating | Commercial and residential stationary combustion | 16,020 | 16 | 0.1% |
| | Agriculture | Stationary combustion and off-road agriculture | 3,292 | 2,999 | 91% |
| | Aviation | Domestic aviation | 1,041 | 812 | 78% |
| BC | First Nations | Stationary combustion | 10,760 | 203 | 2% |
| | Agriculture | Stationary combustion and off-road agriculture | 1,909 | 981 | 51% |
| | First Nations | Transportation | 23,621 | 294 | 1% |
| | Aviation | Domestic aviation | 1,103 | 890 | 81% |
| MB | Light fuel oil heating | Commercial and residential stationary combustion | 2,451 | 25 | 1% |
| | Agriculture | Stationary combustion and off-road agriculture | 1,348 | 1,133 | 84% |
| | Aviation | Domestic aviation | 357 | 257 | 72% |
| NB | Light fuel oil heating | Commercial and residential stationary combustion | 685 | 391 | 57% |
| | Agriculture | Stationary combustion and off-road agriculture | 165 | 50 | 30% |
| | Aviation | Domestic aviation | 64 | 57 | 90% |
| | Fishing | Domestic navigation and fishing | 129 | 23 | 18% |
| NL | Light fuel oil heating | Commercial and residential stationary combustion | 584 | 314 | 54% |
| | Agriculture | Stationary combustion and off-road agriculture | 66 | 43 | 65% |
| | Aviation | Domestic aviation | 174 | 108 | 62% |
| | Fishing | Domestic navigation and fishing | 938 | 440 | 47% |
| NS | Light fuel oil heating | Commercial and residential stationary combustion | 1,672 | 1,063 | 64% |
| | Aviation | Domestic aviation | 137 | 130 | 95% |
| | Fishing | Domestic navigation and fishing | 721 | 533 | 74% |
| | Agriculture | Stationary combustion and off-road agriculture | 111 | 62 | 56% |
| NT | Light fuel oil heating | Stationary combustion | 109 | 70 | 64% |
| | Aviation | Domestic aviation | 115 | 115 | 100% |
| | First Nations | Transportation | 452 | 12 | 3% |
| NU | Remote electricity producers[29] | Public electricity and heat production | 155 | 155 | 100% |
| | Aviation | Domestic aviation | 157 | 157 | 100% |

29 Electricity production in the Northwest Territories and Yukon is also exempt from carbon pricing, but we do not show the exemptions here because we have assumed that the generators in these territories are covered by large emitter programs rather than by carbon prices on fuels.

| Jurisdiction | Exemption type | Emissions NIR category | Total category emissions (kt) | Exempt (kt) | Exempt (%) |
|---|---|---|---|---|---|
| ON | Light fuel oil heating | Commercial and residential stationary combustion | 30,840 | 545 | 2% |
| | Agriculture | Stationary combustion and off-road agriculture | 2,682 | 1,838 | 69% |
| | Aviation | Domestic aviation | 1,572 | 1,258 | 80% |
| PE | Light fuel oil heating | Commercial and residential stationary combustion | 250 | 182 | 73% |
| | Agriculture | Stationary combustion and off-road agriculture | 77 | 72 | 94% |
| | Aviation | Domestic aviation | 11 | 11 | 98% |
| | Fishing | Domestic navigation and fishing | 30 | 30 | 100% |
| QC | Aviation | Domestic aviation | 663 | 630 | 95% |
| | Fishing | Domestic navigation and fishing | 726 | 726 | 100% |
| SK | Natural gas and light fuel oil heating | Commercial and residential stationary combustion | 3,437 | 1,884 | 55% |
| | Agriculture | Stationary combustion and off-road agriculture | 5,294 | 4,693 | 89% |
| | Aviation | Domestic aviation | 146 | 96 | 66% |
| YT | Light fuel oil heating | Commercial and residential stationary combustion | 27 | 3 | 12% |
| | Aviation | Domestic aviation | 33 | 33 | 100% |

Note: Based on modelling that applies 2024 policy design to historical emissions data for 2021.

Table 3 offers a qualitative summary of covered and exempt emissions from industrial facilities. Note that the Northwest Territories carbon tax for industry has narrower coverage than other industrial carbon pricing systems because the federal benchmark only requires it to cover combustion emissions.

Table 3:

## Overview of coverage under large-emitter trading systems

| Jurisdiction | Direct combustion emissions | Process emissions | Fugitive emissions | Indirect emissions | Biomass |
|---|---|---|---|---|---|
| Federal OBPS (MB, NU, PE, YT) | Covered | Covered | Covered, except $CH_4$ emissions from most oil and gas[30] | Uncovered | $CO_2$ emissions treated as carbon-neutral |
| AB | Covered | Covered | Covered, except aggregated conventional oil and gas extraction | Electricity, heat, and hydrogen covered | $CO_2$ emissions treated as carbon-neutral |
| BC | Covered | Covered | Fugitive $CO_2$ and $CH_4$ uncovered, except for useful venting | Uncovered | $CO_2$ emissions treated as carbon-neutral |

30 The federal OBPS would cover methane emissions from oil sands mines, though the federal OBPS does not currently apply in any jurisdictions that have oil sands mines.

| Jurisdiction | Direct combustion emissions | Process emissions | Fugitive emissions | Indirect emissions | Biomass |
|---|---|---|---|---|---|
| NB | Covered | Covered[31] | Covered | Uncovered | $CO_2$ emissions treated as carbon-neutral |
| NL | Covered | Covered | Uncovered | Uncovered | $CO_2$ emissions treated as carbon-neutral |
| NS | Covered | Covered[32] | Uncovered | Uncovered | $CO_2$ emissions treated as carbon-neutral |
| NT | Covered | Uncovered | Uncovered | Uncovered | $CO_2$ emissions treated as carbon-neutral |
| ON | Covered | Covered | Covered | Uncovered, except for transfers of industrial heat | $CO_2$ emissions treated as carbon-neutral |
| QC | Covered | Covered | Covered | Electricity imports covered | $CO_2$ emissions treated as carbon-neutral |
| SK | Covered | Covered | Covered, except $CH_4$ from upstream oil and gas | Uncovered, except for transfers of industrial heat | $CO_2$ emissions treated as carbon-neutral |

## 4.1.2 The coverage standard, the emissions that could be priced

The 2020 Independent Assessment developed the coverage standard as an indicator of carbon pricing coverage that accounts for the different emissions profiles of Canadian jurisdictions. In some jurisdictions, a disproportionate share of emissions come from sources that no carbon pricing system covers, or that systems only ever partially cover.

The coverage standard helps account for these differences while indicating where systems could increase their coverage to match the highest levels of coverage in the country. The coverage standard is different from the requirements of the federal benchmark. The federal benchmark requires provincial and territorial carbon pricing systems to cover at least as many combustion emissions in their jurisdiction as the federal backstop system would cover. The coverage standard is broader than this requirement, since some carbon pricing systems cover emissions sources that the federal backstop does not.

The coverage standard represents a theoretical level of coverage based on the highest level of coverage that exists for each source of emissions across all Canadian carbon pricing systems. To develop the coverage standard, we reviewed the coverage of all emissions sources across Canada to determine the highest share of coverage that existed for each category of emissions. If an emissions source was covered in at least one jurisdiction, we added it to the

31 In New Brunswick and Nova Scotia, the benchmark for these emissions is set based on present-year emissions. This means that a facility will not face additional carbon charges for an increase in their process emissions year-over-year, which mutes the incentive to abate those emissions. In the modelling projections conducted by Navius Research, these emissions were treated as uncovered. See the Annex for more information.

32 See the previous footnote.

coverage standard. If an emissions source was only ever partially covered by carbon pricing, we found the jurisdiction with the highest partial coverage and added that level of coverage to the coverage standard.

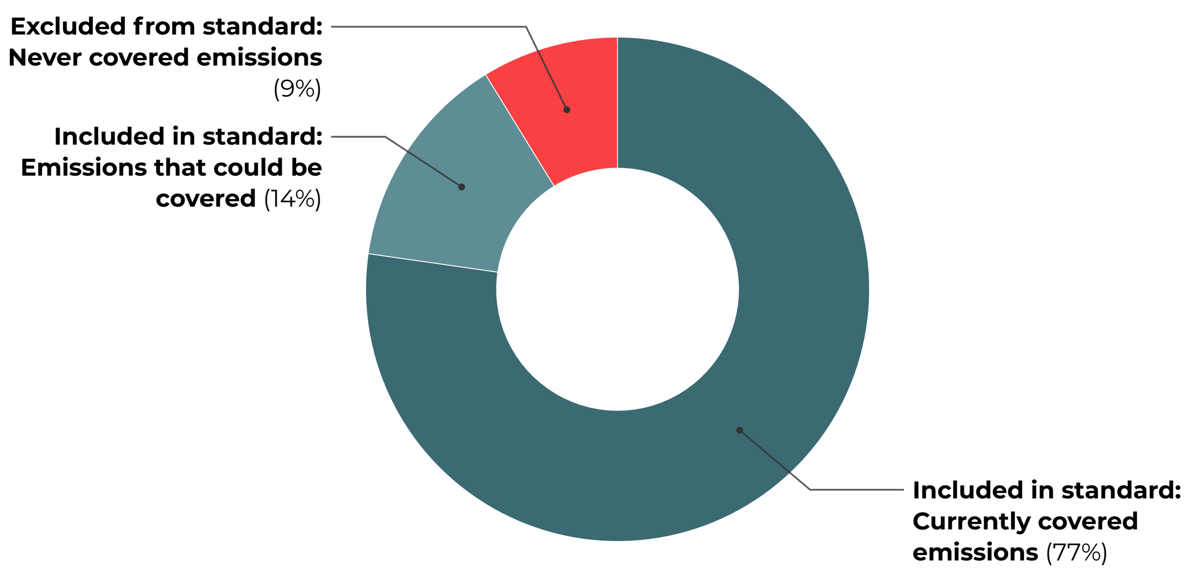
If all carbon pricing systems across Canada achieved the coverage standard, they would cover 91 per cent of Canada's emissions. The updated coverage standard is much higher than the coverage standard in the last assessment, which would have covered 82 per cent of Canada's 2018 emissions. This change suggests that carbon pricing systems are covering more emissions sources than in the past, even if they are not all covering them to the same extent. Section 4.1.3 discusses the differences between the 2020 Independent Assessment and the 2024 Independent Assessment in more detail.

The coverage standard may slightly overestimate the quantity of emissions that would be covered if all systems adopted the same best practices for coverage. Because the coverage standard uses NIR categories that are not as precise as the emissions categories covered by carbon pricing regulations, different emissions profiles across jurisdictions would still lead to some small differences in coverage in our estimates.

Figure 4:

## The coverage standard

Share of national emissions included and excluded from the coverage standard (%)




Note: Based on modelling that applies 2024 policy design to historical emissions data for 2021.

We can compare each jurisdiction's carbon pricing system against the coverage standard as follows:

$$SBPE_i = \frac{CE_i}{TLE_i - EE_i}$$

Where:

$SE_i$ = Share of emissions covered in each jurisdiction, *i*.
$SBPE_i$ = share of priced emissions covered in each jurisdiction, *i*, as a proportion of the coverage standard.
$CE_i$ = emissions covered by the carbon price in jurisdiction, *i*.
$TLE_i$ = total emissions in each jurisdiction, *i* (not including LULUCF).
$EE_i$ = Emissions in each jurisdiction, *i*, that are never covered by carbon pricing or are always at least partially uncovered. Where an emissions category is only ever partially covered (e.g. fugitive methane emissions), the standard reflects the most stringent system with the greatest coverage of these emissions.

The columns in Table 4 display the components and results of these calculations:

A. Emissions that are never covered by carbon pricing, including non-energy agricultural emissions, some industrial product use emissions, and waste emissions that are not related to solid waste disposal.

B. Emissions that are partially covered or excluded in this jurisdiction but are covered to a greater extent elsewhere. This category includes emissions from solid waste disposal; emissions from the production and consumption of halocarbons, $SF_6$, and $NF_3$; fugitive emissions from the oil and gas sector; and some industrial product use emissions. Full coverage of these emission groups under carbon pricing programs is unlikely for several reasons, including the fact that some emission sources fall below reporting thresholds for LETS while some emissions, like halocarbons, come from the household sector.

   Examples of partial coverage in emission groups include some waste disposal landfills in Alberta's TIER Regulation, where about 3 per cent of emissions from solid waste disposal facilities were covered in 2021.[33]

C. The share of total emissions that fall under the coverage standard. This category represents total emissions minus emissions that are excluded in all jurisdictions and partially covered emissions in this jurisdiction (100% – A – B).

D. Coverage in each jurisdiction compared to total emissions.

E. Coverage in each jurisdiction compared to the coverage standard. It is calculated as a jurisdiction's coverage against total emissions, divided by its emissions that fall under the coverage standard (D/C).

33 No other province covers landfills in their LETS, but if we added this to the coverage standard applied to all jurisdictions, we would include a proportion of solid waste disposal emissions equivalent to coverage in Alberta.

Table 4:

## Coverage by jurisdiction compared to the coverage standard

| | A | B | C | D | E |
|---|---|---|---|---|---|
| P/T | Never covered | Partially covered | Emissions in coverage standard | Coverage against total emissions | Coverage compared to coverage standard |
| QC | 11% | 8% | 80% | 79% | **98%** |
| ON | 7% | 9% | 84% | 81% | **96%** |
| BC | 5% | 7% | 88% | 84% | **95%** |
| NB | 5% | 5% | 90% | 84% | **94%** |
| NL | 1% | 9% | 89% | 79% | **89%** |
| AB | 7% | 5% | 88% | 78% | **88%** |
| NS | 2% | 9% | 89% | 78% | **88%** |
| MB | 3% | 5% | 92% | 79% | **86%** |
| YT | 29% | 8% | 63% | 54% | **86%** |
| SK | 0% | 10% | 90% | 72% | **80%** |
| NT | 17% | 3% | 80% | 62% | **78%** |
| PE | 23% | 5% | 72% | 53% | **74%** |
| NU | 1% | 22% | 78% | 41% | **53%** |

Note: Based on modelling that applies 2024 policy design to historical emissions data for 2021.

No jurisdiction in Canada meets the coverage standard. Compared to the coverage standard, jurisdictions cover between 53 per cent and 98 per cent of emissions. We observe a few key differences between jurisdictions:

Emissions coverage is lower in the territories, largely because of their exemptions for aviation fuels and electricity.

Exemptions for light fuel oil for heating drive down coverage against the standard in the Atlantic provinces and the North.[34] Saskatchewan's exemptions for residential heating reduce coverage in that province.

As with the 2020 Independent Assessment, exemptions for fuels used in agriculture help explain lower coverage in several provinces, particularly Manitoba, Prince Edward Island, and Saskatchewan.

Table 5 shows all the NIR emissions categories that make up the coverage standard, illustrating the level of coverage that sets the standard in each category, along with the jurisdiction(s) that have the highest coverage for that category.

34 The effect occurs across the North, but our results show a greater impact in the Northwest Territories because the data for many relevant emissions in Nunavut and Yukon are missing from the National Inventory Report.

Table 5:

# Components of the coverage standard

| Major emission category | NIR category | Emissions included in coverage standard | Jurisdiction with highest coverage |
|---|---|---|---|
| Stationary combustion | Public electricity and heat production | 100% | All but territories |
| | Petroleum refining industries | 100% | All |
| | Oil and gas extraction | 100% | All but NT |
| | Mining | 100% | All |
| | Iron and steel | 100% | All |
| | Non-ferrous metals | 100% | All |
| | Chemical | 100% | All |
| | Pulp and paper | 100% | All |
| | Cement | 100% | All |
| | Other manufacturing | 100% | All |
| | Construction | 100% | All |
| | Commercial and institutional | 100% | AB, QC, SK |
| | Residential | 100% | AB |
| | Agriculture and forestry | 100% | QC |
| Transportation | Domestic aviation | 38% | NL[35] |
| | Military aviation | 38% | NL |
| | Light-duty gasoline vehicles | 100% | All but BC, NT[36] |
| | Light-duty gasoline trucks | 100% | |
| | Heavy-duty gasoline vehicles | 100% | All but BC, NT |
| | Motorcycles | 100% | |
| | Light-duty diesel vehicles | 100% | |
| | Light-duty diesel trucks | 100% | |
| | Heavy-duty diesel vehicles | 100% | All but NT |
| | Propane and natural gas vehicles | 100% | All |
| | Railways | 100% | All |
| | Domestic navigation | 100% | BC, MB, NT, NU, ON |
| | Fishing | 100% | BC, NT, NU, ON |
| | Off-road agriculture & forestry | 100% | QC, YT |

35 Aviation fuels are exempted from carbon pricing in Quebec and the territories. Everywhere else, coverage is equal to the share of aviation emissions that come from intra-jurisdiction flights.

36 British Columbia and the Northwest Territories have lower transportation coverage because they provide exemptions for fuels purchased on reserves by First Nations.

| Major emission category | NIR category | Emissions included in coverage standard | Jurisdiction with highest coverage |
|---|---|---|---|
| Transportation | Off-road commercial & institutional | 100% | All but BC, NT, PE |
| | Off-road manufacturing, mining & construction | 100% | All |
| | Off-road residential | 100% | All but BC, NT, PE |
| | Off-road other transportation | 100% | All |
| | Pipeline transport | 100% | All |
| Fugitive | Coal mining | 100% | All but BC |
| | Oil | 70% | BC |
| | Natural gas | 90% | BC |
| | Venting | 80% | ON |
| | Flaring | 100% | AB, MB, NL, ON, BC, SK |
| Industrial process and product use | Cement production | 100% | BC, NS, ON, QC |
| | Lime production | 100% | AB, MB, NB |
| | Mineral product use | 100% | All |
| | Ammonia production | 100% | All |
| | Nitric acid production | 100% | All |
| | Adipic acid production | 100% | All |
| | Petrochemical and carbon black production | 100% | All |
| | Iron and steel production | 100% | ON |
| | Aluminum production | 100% | All |
| | SF6 used in magnesium smelters and casters | 100% | All |
| | Production and consumption of halocarbons, SF6 and NF3 | 35% | QC |
| | Non-energy products from fuels and solvent use | 20% | BC |
| | Other product manufacture and use | 0% | - |
| Agriculture (non-energy) | Enteric fermentation | 0% | - |
| | Manure management | 0% | - |
| | Direct sources | 0% | - |
| | Indirect sources | 0% | - |
| | Field burning of agricultural residues | 0% | - |
| | Liming, urea application and other carbon-containing fertilizers | 0% | - |
| Waste | Solid waste disposal | 3% | AB |
| | Biological treatment of solid waste | 0% | - |
| | Wastewater treatment and discharge | 0% | - |
| | Incineration and open burning of waste | 0% | - |
| | Industrial wood waste landfills | 0% | - |

### 4.1.3 How has coverage changed since the last assessment?

The primary value of the coverage analysis presented here is to assess the coverage of carbon pricing systems in 2024, not to compare today's coverage to the coverage of the past. **For several reasons, the coverage results from the 2020 Independent Assessment are not directly comparable to the results presented here.**

**First, we had access to more precise data for this assessment.** Most significantly, we requested data on emissions and carbon pricing proceeds from federal, provincial, and territorial governments. These data allowed us to compare total emissions to priced emissions. Because these data were largely from 2021, they needed to be adjusted to account for the changes in system coverage between 2021 and 2024. For example, the federal government adjusted its data on fuel charge proceeds to account for the exemption for light fuel oil heating that it introduced in 2023.

One of the challenges facing the 2020 Independent Assessment was a lack of clarity about emissions from facilities that opted into LETS. In that assessment, we had to make assumptions about these emissions and reassign a fraction of emissions from covered fuels to large-emitter pricing. In the 2024 Independent Assessment, we requested more information about these facilities. Where available, these data have allowed us to make more accurate estimates about opt-in emissions.

**Second, Canada's emissions have changed in ways that make it difficult to isolate the impact of policy changes.** One of the key differences between 2018 and 2021 emissions is the effect of the COVID-19 pandemic, which likely changed the composition of Canada's emissions in a way that presents as a decrease in coverage. In general, we expect that the decreased economic activity associated with the pandemic put greater downward pressure on energy emissions than non-energy emissions.[37]

Because carbon pricing primarily targets energy emissions,[38] the relatively greater share of non-energy emissions in 2021 would tend to depress coverage when measured against total emissions. For example, the pandemic depressed transport emissions, which are covered, while it had less effect on methane emissions from cows, which are uncovered. The coverage standard helps correct for this difference because it excludes emissions that are never covered by carbon pricing.

Any abatement response between 2018 and 2021 may also have changed the profile of Canada's emissions, and therefore the share of emissions covered by carbon pricing. For example, the closure of coal-fired power plants reduced electricity emissions—which are covered by carbon pricing—while non-energy emissions from landfills—which are largely uncovered—remained flat. Once again, the coverage standard helps account for this difference.

37 The share of energy emissions fell by approximately 1 per cent between 2018 and 2021, or 0.7 per cent if comparing the composition of 2018 emissions from the 2020 NIR to the composition of 2021 emissions from the 2023 NIR.

38 The main exceptions to this rule are non-energy process emissions, which carbon pricing systems cover to a greater extent today than in the past, and fugitive energy emissions, which carbon pricing systems cover very unevenly across the country.

**Finally, methodological changes to Canada's NIR make it harder to compare coverage between our two assessments.** ECCC makes methodological improvements in every iteration of the NIR, and these improvements affect the estimates for every year's emissions. Among other things, since the 2020 Independent Assessment, ECCC has improved its estimates of fugitive emissions, accounted for renewable fuels, and disaggregated on- and off-road transportation (Environment and Climate Change Canada 2023c). To account for these changes, we would have had to re-run the analysis conducted in the 2020 assessment, which was beyond the scope of this project.

With those considerations in mind, we can make certain comments about how carbon pricing coverage changed between the 2020 assessment and the 2024 assessment.

**Carbon pricing likely covers a greater share of emissions in 2024 than it did in 2020.** Although the 2020 Independent Assessment found that carbon pricing covered 78 per cent of emissions in Canada, we now believe that figure was an overestimate. We have more accurate data than in the past, and most of the design changes to carbon pricing systems between 2020 and 2024 have increased the scope of these systems. For example, the changes to the federal benchmark have required more provincial systems to cover process emissions, though overall coverage of these emissions is not significantly higher than in our last assessment.

The higher value of the coverage standard in the 2024 Independent Assessment is a further indicator that carbon pricing today likely covers more emissions than in the past. More sources of emissions are being covered *somewhere* in Canada than they were before. At the same time, the wide range in systems' coverage compared to the coverage standard indicates that coverage is still uneven across the country. In other words, jurisdictions now cover more of the same sources of emissions, but still to widely varying degrees.

There is an important exception to the general increase in coverage. The Government of Canada's decision to temporarily exempt light fuel oil used for building heat from the federal fuel charge has materially decreased coverage in several jurisdictions. The change has reduced coverage by slightly more than 2 Mt, with the greatest impact in the territories and in the Atlantic provinces. Saskatchewan's subsequent decision to remove carbon pricing from natural gas and electricity used for residential heating had an even larger impact, reducing coverage by more than 3 Mt. However, these decreases are still offset by increased coverage elsewhere.

## 4.2 Stringency indicators: What is the value of emissions reductions?

*Stringency* refers to the strength of the incentive to reduce emissions. All else being equal, a more stringent policy will be more effective. Economic theory suggests that the more uniform and consistent a price signal, the more cost-effective the incentive. As noted above, policies can send this price signal by applying a fixed price to emissions or by setting a cap that limits the quantity of emissions permitted within the system.

The stringency of a system can be measured in different ways. This assessment updates the two primary stringency indicators from the 2020 assessment, which are:

- The **marginal cost incentive**, which represents the value of an emissions reduction and is the primary indicator of the strength of the signal to abate.
- The **average cost incentive**, or total compliance costs divided by total covered emissions. This indicator provides three insights. First, it indicates the strength of the signal for new facilities. Second, it provides insight into interjurisdictional competitiveness and the relative imposition of costs. Third, it provides an indicator of potential cost pass-through into carbon-intensive goods, which can incentivize their substitution with lower-emissions alternatives.

As we noted in the 2020 Independent Assessment, the expected future marginal cost incentive is also an important indicator of stringency. When emitters expect higher future carbon prices (with greater certainty), they will be more inclined to invest in projects that reduce emissions over the long term. With the implementation of the updated federal benchmark, all carbon pricing systems must maintain stringency aligned with a carbon price that rises to $170 per tonne in 2030. This change increases the effectiveness of carbon pricing systems, though the degree to which it increases effectiveness depends partly on the strength of the expectation that the price will increase as planned. Moreover, as we discuss in Section 6.3, our projections suggest that the stringency—and therefore the marginal cost incentive—of some provincial LETS is at risk of eroding in the future.

Marginal and average cost indicators are mainly useful for assessing the stringency of price-based systems. For cap-and-trade systems, the primary factors of stringency are related to the quantity of allowances within the system, the decline rates of the cap, the access to compliance flexibility, and the impact of complementary policies on emissions. Our analysis of carbon pricing systems in this section does not assess the stringency of Quebec's cap-and-trade system from those angles, but we do consider these issues in our analysis of carbon pricing systems in Sections 5 and 6.

### 4.2.1 The marginal cost incentive

The marginal cost incentive offers the most straightforward way to compare price stringency across carbon pricing systems. The marginal cost incentive represents the cost of carbon in a carbon price on fuels, and in LETS the price of a tradeable unit should be equivalent to the marginal cost.

Given the limited availability of data, the marginal cost incentives presented below do not directly incorporate some dynamics that would put downward pressure on the marginal price. For example, where benchmarks—or portions of benchmarks, as with process emissions in New Brunswick and Nova Scotia—are revised every year to match a facility's present-year emissions, the price signal may be somewhat weakened. Similarly, if facilities may be eligible to receive a full return of their carbon charges, as may occur in Ontario, the price signal might also be diluted. We had insufficient information to address these and other dynamics, including the effects of emissions banking, overallocation of free allowances, or weak benchmarks for large emitters, in the analysis discussed here.

We calculate the marginal cost incentive as follows:

$$MCI_i = (CP_{i,j} - OD_{i,j} \times \frac{OE_{i,j}}{CE_{i,j}})$$

Where:

$SE_i$ = Share of emissions covered in each jurisdiction, *i*.
$MCI_i$ = Marginal cost incentive calculated in each jurisdiction, *i*.
$CP_{i,j}$ = Carbon price in 2024 in each jurisdiction, *i*, for each category of emissions, *j*.
$OD_{i,j}$ = Difference between the carbon price and the estimated average unit price for offsets used as compliance in 2024 for carbon pricing systems in relevant jurisdictions (here only Alberta and Quebec),39 *i*, for each category of emissions, *j*.
$OE_{i,j}$ = Estimated eligible offset units used as compliance in 2024 for carbon pricing systems in relevant jurisdictions, *i*, for each category of emissions, *j*.
$CE_{i,j}$ = Emissions covered by carbon pricing systems in each jurisdiction, *i*, for each category of emissions, *j*.

Figure 5 summarizes the results of these calculations for all jurisdictions, disaggregating the indicator by carbon prices on fuels and LETS.

The marginal cost incentive is better aligned across Canada in 2024, compared to 2020. Assuming all systems function as intended, we would expect the marginal cost to be roughly aligned with the federal price of $80 per tonne throughout the country, except in Quebec. That is the case here. The few slight differences are worth explaining:

- The marginal cost in Alberta is slightly lower than $80 per tonne because of the availability of offsets that trade at a discount. However, third-party information suggests that the trading price of credits in Alberta's LETS may be much lower, closer to $50 per tonne (Intercontinental Exchange Inc. 2024). There is insufficient publicly available data for us to evaluate this information and its impact on the marginal cost, but, as we discuss in Section 6.3, our modelling projections suggest that the marginal cost in Alberta's LETS is likely to be significantly reduced in the future.

  It is possible that the credits in other LETS are also trading below the posted carbon price. We also observe that information about the market value of Alberta credits would impact expectations in other LETS markets and thus influence prices elsewhere.

- The marginal cost in British Columbia is $80 per tonne, but the availability of offsets in B.C.'s new LETS has the potential to reduce the marginal cost incentive, depending on the quantity of offsets and their price. Given that B.C.'s LETS is new as of April 2024, we did not have sufficient information to estimate the impact of offsets in this new system.

39 As we note below, British Columbia also had offsets eligible for use in 2024, but we had insufficient data to account for them in our analysis.

- Newfoundland and Labrador also has a slightly lower marginal cost incentive than $80 per tonne because of unique provisions in their LETS that direct revenues from large emitters to NL Hydro at a floor rate that is lower than the scheduled carbon price. The floor rate represents a discount that pulls down the marginal cost incentive.[40]

- The marginal cost is lower in Quebec's cap-and-trade system. Though this means the system currently has lower price stringency than quantity-based systems, the binding emissions cap provides certainty about the emissions permitted in the system. Research suggests that there are excess allowances in the shared WCI market, which would depress the demand for, and therefore the price of, credits (Comité consultatif sur les changements climatiques 2024; Vert Martin and Pineau 2024).

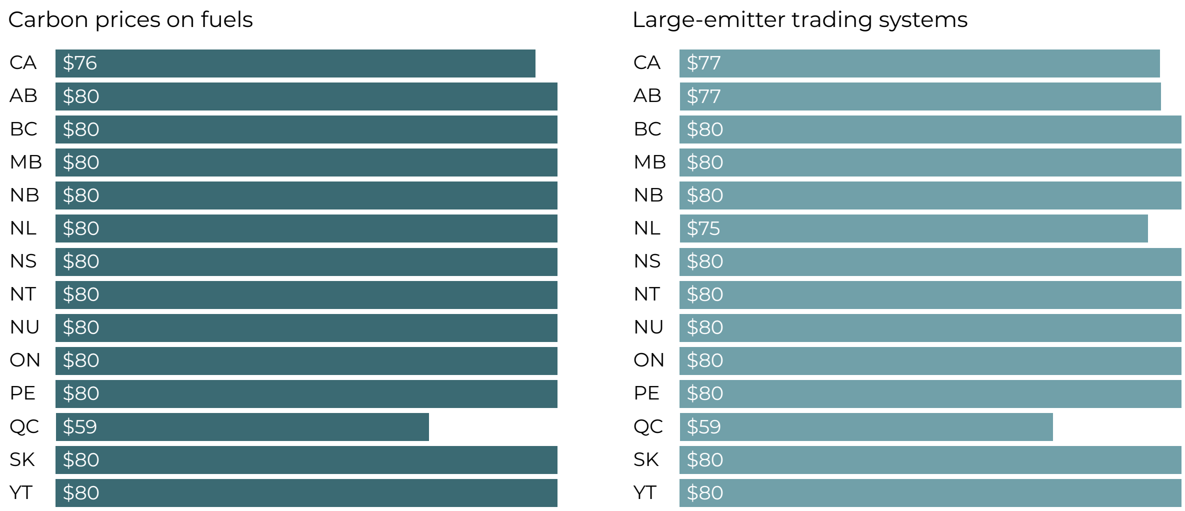
  Our projections of the marginal cost, discussed in Section 6.3.1, suggest that Quebec could close the gap between current auction prices and the national carbon price by 2030. Moreover, in their assessment of the operating parameters of the cap-and-trade market, Quebec and California have committed to reviewing, among other things, future emissions caps considering both the goal of net zero by 2050 and the quantity of saved and accumulated allowances in the system (Government of Quebec 2023).

  Because there is publicly available information about the price of allowances in the WCI system, we used these results to calculate the marginal cost incentive. The marginal cost shown here was calculated by taking the price from the first auction in 2024 (WCI Inc. et al.), increasing it by the average amount that WCI auction prices have historically risen in a year, and adjusting it slightly downward based on the price of offsets.

Figure 5:

## The marginal cost incentive in 2024

Marginal cost by jurisdiction ($/t $CO_2$e)




Note: Based on modelling that applies 2024 policy design to historical emissions data for 2021.
The entry for CA represents the national average, not federal carbon pricing systems.

40 The floor rate is set at 90 per cent of the carbon price in 2023, rising by 1 per cent per year until it reaches 95 per cent in 2028. There is no floor rate for private-sector-owned credits.

### 4.2.2 The average cost incentive

Average cost represents total compliance costs divided by total covered emissions in each jurisdiction. It contributes to the effectiveness of carbon pricing by influencing long-term capital investment decision making. It plays a bigger role in investment decision-making when there is an expectation that the marginal carbon price may not hold, especially if that investment affects credit supply, placing downward pressure on the marginal carbon price. For firms, the average cost also reflects the incentive to reduce emissions by reducing long-term production levels or avoiding investment in new facilities. The average cost also influences the design of the emissions performance of a new facility, since the average cost of emissions affects the overall cost of ownership and the expected return on investment.

The level of the average cost reflects policy design choices about how to minimize adverse competitiveness impacts and avoid carbon leakage. But while the short-term hit to competitiveness of a high average cost is obvious, low average costs can discourage structural changes in the economy over time by locking in high-emitting capital. Given the expected movement of the global economy toward increasingly low-carbon production, low average costs can also present a risk to long-term competitiveness.

To calculate average costs, we first determine the share of covered emissions that are subject to a carbon charge. This allows us to determine total compliance costs. For carbon prices on fuels, all covered emissions are subject to a carbon charge, so they are all priced at the marginal cost. For LETS, emissions below the regulated limit are effectively free, so only emissions above the limit are assumed to face a carbon charge. We used jurisdiction- and sector-specific benchmarks to estimate the quantity of each category of emissions that are effectively free, and assumed that all remaining covered emissions face a carbon charge.

Our estimates are subject to uncertainty due to the limited availability of data. Because we do not have facility-level data, we do not know whether facilities covered by LETS are below or above their applicable benchmarks. Where facility-level benchmarks exist, we also do not know the benchmark level, and have applied sectoral benchmarks instead. Because sectoral benchmarks are likely to be more stringent than facility-level benchmarks, the calculations below likely somewhat overestimate the stringency of systems where facility-level benchmarks apply. We mitigated this uncertainty by providing federal, provincial, and territorial governments with our assumptions about coverage and the quantity of emissions subject to a carbon charge, for their input. We then revised our assumptions where appropriate.

Since the denominator of the average cost calculation is tonnes of covered emissions, the indicator does not capture when tonnes are exempt from the policy. To provide a consistent comparison across jurisdictions, we weigh the average cost against the coverage standard in Section 4.2.3, below.

Table 6 shows the share of covered emissions that we estimate to face a carbon charge across the country.

Table 6:
## Share of covered emissions subject to a carbon charge by jurisdiction

| Jurisdiction | Covered fuels | LETS | Weighted total |
|---|---|---|---|
| YT | 100% | 19% | 99% |
| PE | 100% | 20% | 92% |
| MB | 100% | 15% | 85% |
| BC | 100% | 27% | 75% |
| NU | 100% | 20% | 74% |
| ON | 100% | 9% | 70% |
| QC | 100% | 9% | 69% |
| NT | 100% | 28% | 67% |
| NL | 100% | 8% | 54% |
| NS | 100% | 10% | 51% |
| SK | 100% | 24% | 46% |
| NB | 100% | 7% | 42% |
| AB | 100% | 12% | 30% |
| CA | 100% | 13% | 52% |

Note: Based on modelling that applies 2024 policy design to historical emissions data for 2021.

Our estimates of the average cost in this section of the report reflect carbon costs only. Our estimates do not include subsidies from revenue recycling, and they do not simulate credit-earning or trading dynamics in LETS. We account for these factors in analysis presented in Sections 6.2.2 and 6.2.4.

Our calculations also do not consider banking, advance auctions where allowances are obtained at lower prices, other subsidies like tax credits or grants, or abatement implemented at a cost below the carbon price. These factors would have the net effect of lowering the cost estimates we present in this section.

We calculate the average cost as follows:

$$AC_i = \frac{SE_{i,j} \times MI_{i,j}}{CE_{i,j}}$$

Where:

$ACi$ = Average cost calculated in each jurisdiction, *i*.
$SE_{i,j}$ = Share of emissions subject to a carbon charge in each jurisdiction, *i*, for each category of emissions from covered fuels and LETS, *j*.
$MI_{j}$ = Marginal cost incentive calculated in each jurisdiction, *i*, for each category of emissions, *j*.
$CE_{i,j}$ = Covered emissions in each jurisdiction, *i*, for each category of emissions, *j*.

Figure 6 summarizes the results of these calculations for all jurisdictions, disaggregating the indicator by carbon prices on fuels and LETS.

The average cost incentive under carbon prices on fuels is broadly aligned across the country, reflecting the harmonization of the price for these emissions—where they are covered—since the 2020 Independent Assessment. The exemptions to natural gas and light fuel oil used for heating, among others, do affect the marginal cost of emissions when measured against the coverage standard, as discussed in the section below. In Quebec, fuel distributors have access to offsets, which trade at a discount and slightly reduce the average cost.

The average cost for large emitters varies widely across the country. This assessment finds slightly less variation than in the 2020 assessment. Many design choices influence the changes since the last assessment, as well as the continued variation in average costs, of which we highlight the following:

- The average cost for large emitters is relatively aligned in jurisdictions covered by the backstop federal OBPS, with a slightly lower average cost incentive in Manitoba.
- As we noted above, the price of tradeable credits in Alberta's TIER system may be lower than we estimate. If so, the average cost for large emitters in Alberta could be around $6 per tonne rather than the $9 per tonne we estimate below.
- British Columbia's new provincial OBPS provides a lower average cost incentive, relative to the marginal, than the preceding carbon tax system for industry. This change reflects a deliberate design choice to lower the average cost incentive. Under B.C.'s previous system for large emitters, the CleanBC Industrial Incentive Program, the province's average cost was higher relative to other jurisdictions. Even with the new system, B.C.'s average cost incentive remains stronger than in most other jurisdictions.
- The lowest average cost incentives are in New Brunswick and Newfoundland and Labrador, where compliance emissions are the smallest fraction of covered emissions.
- Nova Scotia's new provincial OBPS provides a stronger average cost incentive relative to its previous cap-and-trade system, where free allocations for fuel distributors

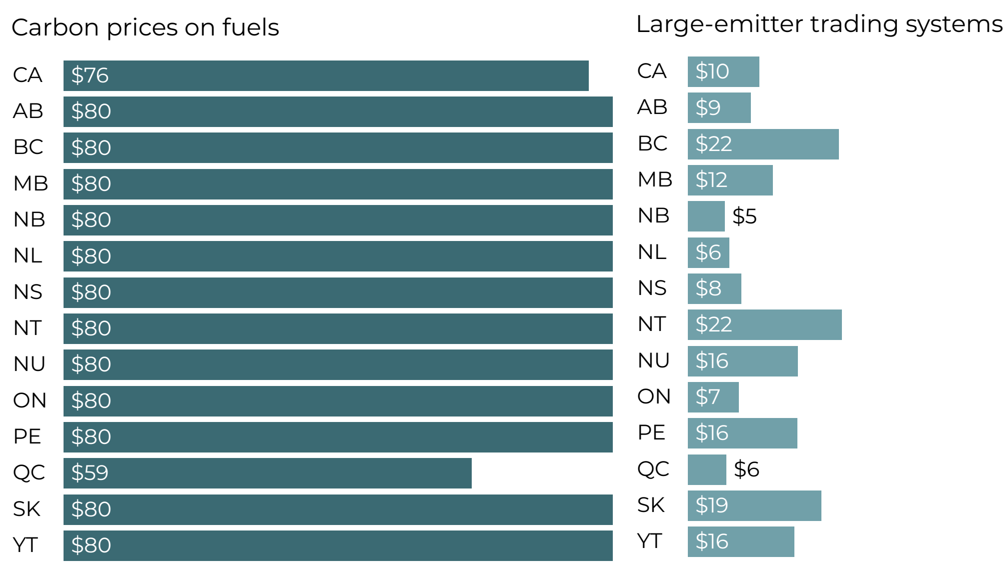
lowered the average cost incentive. Free allocations for process emissions somewhat reduce the average cost.

- The low average cost incentive in Quebec is primarily a function of the relatively low marginal cost incentive, but is also a function of free allocations that reduce facilities' compliance obligations.

Figure 6:

## The average cost incentive in 2024

Average cost by jurisdiction ($/t $CO_2$e)




Note: Based on modelling that applies 2024 policy design to historical emissions data for 2021.
The entry for CA represents the national average, not federal carbon pricing systems.

The average cost varies by sector as well as by jurisdiction. Figure 7 shows the spread of average costs for large emitters from nine sectors in 2024, based on 2021 emissions data.

Note that there is uncertainty in these estimates, which should be considered directional. For example, the distribution of facility emissions performance relative to the assumed sector benchmark will vary significantly, affecting the average cost for each facility. Furthermore, because some sectors produce more than one product (and therefore are subject to more than one benchmark), the estimates below may overstate the spread in average cost for facilities in different jurisdictions that produce the same product. There is also uncertainty related to our apportioning of emissions between carbon prices on fuels and LETS, and the quality of emissions data.

As in the 2020 Independent Assessment, we find that some sectors face very low average costs, relative to the carbon price.

As we noted in the last assessment, a low average cost does not necessarily mean low effectiveness in the short term. If credit markets are functioning efficiently, the marginal cost will incentivize abatement, and low average cost may only be the result of design choices to protect competitiveness. But in the longer term, low average costs do not send a strong enough signal to improve the emission intensity of new investments or to shutter old, inefficient, or high-emitting operations.

Low average costs also matter because the average cost will also have more influence on investment decisions when there is uncertainty about the expected future carbon price or marginal cost. For example, where large investment decisions could lead to significant credit generation and put downward pressure on the price of tradeable credits, such as investments involving carbon capture, utilization, and storage (CCUS), firms may not be able to capture the marginal cost on their abatement efforts and may place a greater emphasis on the average cost when making their investment decision, especially if there is lag in the system to rebalance supply with demand.

This assessment, like its predecessor, finds that the same sectors in different jurisdictions face widely varying average costs. The difference in average cost incentives for large emitters across Canada continues to present a risk to interjurisdictional competitiveness. That said, we observe some alignment in average costs since our last assessment. Although there is still a range of average cost incentives in LETS across the country, this range is narrower than in the last assessment. The question is whether systems have been designed to continue aligning, or whether they are likely to diverge again in the future. We return to this question in Section 6.1, where we compare LETS in greater detail.

Figure 7:

## Average costs for large-emitter sectors in 2024

Average cost by jurisdiction and sector (\$/t $CO_2e$)


Note: Based on modelling that applies 2024 policy design to historical emissions data for 2021.

The laelled red dots represent the emissions-weighted sectoral average cost across Canada. The dark dots represent the sectoral average cost in each province and territory.

### 4.2.3 The marginal and average cost incentive adjusted by the coverage standard

As we outlined earlier, effectiveness is a function of coverage and stringency. To combine the indicators of coverage and stringency discussed above, this section presents the cost incentives in each jurisdiction adjusted by the coverage standard.

The marginal cost incentive adjusted by the coverage standard is the product of each jurisdiction's coverage compared to the coverage standard and the marginal cost incentive.

The average cost incentive adjusted by the coverage standard is the product of each jurisdiction's coverage compared to the coverage standard and the average cost incentive.

For these indicators, a higher value reflects greater stringency, where the incentive—short-term for the marginal cost incentive and long-term for the average incentive—is maintained and broadly transmitted throughout the economy. The values presented here are likely upper bounds given that emitters could likely comply more cheaply than we have assumed—for example, through abatement that generates saleable performance credits, or because of subsidies, including revenue recycling.

Figure 8 shows the coverage-adjusted costs of carbon prices on fuels. We observe the following:

- These indicators are much better aligned today than they were at the time of the 2020 Independent Assessment. The removal of point-of-sale rebates and free allocations for fuel distributors has increased the stringency of carbon prices on covered fuels. As a result, the marginal cost is equal to the average cost in each jurisdiction.
- As we would expect, this indicator shows that systems with larger exemptions have lower stringency. Jurisdictions with large heating fuel exemptions—chiefly Saskatchewan, the Atlantic provinces, and the North except Yukon—have among the lowest coverage-adjusted cost incentives under carbon prices on fuels. Note that NIR data errors for the North make the territorial results less informative than for other jurisdictions.
- Though Quebec has the highest coverage compared to the coverage standard, its relatively low allowance price reduces its cost incentive compared to other jurisdictions.

Figure 8:

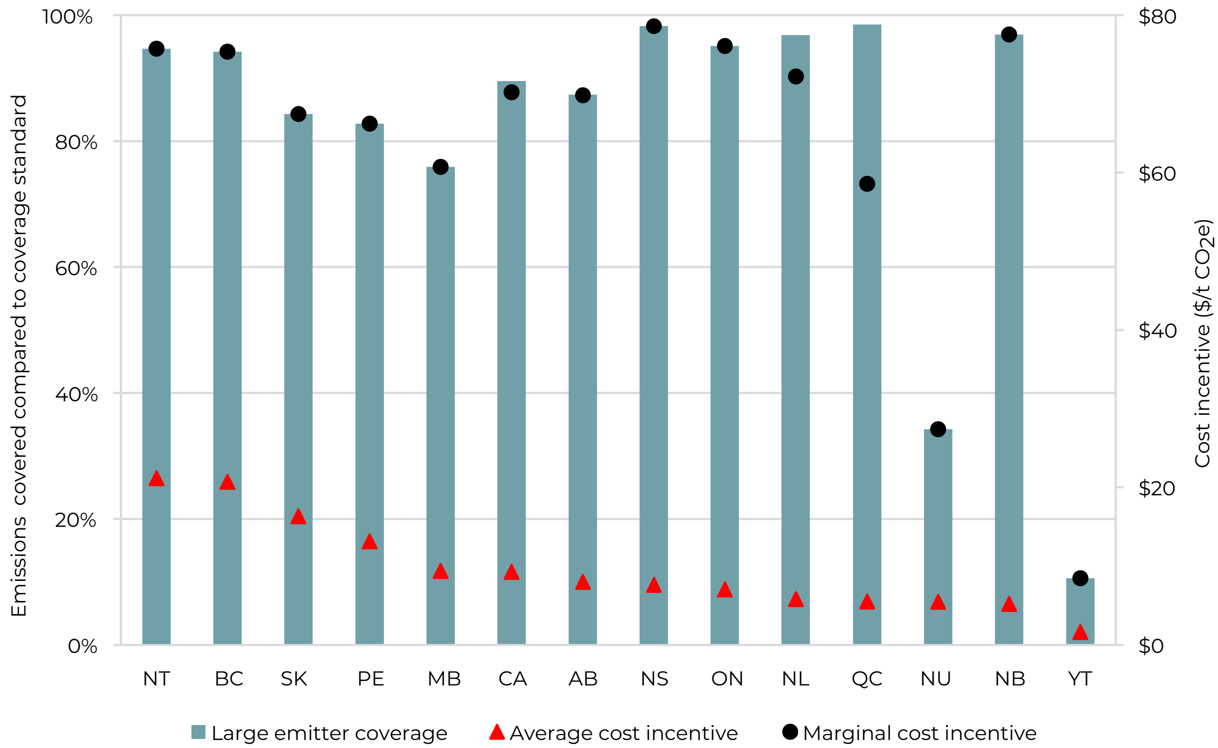
## The coverage-adjusted cost incentive in 2024 for carbon prices on fuels


Note: Based on modelling that applies 2024 policy design to historical emissions data for 2021.

For large emitters, as shown in Figure 9, there is greater variation in coverage-adjusted costs. The large differences in average costs are not surprising, given the presence of LETS and differentiated benchmark setting by jurisdiction. This difference is by design and does not necessarily imply that large-emitter programs are not stringent. If credit markets are functioning well, the marginal cost incentive drives abatement choices and emissions reductions. The question then becomes whether the market mechanisms are in place and are being adequately monitored to ensure a well-functioning credit market. The modelling projections in Sections 5 and 6 offer additional insight into the functioning of these markets.

Figure 9:

## The coverage-adjusted cost incentive in 2024 for large emitters




Note: Based on modelling that applies 2024 policy design to historical emissions data for 2021.

5

# Effectiveness of carbon pricing systems in 2030

The indicators above provide a useful picture of the effectiveness and stringency of carbon pricing systems in 2024, using historical data. This section supplements those indicators with the results of integrated modelling that provide insight into the longer-term effectiveness and stringency of carbon pricing systems in 2030.

The Institute commissioned Navius Research to conduct this modelling analysis. First, Navius and the Institute undertook a detailed review of carbon pricing systems across Canada. Navius then used the resulting information to represent each carbon pricing system, along with other federal and provincial climate policies, within its model. Federal, provincial, and territorial governments were invited to review this policy research and the assumptions in Navius' model. Navius then adjusted the parameters in the model based on the comments they received.

Navius Research modelled several scenarios to assess the effects of carbon pricing systems in Canada. For each scenario category, carbon prices on fuels and large-emitter trading system were added separately to isolate the incremental impact of each. These scenarios can be grouped into three categories:

1. **No policy:** A counterfactual that simulates what would have happened if Canada had adopted no emissions-reducing policies since 2015. It is not a business-as-usual scenario.
2. **Legislated policies:** These scenarios model carbon pricing plus federal, provincial, and territorial policies that are currently in effect or for which spending is already allocated. A list of these policies is available online.
3. **Announced policies:** These scenarios model carbon pricing, other legislated policies, and a representation of federal policy proposals that have not yet been implemented. A list of these policies is available online.

   The *announced policies* scenarios include a federal cap on emissions from the oil and gas sector, which is modelled as a cap-and-trade system that overlaps with carbon pricing systems. The federal government has not finalized the design of the oil and gas emissions cap, so our findings from these scenarios should be interpreted as an illustration of the considerations worth weighing when developing policies that will interact with carbon pricing.

There are two versions of this scenario. The reference version is called the *announced, less stringent policies* scenario. We consider it less stringent because the interaction between some announced policies and carbon pricing causes an over-supply of credits in some provincial LETS. This can lead to no net demand for credits and a marginal cost incentive that is lower than the national carbon price (referred to here as a non-binding carbon price).

To simulate a binding carbon price, Navius modelled another version of the *announced policies* scenarios that tightens LETS benchmarks until there is a net demand for credits in 2030. We call this the *announced, more stringent* scenario. This scenario represents one of the objective of the federal benchmark, which is to ensure that systems are stringent enough to maintain binding carbon prices.

Navius Research also modelled a series of sensitivities that varied key assumptions within the model, namely the price of oil and the cost of emissions-reducing technologies. Altogether, Navius conducted 50 modelling runs for this assessment.

## 5.1 Overall effectiveness indicators: Emissions reductions

If the primary goal of carbon pricing is to reduce emissions of heat-trapping gases, then emissions reductions are the most important indicator of effectiveness. For this assessment, it was not practical to measure the emissions that may have already been reduced by carbon pricing across Canada,[41] but it is possible to estimate the future impact of carbon pricing. The integrated modelling conducted for the 2024 Independent Assessment allows us to estimate emissions in each jurisdiction of Canada in 2030 under various policy scenarios, and to attribute a share of the avoided emissions to carbon pricing.

From this analysis, we find that:

- Carbon pricing delivers significant emissions reductions.
- Large-emitting trading systems deliver the bulk of emissions reductions from carbon pricing, though carbon prices on fuels still deliver substantial reductions, and in some smaller jurisdictions these carbon prices are more important than those for large emitters.
- Announced federal policies are expected to increasingly overlap with carbon pricing, and there is a risk that some of these policies could diminish the effectiveness of carbon pricing.

41 There is research into the impact of carbon pricing policies on emissions, including in Canada. However, that research relied partly on the existence of a natural counterfactual wherein carbon pricing policies did not exist in all jurisdictions. There are several reasons that a similar analysis could not be undertaken here. First, the existence of pan-Canadian carbon pricing means there is no real-life counterfactual against which to compare these policies. Second, at the time of writing, there were only three years of emissions data available to assess the impact of pan-Canadian carbon pricing, and two of these years reflect the distorting impacts of the COVID-19 pandemic. Third, the mandate of the 2024 Independent Assessment was to examine existing carbon pricing systems, many of which had only recently entered into force.

Our findings are consistent under a range of sensitivities, align with previous analyses by the Institute, and are broadly comparable to federal modelling.

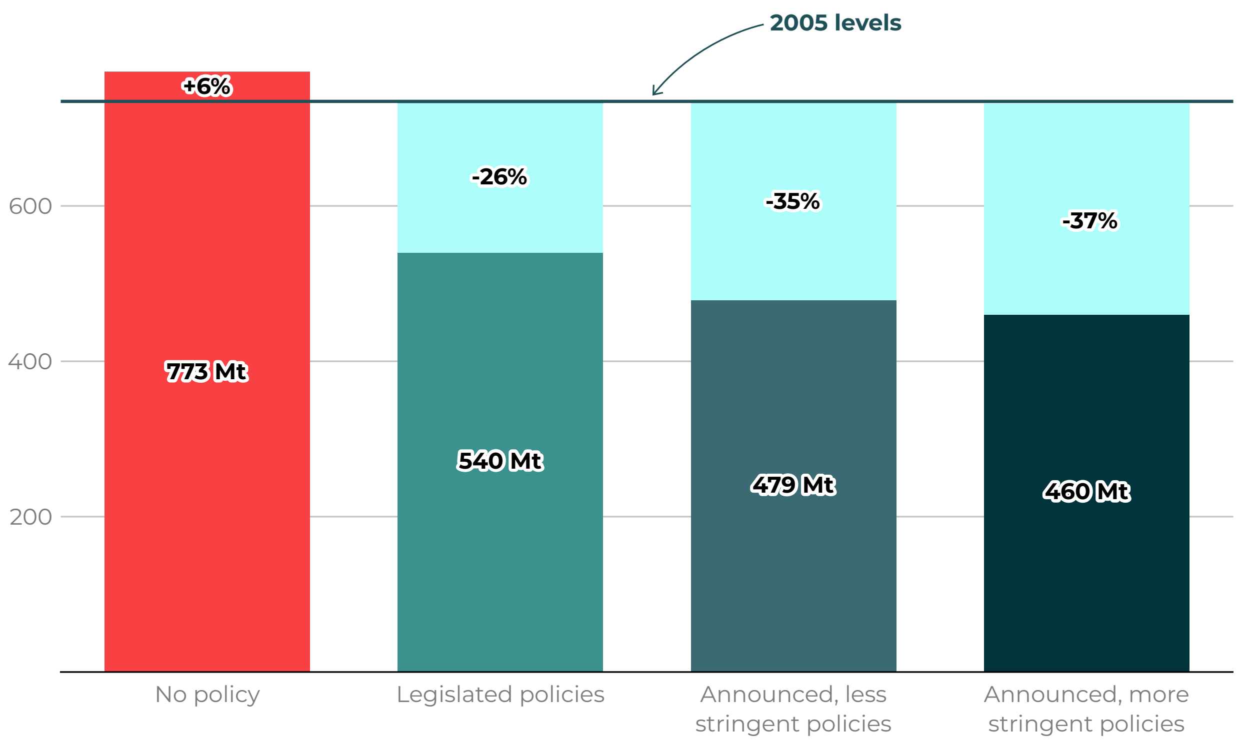
### 5.1.1 National results

Figure 10 offers a high-level overview of the national results, showing net emissions in Canada under the principal scenarios. In brief, these results show that emissions-reducing policies—carbon pricing, regulations, and subsidies—are reducing Canada's emissions. Without these policies in place, Canada's emissions would be above historical levels in 2030. These results are consistent with the findings from the Canadian Climate Institute's independent assessment of the federal *2023 Progress Report on the 2030 Emissions Reduction Plan* (Sawyer et al. 2023).

Figure 10:

## Projected net emissions in Canada in 2030

Net national emissions (Mt $CO_2e$) and comparison to 2005 levels (%)




Note: Based on a projection from integrated modelling.

The *no policy* scenario represents gross emissions. For all other scenarios, net emissions include 4 Mt of imported WCI allowances; 32 Mt in reductions from LULUCF accounting, 13 Mt in reductions from agricultural- and nature-based solutions; and—in the *announced policies* scenarios only—25 Mt in compliance flexibility for the federal cap on oil and gas sector emissions. The quantity of WCI allowance imports is derived from the Navius Research modelling, while the other three figures are exogenous to the model and are taken directly from ECCC's 2023 emissions projections.

The gross emissions for the policy scenarios are as follows: 589 Mt in the *legislated policies* scenario, 552 Mt in the *announced, less stringent policies* scenario, and 534 Mt in the announced, *more stringent policies* scenario. Figures may not add due to rounding.

The key question for this assessment is how carbon pricing contributes to these reductions. Because policies inherently overlap and interact, it is difficult to assign a precise value to the impact of any policy. Instead, this analysis presents a range of values for the emissions reduced by carbon pricing. The range of values reflects the order in which climate policies were added to the model. If two policies overlap, whichever one is added to the model first will generally have the greater impact. Consequently, Navius Research modelled scenarios that added carbon pricing before other policies as well as scenarios that added carbon pricing after other policies. In this way, a range of emissions reductions can be attributed to carbon pricing and other policies, where the range reflects the degree of overlap between these measures.

The figures below illustrate how carbon pricing contributes to emissions reductions in 2030. Figure 11 breaks down the emissions reductions in the *legislated policies* scenario, and Figure 12 does the same for the *announced, less stringent policies* scenario. In both figures, the *no policy* scenario is the baseline. This means that emissions reductions represent the effect of policies on Canada's emissions compared to a scenario where no climate policy exists.

In the *legislated policies* scenario, we disaggregate emissions reductions into the following categories:

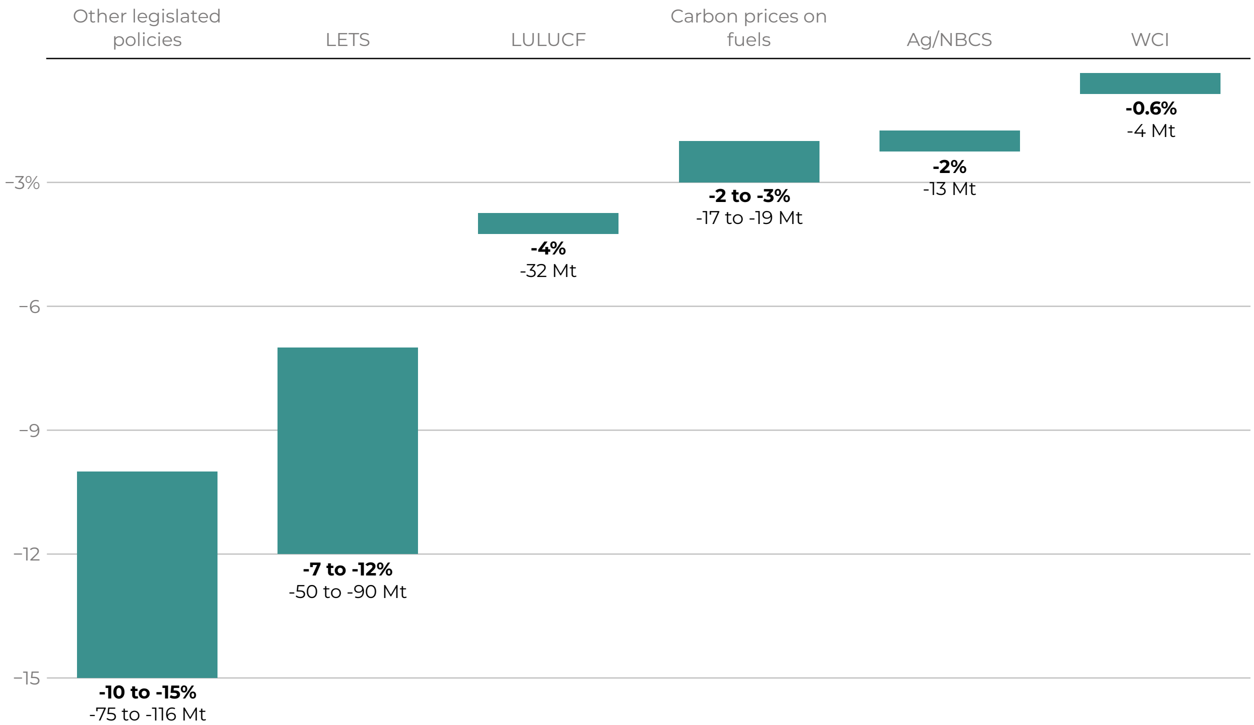
- **LETS,** which are the carbon pricing systems for large emitters in each jurisdiction. In the *legislated policies* scenario, LETS reduce emissions by 7 to 12 per cent below *no policy* levels in 2030, or between 51 and 90 Mt. This effect represents a significant proportion—between 22 and 39 per cent—of net emissions reductions from all measures in the *legislated policies* scenario. These results are consistent with the Institute's previously published research (Beugin et al. 2024).
- **Carbon prices on fuels,** which reduce emissions by between 2 and 3 per cent below *no policy* levels in 2030, or between 15 and 19 Mt, representing 8 to 9 per cent of net emissions reductions in this scenario.
- **WCI allowances,** which account for the net trade in allowances between Quebec and California. In the *legislated policies* scenario, Quebec imports 4.4 Mt of allowances in 2030.
- **Other policies,** which encompass all existing federal, provincial, and territorial policies that we modelled. They reduce emissions by 10 to 15 per cent below *no policy* levels in 2030, accounting for 32 to 50 per cent of net reductions. A list of these policies is available online.
- **Land use, land-use change, and forestry (LULUCF),** what the federal government calls an "accounting contribution" obtained by comparing projected LULUCF emissions to a reference case. Because Navius' model does not represent the LULUCF sector, we adopted the figure of 31.6 Mt from ECCC's latest annual emissions projections. We describe ECCC's projections in Section 5.3.
- **Agricultural- and nature-based climate solutions (Ag/NBCS),** representing the use of best management practices on agricultural land as well as the avoided conversion and restoration of ecosystems such as wetlands, grasslands, and forest land. These 13 Mt of

reductions are exogenous to Navius modelling and were adopted from ECCC's emissions projections.

Figure 11:

## Emissions reductions in 2030 by measure, *legislated policies* scenario

Net emissions reductions compared to *no policy* levels (%)




Note: Based on a projection from integrated modelling.

In the *announced policies* scenarios, the breakdown of measures changes slightly:

- **Additional policies overlap with carbon pricing in new ways**. The additional federal measures in this scenario deliver additional emissions reductions, but they also overlap with carbon pricing to a greater extent than current policies. In some cases, these additional policies reinforce or simply duplicate the effect of carbon pricing, but in other cases, they make carbon pricing less effective. When carbon pricing is added to the model first, it reduces the same quantity of emissions, as we would expect. However, when carbon pricing is added after announced policies, it reduces fewer emissions. The low end of expected reductions from LETS is 20 Mt in 2030, compared to 50 Mt in the *legislated policies* scenario.

  As we discuss in Section 6.3, the diminished role of LETS is partly because some provincial systems do not maintain a net demand for credits, making carbon pricing less effective at reducing emissions.

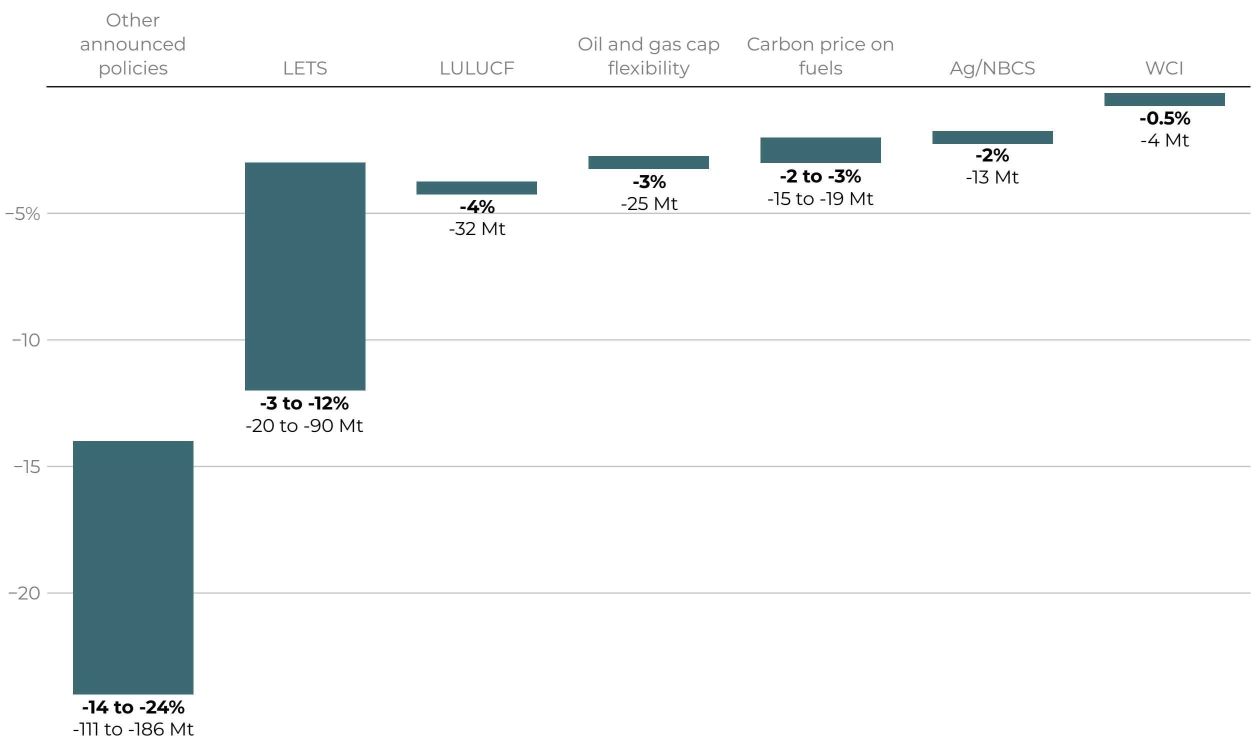
- **Quebec imports slightly fewer WCI allowances.** In the *announced, less stringent policies* scenario, Quebec is a net importer of 3.8 Mt of WCI allowances.

- **We adopt an exogenous assumption about additional emissions reductions from the federal oil and gas emissions cap.** In the *announced policies* scenarios, we add emissions reductions from the compliance flexibility permitted under the proposed federal cap on oil and gas sector emissions and assume they take place within the year in which the technology fund payment takes place or in which the offset is purchased. Rather than simulate this element of the oil and gas emissions cap endogenously, we have added these reductions exogenously to align with ECCC's assumption that the compliance flexibilities could deliver 25 Mt of emissions reductions in 2030. For a description of Navius' assumptions in modelling the oil and gas emissions cap, please refer to the Annex.

Figure 12:

## Emissions reductions in 2030 by measure, *announced, less stringent policies* scenario

Net emissions reductions compared to *no policy* levels (%)




Note: Based on a projection from integrated modelling.

These figures illustrate three important findings about the role of carbon pricing at a national level:

1. **Carbon pricing systems are projected to drive significant emissions reductions in 2030.** These reductions represent a large share of the effort to achieve Canada's target. In the *legislated policies* scenario, carbon pricing systems account for a third to a half of all the emissions reductions expected in 2030.

2. **Large-emitter trading systems have a greater impact on emissions.** The maximum potential impact of LETS is roughly four-and-a-half times greater than carbon prices on fuels.

   LETS have a greater impact partly because they have greater scope than carbon prices on fuels, applying to 42 per cent of national emissions compared to 34 per cent for carbon prices on fuels. LETS also apply to emissions that have lower-cost abatement pathways (e.g., reducing reliance on fossil fuel electricity generation), resulting in a greater emissions response than carbon prices on fuels (e.g., shifting to electric vehicles). That said, our findings in the following section add important nuance to this finding.

3. **Policy interactions can undermine the effectiveness of carbon pricing.** We discuss this finding further in Section 6.3. Depending on the final design of complementary policies, LETS and other sectoral climate policies are at risk of interacting in ways that lead to excess credits in carbon pricing systems, undermining the price signal from carbon pricing and leading to fewer emissions reductions from LETS. As we noted earlier, overlap between climate policies is inevitable. However, where two policies overlap, there is a risk that they duplicate efforts, or at worst, undermine each other. The *announced, less stringent policies* scenario shows that adverse policy interactions put the effectiveness of carbon pricing at risk.

### 5.1.2 Results by jurisdiction

Carbon pricing plays an important, but widely varying, role in sub-national emissions reductions. Figure 13 shows how carbon pricing contributes to emissions reductions in each jurisdiction in the *legislated policies* scenario, and Figure 14 illustrates the contribution of carbon pricing in the *announced, less stringent* scenario. Whereas the previous section showed net emissions reductions, the figures below show gross emissions reductions in all jurisdictions except in Quebec, where we show imported WCI allowances estimated from the integrated modelling.

The data add some useful nuance to the national picture described in the preceding section:

- **Carbon prices on fuels play a more important role than LETS in select jurisdictions**. Carbon prices for covered fuels represent an important driver of emissions reductions, particularly in jurisdictions with a small number of industrial facilities or limited industrial abatement options. For example, in Prince Edward Island, large emitters represent a much smaller share of total emissions, so carbon pricing for these facilities contributes a smaller share of total reductions. Offshore emitters in Newfoundland and Labrador and large emitters in the territories have fewer opportunities to abate, so LETS are projected to drive fewer emissions reductions in these jurisdictions. And gaps and errors in the NIR data for the territories, particularly Nunavut, help to explain the smaller contribution of LETS.
- **LETS are particularly powerful in jurisdictions with fossil-fuelled electricity**. This data reinforces evidence that one of the most significant roles for LETS is to amplify the impact of decarbonization policies for the electricity sector, such as coal phase

out regulations (Olmstead and Yatchew 2022). LETS have the greatest potential impact in provinces with coal-fired electricity,[42] or where new sources of gas-fired electricity receive separate benchmarks.[43] This is also where the impact of LETS is the most sensitive to the order in which policies are added to the model. When other policies—such as the mandate to phase out coal-fired electricity by 2030—are added to the model first, the impact of LETS is much lower. The true impact of carbon pricing is likely in between these extremes.

- **Some LETS are at risk of interacting with other policies in ways that make carbon pricing less effective**. In the *announced, less stringent* scenario, we observe a significant decrease in the low end of the range of emissions reductions from LETS. This decrease has two causes: the re-attribution of emissions reductions from carbon pricing to other policies, and the reduced effectiveness of carbon pricing due to potential adverse policy interactions. As we discuss in Section 6.3, there is a risk that some policies—depending on their final design—could contribute to an oversupply of credits in LETS markets, depressing the marginal incentive to abate.

42 In the modelling, those provinces are Alberta, New Brunswick, Nova Scotia, and Saskatchewan. The last coal-fired power plants in Alberta closed in 2024.

43 As in Nova Scotia and Saskatchewan. The federal OBPS also has a separate benchmark for new gas-fired generation.

Figure 13:

# Emissions reductions in 2030 by jurisdiction, *legislated policies* scenario

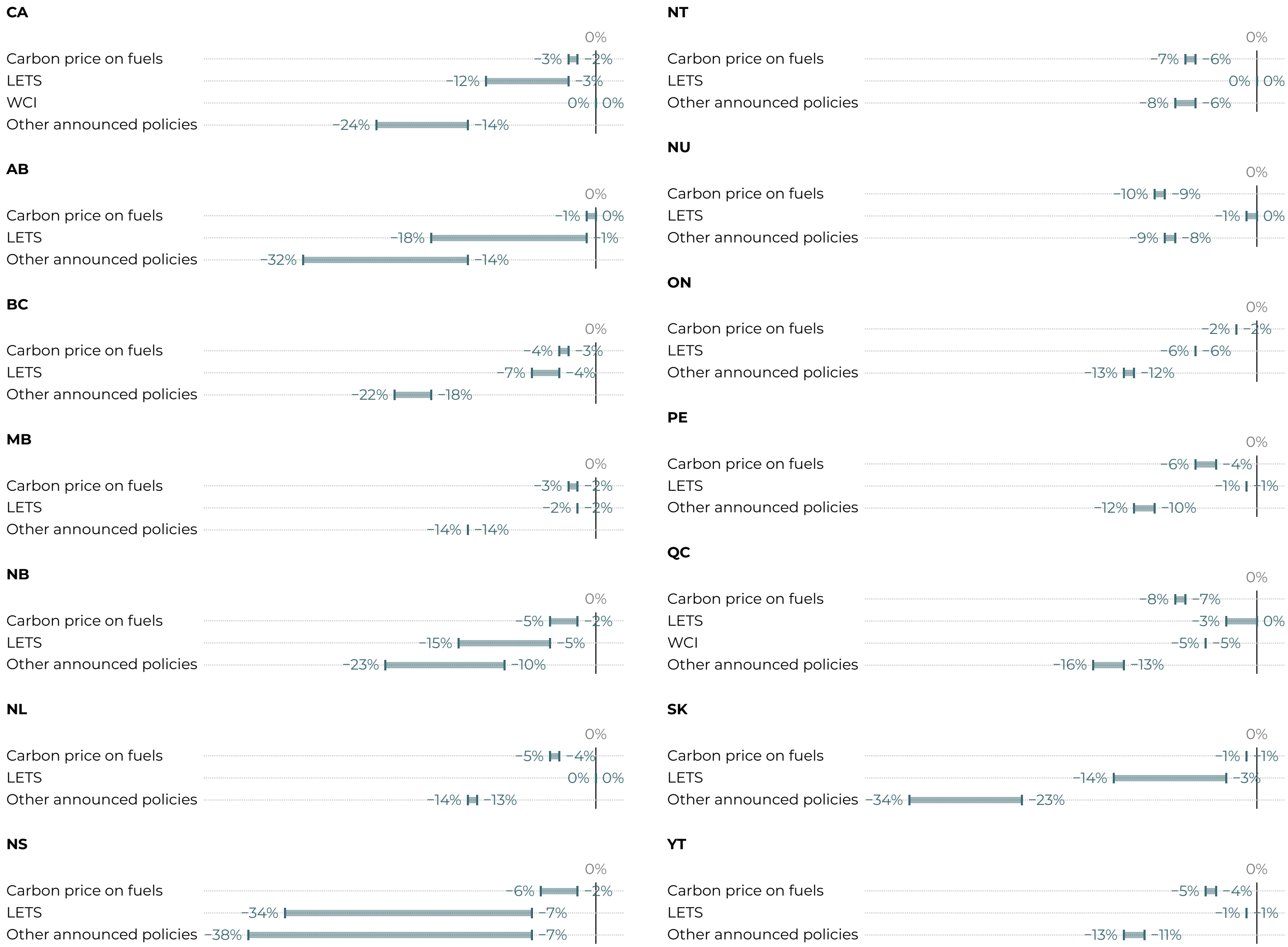
Gross emissions reductions compared to *no policy* levels (%)


Note: Based on a projection from integrated modelling.

Figure 14:

## Emissions reductions in 2030 by jurisdiction, *announced, less stringent* policies scenario

Gross emissions reductions compared to *no policy* levels (%)




Note: Based on a projection from integrated modelling.

## 5.2 Sensitivity analysis

Uncertainty is always inherent in modelling projections. To account for the most significant uncertainties, Navius Research modelled five sensitivity cases: a reference case, plus four scenarios with either high or low oil prices and high or low technology costs. The results presented elsewhere in this report use the reference case assumptions for technology costs and the price of crude oil.

In the *legislated policies* scenario, Canada's gross emissions are between 6 per cent lower and 1 per cent higher than the reference case under different sensitivities. In the *announced, less stringent policies* scenario, the country's gross emissions are between 5 per cent lower and 1 per cent higher compared to the reference case under all sensitivities. The sensitivities do not alter the key findings discussed above.

The emissions impact of sensitivities varies between production and consumption:

- **Oil prices primarily drive upstream emissions, and have less of an impact on end-use emissions.** Low oil prices induce lower production in the oil and gas sector compared to high prices, resulting in fewer emissions that need to be addressed by LETS and vice versa. Low oil prices do not necessarily lead to a countervailing impact of increased fossil fuel consumption given that end-uses are decarbonizing rapidly and therefore are less sensitive to the rebound effect of lower oil prices.
- **Technology costs impact large-emitter emissions the most.** Emissions reductions achieved through LETS are more sensitive to the costs of clean technology. LETS represent a larger share of emissions reductions when clean technology costs are low and oil prices are high.

For more information about the sensitivities, see the Annex.

## 5.3 Comparison to federal modelling

Canadian governments undertake modelling and analysis of their own climate measures, and the modelling for the 2024 Independent Assessment has been discussed and shared with the federal, provincial, and territorial governments. For the sake of additional transparency and rigour, it is worth comparing the modelling in this assessment to the publicly available federal modelling of Canadian climate policies.

Every year, ECCC publishes modelled projections of Canada's emissions under different scenarios. Figure 15 compares ECCC's latest projections, from December 2023, with the results of the 2024 Independent Assessment (Environment and Climate Change Canada 2023a). The figure shows two ECCC scenarios that can be compared with the 2024 assessment scenarios, as follows:

- The ECCC Reference Case is most like our *legislated policies* scenario. The ECCC Case includes federal, provincial, and territorial policies and measures that were in place in August 2023. The ECCC Case also includes the accounting contribution from the LULUCF sector. Our *legislated policies* scenario is similar but also includes emissions reductions from agricultural- and nature-based climate solutions, as well as WCI allowances.

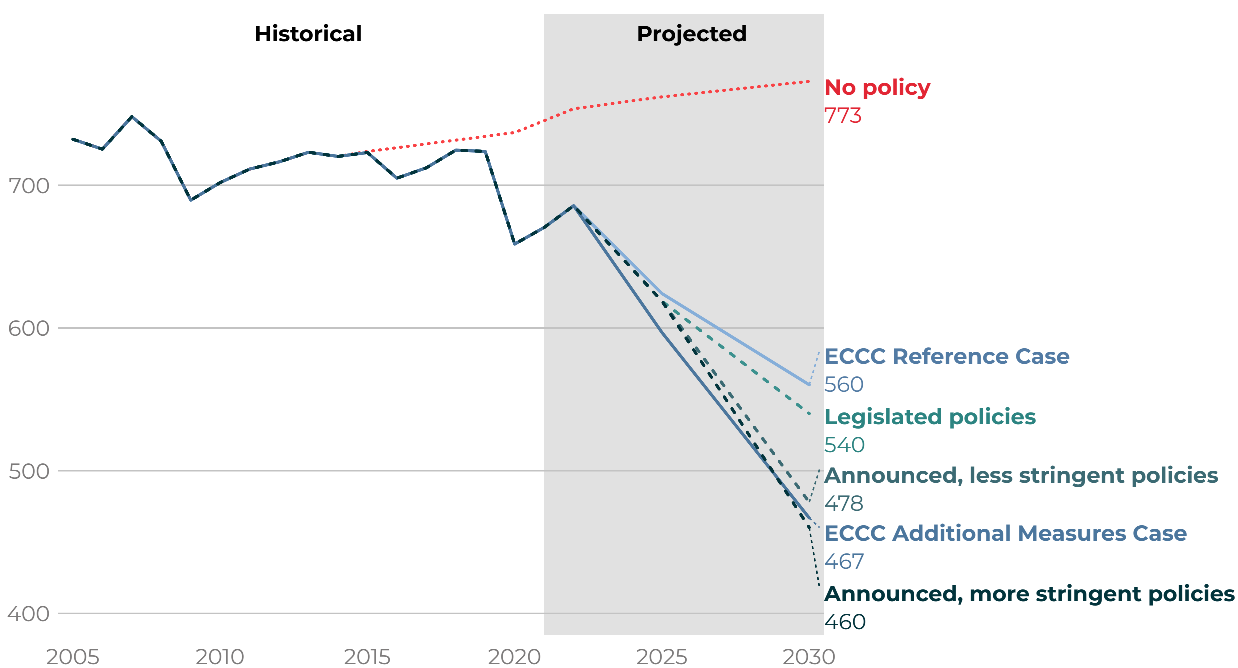
- The ECCC Additional Measures Case is most like our *announced, more stringent policies* scenario. The Additional Measures Case includes all federal, provincial, and territorial policies and measures from the Reference Case as well as those that have been announced but have not yet been fully implemented. It includes the accounting contribution from the LULUCF sector, agriculture- and nature-based climate solutions, and WCI allowance imports. The *announced, more stringent* policies scenario differs mainly in that it does not include announced provincial or territorial measures, only federal ones. Both scenarios assume a binding carbon price.

There is greater uncertainty about the future trajectory of Canada's emissions than the figure suggests. Policies may be implemented at a different speed or in different ways that these models assume. Furthermore, all the modelling presented in this report relies on some of the same assumptions about emissions reductions attributed to the agriculture and LULUCF sectors. The actual contributions of agricultural- and nature-based climate solutions, and the evolution of LULUCF emissions, are uncertain.

Figure 15:

## Comparing federal emissions projections to the 2024 Independent Assessment

Net national emissions (Mt $CO_2e$)



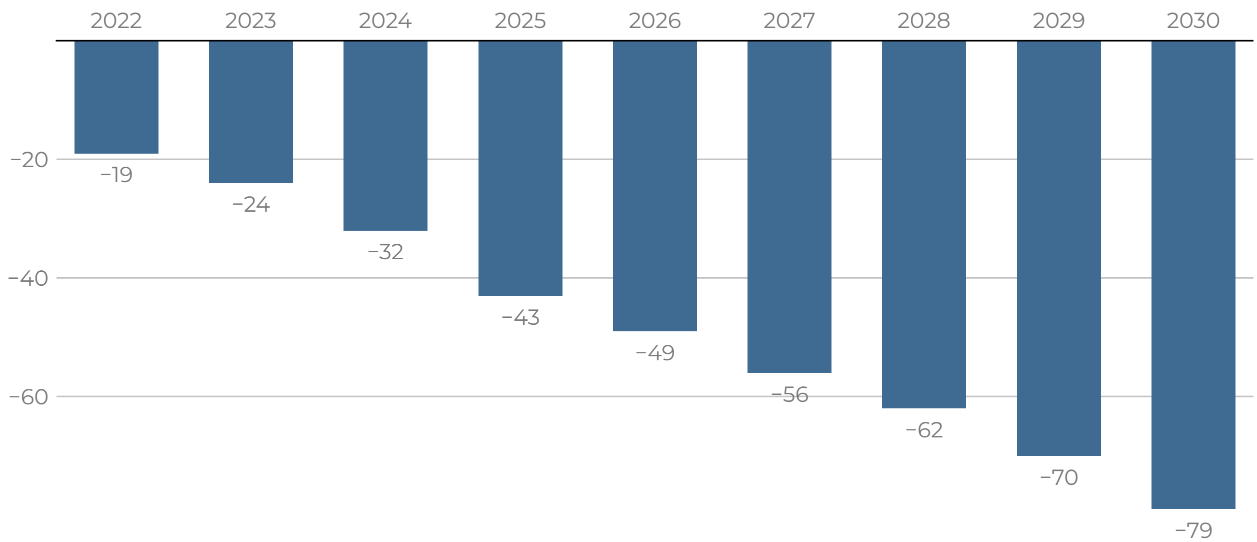

Note: Based on projections from integrated modelling. ECCC scenario results are taken from its report, Greenhouse gas and air pollutant emissions projections - 2023.

The federal government has also published its own estimates of the emissions reduced by carbon pricing (Environment and Climate Change Canada 2023b). These estimates are reproduced below in Figure 16. The results for 2030 are comparable to our estimates for the combined impacts of all carbon pricing systems, being toward the low end of the range in our *legislated policies* scenario or the middle of the range in the *announced policies* scenario. Though the federal figures are based on very different modelling approaches, assumptions, and policy specifications from those used in this assessment, we note that the results are comparable to ours.

Figure 16:

## ECCC estimates of emissions reduced by carbon pricing, 2022–30

Emissions reduced per year (Mt $CO_2e$)




Note: Reproduced from ECCC, How pollution pricing reduces emissions.

# 6 Large-emitter trading systems: Reducing emissions while protecting competitiveness

## 6.1 Design features of large-emitter trading systems

Large-emitter trading systems, the single most effective emissions reduction policy currently deployed in Canada, have a dual purpose of incentivizing facilities to reduce their emissions and protecting their competitiveness, with various design features to drive these outcomes. Table 7 compares LETS design across jurisdictions, focusing on the following features:

**Different approaches to setting benchmarks.** Systems can provide sector-wide, product-specific, or fuel-specific emissions intensities that are used to calculate the compliance obligation of an individual facility, or they can set benchmarks based on the historical emissions intensity of that specific facility. Many systems also contain provisions for facilities to request revised benchmarks.

Some important information about benchmarks is unpublished. While governments publish tightening rates and sector-wide benchmarks, facility-level benchmarks are confidential since any facility-specific information is considered commercially sensitive. However, this information is not considered commercially sensitive in all parts of the world. For example, the European Union publishes facility-specific free allocations under its Emissions Trading System (European Commission 2021).

Furthermore, some carbon pricing systems contain provisions allowing regulators to revise benchmarks. In some cases, facilities can request a revision. In many jurisdictions, the regulator adjusts benchmarks based on the emissions intensity and trade exposure of a facility or sector. The criteria for deeming a facility or sector as EITE vary by jurisdiction. These criteria are public, but the subsequent adjustments to benchmarks are not. The opacity of benchmarking approaches, and the limited public information about activity in carbon pricing markets, are significant barriers to external analysis of carbon pricing systems and potential threats to their effectiveness.

**Mandatory emission thresholds,** or the level of emissions required for a facility to be covered by a LETS. Nearly every system also contains opt-in provisions, allowing certain facilities below the mandatory coverage threshold to opt into the LETS.

There are also different ways to define facility boundaries and measure their emissions. Some systems allow multiple smaller-emitting facilities to be “aggregated” and treated jointly as a single emitter. There may also be some differences between the emissions quantification approaches used in different jurisdictions, but we did not examine those as part of this assessment.

**Tightening provisions for benchmarks that increase compliance emissions,** either through tightening rates in output-based systems or through declining emissions caps and reduced free allocations in cap-and-trade systems. Tightening provisions are supposed to be designed to maintain the price stringency of the system as emitters abate or otherwise comply with the system. They are also designed to be adjusted as major trading partners also price emissions, lessening the misalignment of carbon prices among trading partners.

**Offsets.** Only a few jurisdictions currently allow the use of offsets, namely Alberta, British Columbia, Quebec, and the federal OBPS, which currently applies in four jurisdictions. Some jurisdictions do not permit offsets. In some other jurisdictions, carbon pricing legislation or regulations refer to offsets, but do not outline a process to earn or submit credits.[44] Many systems allow the use of offset credits, at least in theory, though many systems do not currently recognize any offset protocols.

**Compliance use limits.** Systems may impose a limit on the share of tradeable or other performance credits that facilities can use to meet their compliance obligations. Such limits can have distortionary effects on abatement choices and emission markets. Lower limits could increase the marginal incentive for facilities that emit above their benchmarks because they are forced to use the fund payment, which is presumed to have a higher cost. Conversely, lower limits can erode the incentive to generate credits from facilities that emit below their benchmarks by artificially suppressing the demand for and market value of credits. Additionally, many systems apply time limits to the usage of compliance credits to ensure that the supply of compliance units does not rise to levels that would erode the price signal.

**Provisions specific to the treatment of new facilities,** intended to ensure that new facilities are not subject to undue cost burdens during their initial phase of operations.

44 For example, the regulations for Saskatchewan's Output-Based Performance Standards Program note that the government may develop a standard for "performance credits, CCUS credits and offset credits," but the provincial government has not developed an offset standard.

Table 7:

## Comparison of large-emitter provisions, 2024–30

| Jurisdiction | Benchmarking approach | Coverage thresholds | | Tightening provisions | Offsets and compliance use limits | Time limits on usage | Treatment of new facilities |
|---|---|---|---|---|---|---|---|
| | | Mandatory | Opt-in | | | | |
| **Federal OBPS (MB, NU, PE, YT)** | Product-specific, except electricity, which is fuel-specific | 50 kt/yr | 10 kt/yr | 1% for cement, lime, petrochemicals, iron and steel, some aluminum, and organic basic chemicals standards<br>2% for all other emissions<br>Separate schedule for electricity | Credit and offset use up to 75% of compliance | 5 years for surplus credits, 8 years for eligible offsets | 2-year grace period |
| **AB** | Most facilities can opt for facility-specific or product-specific.<br>Product-specific for electricity, hydrogen, and industrial heat | 100 kt/yr | 2 kt/yr if EITE, 0 kt/yr for those competing with TIER facilities | No tightening rate for process emissions<br>2% for all other emissions<br>4% for oil sands facilities in 2029 and 2030 | Credit and offset use up to 70% in 2024, 80% in 2025, and 90% after 2026. | 5 years | Up to 3-year grace period |
| **BC** | Product-specific | 10 kt/yr | 0 kt/yr for facilities in regulated sectors | 0% for process emissions<br>1% for all other emissions | Credit and offset use up to 50% in 2024, 40% in 2025, and 30% 2026–30 | Offsets expire after 3 years<br>Earned credits do not expire | Grace period up to 3 years less a day |
| **NB** | Mostly facility-specific.<br>Electricity is fuel-specific | 50 kt/yr | 10 kt/yr | 2% for combustion emissions<br>Benchmark for process emissions linked to each year's emissions (no tightening)<br>Separate schedule for electricity | Credit and offset use up to 100%, but no offsets currently recognized | Seven years | 3-year grace period[45] |
| **NL** | Mostly facility-specific, with unique crediting provisions for the thermal Holyrood Generating Station | 25 kt/yr | 15 kt/yr | Existing facilities must reduce emissions intensity by 2% per year, reaching 28% by 2030 | Credit use up to 100% for offshore facilities and 80% for others. Remaining compliance must be bought at 4 times the carbon price.<br>No offsets currently recognized | Seven years | 3-year grace period[46] |

45 New facilities begin with a benchmark at "reduction period 1," which is equal to the 2021 benchmark for existing facilities.

46 New facilities must reduce emissions at an accelerated rate, but do not have to meet the 28 per cent reduction target until their eighth year of operation.

| Jurisdiction | Benchmarking approach | Coverage thresholds | | Tightening provisions | Offsets and compliance use limits | Time limits on usage | Treatment of new facilities |
|---|---|---|---|---|---|---|---|
| | | Mandatory | Opt-in | | | | |
| **NS** | Mostly facility-specific.<br>Electricity is fuel-specific | 50 kt/yr | 10 kt/yr | 1% for combustion emissions of EITE products<br>1.5% for combustion emissions of all other products<br>Benchmark for process emissions equal to each year's emissions (no tightening)<br>Separate schedule for electricity | Credit and offset use up to 100%, but no offsets currently recognized | Seven years | Apply to the Minister for a benchmark |
| **NT** | Facilities receive a rebate equal to 72% of their average fuel use in the preceding 3 years | Facilities identified by regulation | | None (carbon tax) | None | No tradeable allowances | Receive a 72% rebate until a baseline can be established.<br>More adjustments in construction phase |
| **ON** | Mostly facility-specific | 50 kt/yr | 10 kt/yr | 1.5%<br>Fixed benchmark for electricity | Credit use up to 100% of compliance<br>No offsets | 5 years | Product-specific benchmark for relevant facilities; benchmarks based on initial emissions intensity for others |
| **QC** | Free allocation is sector specific for aluminum, lime, and cement. Facility-specific for all other large emitters | 25 kt/yr | 10 kt/yr | Caps decline at an average rate of 2.6% per year<br>Free allocations will be reduced at rates that depend on the EITE intensity of the facility, averaging an annual reduction of 2.7% | Offset use up to 8% of compliance | No time limits on usage | Benchmark based on 3 years of emissions, depending on when facility reaches emissions threshold |
| **SK** | Facility-specific for most sectors, fuel-specific for electricity, and product-specific for sold heat | 25 kt/yr, and 10 kt/yr for electricity facilities | 0 kt/yr | 0.63% for gas-to-power<br>1.67% for oil and gas<br>1.5% for all other sectors<br>Separate schedule for electricity<br>No tightening rate for non-energy emissions[47] | Credit use up to 100%. No offsets currently recognized | No time limits on usage | 2-year grace period, benchmark based on initial emissions intensity |

47 These are emissions from the use of associated gas for electricity generation, when that gas would have otherwise been flared or vented.

# 6.2 Competitiveness indicators for large emitters

This section assesses the impact of LETS on the competitiveness of large emitters. It considers various dimensions of competitiveness, including trade and carbon pricing, average cost, macroeconomic impacts, and a sales test to assess the materiality of carbon costs. Except for the trade analysis, the results presented in this section are projections from integrated modelling scenarios that account for increasingly stringent benchmarks, an increase in the carbon price, and subsidies and grants.

## 6.2.1 Trade and carbon pricing in other jurisdictions

A major competitiveness risk for Canada arises from misaligned carbon prices between domestic and international markets. If Canada alone imposes a carbon price on its domestic producers, these costs can disadvantage producers, resulting in lost market share, production moving offshore, and carbon leakage. Traditionally, competitiveness analysis of carbon policy often assumes that no carbon pricing exists in other jurisdictions. However, this assumption is incorrect, as recent data show that, in 2024, over 75 national and subnational carbon pricing programs have been implemented, with another 44 under development. Of these, 55 currently cover large emitters, including heavy industry and extractive industries, with an average coverage of 44 per cent of jurisdictional emissions and an average marginal cost of $50 per tonne (World Bank 2024).

In this section, we analyze the imports and exports of nine of the highest-emitting, internationally traded large-emitter sectors in relation to foreign jurisdictions that have carbon pricing. Using detailed country- and U.S. state-level trade data, we identify the proportion of trade for each sector that involves markets with an operating or advanced carbon pricing program (Innovation, Science and Economic Development Canada 2024). This assessment does not address the relative stringency of these programs, but rather highlights the share of imports or exports associated with jurisdictions implementing carbon pricing. The actual impact of these relative differences is difficult to ascertain, but the analysis nevertheless shows that Canada is not going alone on carbon pricing.

The results show that a large share of Canadian import and export markets have carbon pricing systems in place, imposing some degree of costs on Canadian competitors:

- **Imports**: In 2023, Canada's total imports across nine of the largest-emitting sectors amounted to $140 billion, representing 19 per cent of national goods imports. Overall, 37 per cent of the $140 billion in imports originate from jurisdictions with some form of carbon pricing. The variation in Canada's imports from jurisdictions with carbon pricing differed significantly across sectors. For instance, the oil and gas extraction sector had 19 per cent of its $42.4 billion in imports coming from carbon pricing jurisdictions. In contrast, the alumina and aluminum production sector had the highest percentage, with 74 per cent of its $6.9 billion in imports from such jurisdictions. Other sectors like basic chemical manufacturing and cement and concrete product manufacturing also had high proportions of imports from jurisdictions with carbon pricing, at 52 per cent and 68 per cent respectively.

- **Exports:** Canada's total exports across various sectors amounted to $438 billion, with 31 per cent directed to jurisdictions with some form of carbon pricing. The oil and gas extraction sector had the highest export value at $285 billion (37 per cent of Canadian goods exports), but only 15 per cent of these exports went to carbon pricing jurisdictions. In contrast, the mining sector exported $68 billion (8.9 per cent of Canadian goods exports), with a substantial 71 per cent going to carbon pricing jurisdictions.

Table 8:

## Imports from jurisdictions with some form of carbon pricing

| | Total imports | | From carbon-pricing jurisdictions | | |
|---|---|---|---|---|---|
| | Annual in 2023 ($M) | % CDN goods imports | Total from U.S. ($M) | Total from non-U.S. countries ($M) | % with carbon pricing |
| Oil and gas extraction | $42,438 | 6% | $1,231 | $6,789 | 19% |
| Mining | $22,991 | 3% | $1,291 | $9,039 | 45% |
| Pulp, paper, and paperboard mills | $4,700 | 1% | $1,617 | $769 | 51% |
| Petroleum refineries | $23,513 | 3% | $1,989 | $4,752 | 29% |
| Basic chemical manufacturing | $18,117 | 2% | $1,570 | $7,872 | 52% |
| Pesticide, fertilizer, and other agricultural chemical manufacturing | $6,223 | 1% | $481 | $1,397 | 30% |
| Cement and concrete product manufacturing | $828 | 0% | $185 | $374 | 68% |
| Iron and steel mills and ferro-alloy manufacturing | $14,335 | 2% | $1,672 | $5,452 | 50% |
| Alumina and aluminum production and processing | $6,844 | 1% | $1,207 | $3,887 | 74% |
| Total | **$139,991** | **19%** | **$11,243** | **$40,331** | **37%** |

Table 9:

## Exports to jurisdictions with some form of carbon pricing

| | Total exports | | To carbon pricing jurisdictions | | |
|---|---|---|---|---|---|
| | Annual in 2023 ($M) | % CDN goods exports | Total to US ($M) | Total to non-US countries ($M) | % with carbon pricing |
| Oil and gas extraction | $285,090 | 37% | $35,918 | $7,978 | 15% |
| Mining | $68,111 | 8.9% | $5,541 | $42,723 | 71% |
| Pulp, paper, and paperboard mills | $14,574 | 1.9% | $3,596 | $4,980 | 59% |
| Petroleum refineries | $27,274 | 3.6% | $16,528 | $2,296 | 69% |
| Basic chemical manufacturing | $15,553 | 2.0% | $3,129 | $4,036 | 46% |
| Pesticide, fertilizer, and other agricultural chemical manufacturing | $2,497 | 0.3% | $550 | $41 | 24% |
| Cement and concrete product manufacturing | $1,109 | 0.1% | $647 | $5 | 59% |
| Iron and steel mills and ferro-alloy manufacturing | $9,870 | 1.3% | $2,189 | $790 | 30% |
| **Total** | **$437,831** | **57.1%** | **$72,298** | **$63,684** | **31%** |

## 6.2.2 Projected average cost by sector

The average cost of carbon is an important indicator of the stringency of a carbon pricing system and plays a crucial role in managing competitiveness risks associated with carbon pricing. Average costs influence long-term investment decisions, and if a facility faces significantly higher average costs than a competitor in another jurisdiction, and those costs represent a substantial portion of total operational expenses, it may lead to carbon leakage.

Canada's LETS are designed to incentivize emissions reductions while mitigating leakage risks by lowering the average cost of compliance. Each sector has different compliance obligations, such as benchmarks and varying rates of stringency through 2030, leading to variation in average costs across sectors and jurisdictions. Economic theory presumes that firms will invest in emissions reductions that cost up to value of the carbon price.

Figure 17 shows the average costs for large-emitter sectors in 2030 in the *legislated policies* scenario. These results are not directly comparable with the average sectoral costs shown in 4.2.2, calculated using historical data. While both approaches—the model projections and the historical data—start with the same sectoral benchmarks, the model projections tighten the benchmarks over time and include the evolution of emissions driven by economic activity, carbon policy, and market dynamics. The sectors for which average costs are estimated are like the sectors shown in Section 4.2.2, with two exceptions:

- Below, the non-ferrous metals and iron and steel sectors are combined into one metals sector.
- The non-metallic minerals sector shown below includes cement, lime and gypsum, glass, clay, and other non-metallic mineral production.

Before we present the results, a few caveats:

- These estimates are sectoral, and do not capture variations between facilities in the same sector. Not all facilities within a given sector will face the same costs. The national average costs shown as red dots are emissions-weighted averages of the costs across all jurisdictions. In some cases, notably the electricity sector, the national average is skewed by an outlier (in this case, Alberta).
- The cost estimates below are upward-biased. Like the historical average cost calculations, the projected average costs do not include abatement costs, revenue recycling, or subsidy programs that lower the average cost of mitigation. Also not included are interactions that would lower the average cost, including the ability to pass on costs, tax and royalty interactions, and lower compliance costs from credit and offset purchases.
- A high average cost does not necessarily mean competitiveness risk. There are a number of reasons why this is so. Sector-level profits, as in the case of oil and gas, likely mean that the higher average costs can be absorbed without a significant impact on operations. Conversely, a low profit level with a low average cost could still result in a material risk.

In general, the results show a widening spread in average costs across the federation (Figure 17). They illustrate some findings about competitiveness impacts as well as potential risks to effectiveness:

- **Average costs are low, and perhaps even lower than shown here.** Nation-wide average costs in several sectors remain low, at less than $10 per tonne in nominal terms, in six out of seven large-emitting sectors (we exclude the electricity sector from this total because Alberta's unique benchmarking approach significantly skews the average in that sector). As we discussed earlier, low average costs are reasonable if the marginal cost incentive can be counted on to incent emissions reductions. However, as we discuss further in Section 6.3, there is no guarantee the marginal cost will hold as expected in all jurisdictions. If it does not, average costs would be even more misaligned.
- **The spread of average costs within some sectors is projected to widen by 2030, potentially exacerbating domestic competitiveness challenges.** In 2024, we estimate the average spread—the difference between the lowest and the highest average cost in each sector, across all jurisdictions—to be 30 per cent of the carbon price, after excluding the electricity sector (where Alberta's unique approach significantly skews the average). In 2030, we project the average spread to be 53 per cent of the carbon price, after excluding the electricity sector.[48]

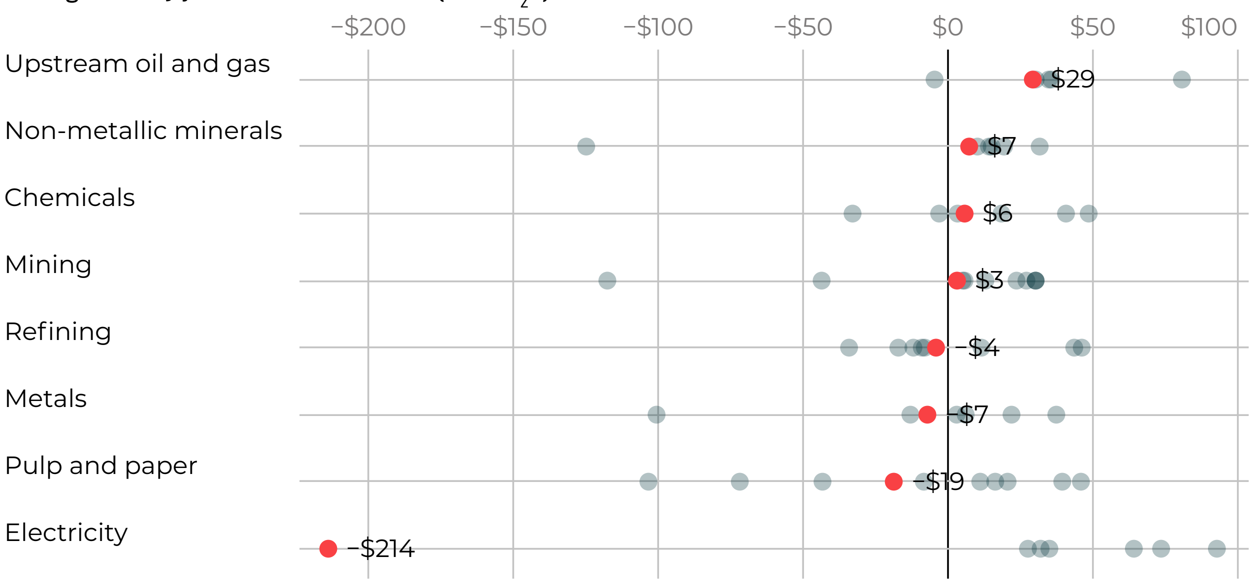
48 The average spread is weighted according to the covered emissions in each sector.

- **Several sectors have the potential to be net credit suppliers.** In the *legislated policies scenario*, reflecting current LETS design, some sectors in certain jurisdictions reduce their emissions more quickly than their benchmarks tighten. These sectors earn more credits than they need for compliance, allowing the sector as a whole (and therefore, presumably the average facility within the sector) to earn a net return from the carbon pricing market—shown here as a negative average cost. In one case, the electricity sector in Alberta—where renewable and low-carbon power producers can earn credits—generates so many credits that it substantially skews the national average cost into negative territory.[49] Some crediting is an expected outcome and not necessarily problematic, but the sheer number of sectors with low to negative average costs suggests the benchmarks in many jurisdictions are overly generous.
- **Over-crediting is a major risk for LETS effectiveness**. Where sectors generate very large volumes of credits, there is a risk that supply may outstrip demand, putting downward pressure on the marginal cost and lessening the incentive to abate. Section 6.3 discusses the risk illustrated by our *announced, less stringent policies* scenario, where credit supply comes to exceed demand in 2030 across the whole trading system in British Columbia, Alberta, and Saskatchewan, leading to a decrease in the marginal cost in those systems.

Figure 17:

## Average costs for large-emitter sectors in 2030, *legislated policies* scenario

Average cost by jurisdiction and sector (\$/t $CO_2$e)




Note: Based on a projection from integrated modelling.

The labelled red dots represent the emissions-weighted sectoral average cost across Canada. The dark dots represent the sectoral average cost in each province and terriroty.

The average cost for electricity in Alberta is too low to be shown; it is -\$1031/t$CO_2$e

49 The national averages shown in this report are illustrative; there is no national market.

### 6.2.3 The sales test from projected output

This indicator assesses whether current climate policies, including carbon pricing, are material to the operational viability of large emitters. We apply a sales test, which is a standardized approach for assessing competitiveness impacts in different sectors. These tests divide compliance costs by sector output at market prices. This competitiveness test is consistent with Alberta's Compliance Cost Containment Program under the TIER Regulation, which uses sales and profit tests to determine whether to loosen benchmarks to reduce the vulnerability of a facility (Government of Alberta 2020). The federal OBPS uses a sales ratio[50] as one test for sectoral carbon leakage and negative competitiveness impacts risks to determine whether a facility can opt into the federal OBPS (Environment and Climate Change Canada 2022c).

In this application of the test, we compare compliance costs and the value of output (or sector sales) under the *legislated policies* scenario to assess if the cost impacts are material in 2030. In the modelling, the market effects of carbon pricing on firm output are captured, as are the compliance costs. We calculate compliance costs by multiplying the estimated compliance obligation by the carbon price of $170 in 2030.

The output level is influenced by increased costs and the sector's ability to compete, which depend on net compliance costs, including abatement, fund payments, and credits or allowances bought or sold. These costs are offset by factors such as revenue recycling, tax and royalty interactions, and the ability of firms to pass on costs to customers. This pass-through varies by sector, ranging from no pass-through for highly traded global commodities to nearly 100 per cent for electric power utilities. Technology subsidies from non-pricing policies are not included in this analysis; they are addressed in the next section.

Consistent with Alberta's TIER Regulation and ECCC guidelines, a threshold of 3 per cent indicates that compliance costs may pose a significant competitiveness risk. A negative value indicates that the sector is creating value through credit sales due to abatement or is over-crediting due to generous performance benchmarks. Table 10 indicates the sectors that exceed the 3 per cent threshold (red) and those that are crediting (green):

- **Significant financial impacts are likely not widespread, but rather limited to several sectors within regions.** Saskatchewan's electricity sector exceeds the 3 per cent threshold, being primarily thermal-based, with a declining benchmark for newly constructed gas generation. This benchmark will apply to an increasing share of generation as unabated coal is phased out. However, the cost pass-through for electricity generators approaches 100 per cent, meaning the financial impact on the sector's viability is significantly reduced and largely passed on to ratepayers. Secondary competitiveness impacts are expected as a result.
- **Several sectors are crediting on average, and therefore the average facility within those sectors is better off with carbon pricing.** Nationally, pulp and paper, metals, and refining are crediting with a negative sales ratio, meaning they are better off due

50 "Carbon costs are large relative to revenue—i.e., facilities that make up 10% or more of the sector's revenue face carbon costs that exceed 3% of revenue" (Environment and Climate Change Canada 2022c).

to the value they generate from credit creation. The electricity sector also has a negative sales ratio nationally, though this result is driven by net crediting in only a single jurisdiction: Alberta.

The significant crediting in Alberta's electricity sector is notable, with the value of compliance primarily driven by credits sold equal to the value of 50 per cent of the sector's output at wholesale prices. This is because of the comparatively high value for a credit produced by low-carbon electricity (~$53/MWh for the TIER credit alone), coupled with a decline in wholesale prices due to net transfers into the sector from carbon pricing. Overall, the most notable financial performance improvements are seen in Alberta's electricity sector (-52.3 per cent), but some high costs in other electricity sectors are also evident.

Table 10:

## Sales tests in the *legislated policies* scenario in 2030

| | Oil and gas | Electricity* | Pulp and paper | Chemicals | Cement | Metals | Refining | Mining |
|---|---|---|---|---|---|---|---|---|
| Canada | **1.8%** | **-3.6%** | **-0.1%** | **0.2%** | **0.01%** | **-0.2%** | **-0.04%** | **0.1%** |
| British Columbia | 2.1% | - | 0.9% | 0.6% | 1.3% | -1.5% | 0.7% | 0.07% |
| Alberta | 2.0% | -52.3% | -0.4% | -0.2% | -6.6% | 0.3% | -0.3% | 0.2% |
| Saskatchewan | 0.2% | 3.6% | 0.2% | -1.2% | - | 1.4% | -0.5% | 0.3% |
| Manitoba | 0.6% | 0.0% | 0.3% | 1.9% | 1.2% | 0.3% | 1.1% | -0.2% |
| Ontario | - | 0.6% | -1.3% | 0.4% | 1.4% | -0.4% | 0.2% | 0.1% |
| Quebec | - | - | -0.9% | 0.04% | 2.9% | 0.06% | -0.2% | -0.5% |
| New Brunswick | - | 2.6% | 0.3% | - | - | 0.07% | -0.1% | - |
| Newfoundland and Labrador | 0.59% | 0.01% | -0.6% | - | - | - | - | 0.6% |
| Nova Scotia | - | 2.1% | 0.5% | - | 0.4% | - | -0.3% | - |
| Prince Edward Island | - | 0.5% | - | - | - | - | - | - |
| Territories | - | - | - | - | - | - | - | 0.2% |

Note: Based on a projection from integrated modelling. More than 3 per cent is a significant competitiveness risk (red), green is crediting and better off with carbon pricing.

*A cost pass-through in the electricity sector of close to 100 per cent would mean the sector is transferring most of this cost to ratepayers, negating the impact on the electricity sector's balance sheet. Other interactions that would reduce the cost impact, applicable to all sectors, include tax and royalty interactions, lower compliance costs through credit purchases, offsets, and abatement. These estimates are therefore upwardly biased.

### 6.2.4 The projected incremental impact of all carbon policies

This section provides a comprehensive view of the impact of carbon pricing and other carbon policies on the competitiveness of large emitters. The two indicators presented in this section—operating margin and profit tests—complement the sales test by integrating the cost impact on large emitters of all policies, including carbon prices on fuels (Scope 3 costs), subsidies, and regulations, as well as revenue recycling, on the operating margins of the sectors. The indicators acknowledge that LETS are not implemented in isolation, and so seek to capture the financial benefits of federal and provincial subsidy programs that lower the average cost of abatement and regulatory costs.

Table 11 presents the operating margin in 2030 for eight major large-emitter sectors. Operating margin is calculated in the integrated model as revenue minus cost, where cost includes labour, capital, intermediate inputs, and direct and indirect carbon costs. Direct carbon costs include net compliance payments, abatement costs, revenue recycling, and technology subsidies, while indirect carbon costs include carbon costs passed through supply chains, emissions bought and sold, and tax and royalty payment reductions (for instance, when compliance costs reduce taxes paid). General equilibrium price effects on capital, labour, and inputs of carbon policy are also captured.

The starting operating margin is indicated in the *no policy* column, then *carbon pricing alone* is added, including revenue recycling, and finally, *all legislated policies* adds regulations and subsidies. Also included is the profit test for the scenarios with carbon pricing and with all policies, which complements the sales test presented in the previous section. As with the sales test, Alberta's TIER Regulation concludes that a significant profit impact is likely if an operating profit margin impact is greater than 10 per cent (Government of Alberta 2020).

As indicated in the table, carbon pricing alone reduces profits across all sectors nationally, but no sector experiences a profit impact where significant financial hardship is likely. With the addition of regulations and subsidy programs, negative profit impacts are slightly ameliorated. In several cases, profits increase above the no-policy scenario due to significant credit creation across some sectors and jurisdictions.

Aggregate margins across these LETS sectors indicate a strong operating margin baseline (36.1 per cent), with a small profit impact under carbon price (1.7 per cent), which is then reduced by half when all legislated policies (for example, technology subsidies) are considered (0.8 per cent):

- **Oil and gas**: High operating margins with and without climate policies, but a drop when only the carbon price is applied (carbon costs equal 4 per cent of the operating margin) and an improvement with all legislated policies combined (3.6 per cent).
- **Electricity**: Strong operating margins across the board, but a noticeable profit increase in Alberta due to crediting with carbon price (carbon costs represent -3.6 per cent of operating margin, that is, they are negative costs) that is further improved when all legislated policies are considered (-5.3 per cent). This would have the effect of lowering the impact on rate payers of carbon policy in Alberta.

- **Pulp and paper**: Margins remain stable or rise due to crediting and subsidy programs, even with carbon pricing (-2.3 per cent with carbon price, -2.6 per cent with all legislated policies).
- **Chemicals**: Operating margins are stable, with minor fluctuations; a slight profit increase is noted with carbon price alone (-0.1 per cent), but costs are added with all legislated policies (0.9 per cent). Still, the profit impact remains well below the threshold of 10 per cent.
- **Cement**: Operating margins show a small overall change with policy, with an adverse profit impact with carbon pricing (5.3 per cent) that is reduced somewhat with all legislated policies (4.1 per cent).
- **Metals**: Margins are impacted somewhat when just carbon pricing is considered, but when all legislated policies are added, and subsidies coupled with sector crediting is included, the sector see a slight profit increase (-0.3 per cent).
- **Refining**: Margins remain stable, with and without policies, but see a slight profit increase with all legislated policies (-0.3 per cent).
- **Mining**: Strong operating margins overall, with some reduction in profit under carbon pricing alone (2.8 per cent) and with all policies reducing the cost impact (1.4 per cent).

Table 11:

## Impact on operating margins in 2030, *legislated policies* scenario

| | Operating margin (higher better) | | | Profit test (>10%?) (lower better) | |
|---|---|---|---|---|---|
| | *No Policy* | Carbon pricing alone | All *legislated policies* (Adds regulations and subsidies) | Carbon pricing alone | All *legislated policies* |
| Oil and gas | 51.9% | 49.7% | 50.0% | 4.0% | 3.6% |
| Electricity | 63.9% | 63.5% | 67.7% | -3.6% | -5.3% |
| Pulp and paper | 15.1% | 15.5% | 15.6% | -2.3% | -2.6% |
| Chemicals | 21.9% | 22.0% | 21.7% | -0.1% | 0.9% |
| Cement | 16.4% | 16.0% | 16.2% | 5.3% | 4.1% |
| Metals | 10.2% | 9.9% | 9.8% | 2.9% | -0.3% |
| Refining | 24.2% | 24.4% | 24.3% | 0.6% | -0.3% |
| Mining | 30.3% | 29.5% | 30.0% | 2.8% | 1.4% |
| Total | 36.1% | 35.5% | 36.0% | 1.7% | 0.8% |

Note: Based on a projection from integrated modelling.

# 6.3 Risks to the effectiveness of large-emitter trading systems

In this section, we assess the risks to the effectiveness of large-emitter trading systems. Our modelling scenarios illustrates different facets of the risk to LETS, as well as possible responses:

- *Legislated policies* scenario: Illustrates how LETS markets under currently existing policies could lead to significant crediting, with several markets barely maintaining a net demand for credits.
- *Announced, less stringent policies* scenario: This scenario contains additional federal policies whose design has not been finalized. In our modelling, we project that credit supply will exceed demand in some LETS, eroding the marginal cost incentive (what we call a non-binding carbon price). Our findings demonstrate that policy interactions, coupled with over-crediting in some sectors, pose significant risks to effectiveness.
- *Announced, more stringent policies* scenario: This scenario ensures that there is a binding carbon price in all markets—as required by the federal benchmark—by tightening the performance benchmarks in systems that do not have a net demand for credits in 2030. It shows that measures to strengthen systems, such as more rapid tightening of benchmarks, can preserve a binding carbon price and the effectiveness of systems.

## 6.3.1 Policy interactions and erosion of the marginal cost incentive

We find that some LETS are vulnerable to erosion of their marginal cost incentive, which would make carbon pricing less effective. The marginal cost erodes when there is more supply of credits in carbon pricing markets than there is demand. Where too many facilities can outperform their benchmarks, credit supply can outstrip demand, thereby depressing the market price of credits and undermining the incentive to reduce emissions.

The interaction between carbon pricing systems and some overlapping climate policies exacerbates these market imbalances. As we discussed below, there is a risk that some overlapping policies could drive the generation of more credits, leading to further erosion of the market price.

The proposed federal oil and gas emissions cap (*announced policies* scenarios only), the oil and gas methane regulations in Alberta, and generous technology subsidy programs are examples of policies that overlap with LETS and are at risk of contributing to these market imbalances. As we noted above, the design of the federal oil and gas emissions cap has not been finalized.

In the *legislated policies* scenario, we project that demand will barely exceed supply in some LETS in 2030, while in the *announced, less stringent policies* scenario, supply exceeds demand in some systems, collapsing the marginal cost incentive well below the national carbon price. In most sensitivities in the *announced, less stringent policies* scenario, there are three provinces[51] where the marginal carbon price does not hold at the scheduled price in 2030 due to a market surplus of credits:

- **In Alberta, the marginal cost is at risk of falling due to oil and gas policy interactions and generous crediting in electricity.** In the *announced, less stringent policies* scenario, the marginal cost for large emitters falls below the national carbon price in all five sensitivities, collapsing to $46 per tonne in 2030. Because the oil and gas sector reduces its emissions in this scenario to comply with the oil and gas emissions cap, there is less demand for credits in the TIER market. At the same time, the electricity sector generates surplus credits from renewables and carbon capture. The result is an oversupply of credits and a lower marginal cost incentive.

  This erosion of the marginal cost incentive undermines the incentive to reduce emissions for non-oil-and-gas LETS sectors. For example, though the electricity sector continues to generate credits, it generates significantly fewer in the *announced, less stringent* scenario than in the *legislated policies* scenario. Likewise, whereas the cement sector installs CCS to abate its emissions in the *legislated policies* scenario, it does not do so in the *announced, less stringent* scenario.

  This result is unique to Alberta, due to its combination of a large oil and gas sector and unique benchmarking in the electricity sector. Unlike other provinces, Alberta has uniform benchmarks for electricity generation technologies that reward low-emitting electricity, including renewables. This benchmarking approach is considered best practice, and the carbon price thus incentivizes the adoption of renewable electricity generation technologies (an efficient market response to the abatement incentive). However, the modelling shows that the electricity sector can decarbonize more quickly than the decline rate of the current electricity benchmark, at an abatement cost below $170 per tonne. This results in the sector being a net generator of credits.

  In other provinces, this same market response does not materialize, because other LETS only provide benchmarks for fossil-fuel-fired generation technologies. That approach maintains a net demand for credits at the expense of eroding the marginal incentive to adopt renewable electricity.

- **In Saskatchewan, policy interactions and insufficiently stringent benchmarks could also lead to over-crediting that reduces the marginal cost.** The marginal cost also erodes in the *announced, less stringent policies* scenario in Saskatchewan, though to a lesser extent than in Alberta. The marginal cost erodes in Saskatchewan in three out of the five sensitivities that we tested. The price holds in the two technology-pessimistic sensitivities, reflecting the role that CCUS could play in credit generation.[52] In this province, most excess credits are generated in the upstream oil and gas sector, while the chemicals sector is also a small net generator of credits. The dynamic that occurs in the oil and gas sector is similar to in Alberta, where the fed-

51 These are the only jurisdictions where the marginal cost erodes in any of our modelling runs.

52 The price in Saskatchewan erodes in the reference sensitivity and both techno-optimistic sensitivities.

eral oil and gas emissions cap leads facilities in the sector to reduce their emissions, reducing the demand for credits from Saskatchewan's Output-Based Performance Standards Program.

- **In British Columbia, the market is at risk of excess supply because some sectors could generate large volumes of credits (depending on the final design of the provincial benchmarks), and because of limits on the use of credits for compliance.** In the *announced, less stringent policies* scenario, B.C.'s marginal cost erodes in three out of five sensitivities.[53] The results are particularly sensitive to the level of the LNG benchmark, since most excess credits are generated in an electrified LNG sector, for which we used a hypothetical sectoral benchmark.[54] The model also projected some net credit generation in the metals and refining sectors.

  Although credit supply and demand are nearly balanced in this scenario, the B.C. OBPS still sees a slight decrease in the marginal cost incentive in 2030 compared to other jurisdictions. The province's policy of restricting tradeable credit use to 30 per cent of compliance by 2030 also plays an important role in this result. Even if credit generation from LNG were to be zero, the limit on the use of tradeable credits for compliance is low enough that there would be a net surplus of credits relative to market demand because of credit generation in other sectors. This surplus would erode the marginal incentive for credit-generating facilities, though the system would still have a higher marginal incentive for credit-buying facilities (because they are required to achieve 70 per cent of their compliance through fund payments).

- **By 2030, Quebec's WCI marginal cost may no longer be lower than elsewhere.** In Quebec, we project that the marginal cost in 2030 will be higher than in other jurisdictions under all scenarios, hitting the price ceiling of the WCI system. The higher price is due largely to the declining emissions caps in the system. Banked allowances—which are not represented in the model—might reduce the cost pressure in the market, but the market reforms that WCI jurisdictions are studying could also reduce the quantity of banked allowances.

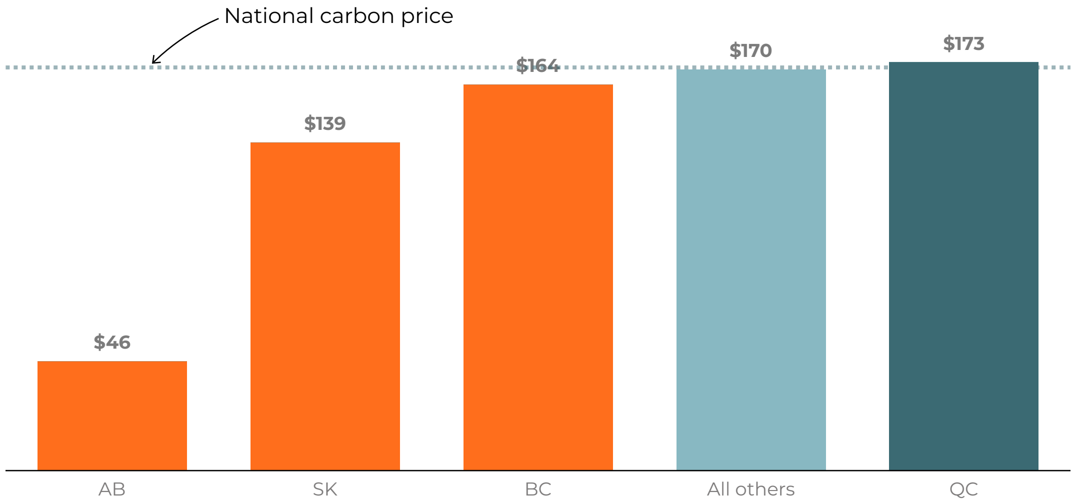
53 In the two low-oil-price sensitivities, our modelling shows that the supply and demand for credits in British Columbia are roughly balanced. However, we estimate that there would still be an excess of credit supply compared to demand—and therefore an erosion of the marginal cost—because B.C.'s system only allows firms to use tradable compliance credits to meet 30 per cent of their compliance obligations.

54 At the time of writing, B.C. had not finalized benchmarks for liquefied natural gas facilities in the province.

Figure 18:

## Marginal costs for large emitters in 2030, *announced, less stringent policies* scenario

Marginal cost by jurisdiction (\$/t $CO_2e$) scenario




Note: Based on a projection from integrated modelling.

## 6.3.2 Tightening benchmarks to maintain the marginal cost incentive

Given the risk to LETS effectiveness, both now and in the future, it is useful to understand how greater stringency could address the problem. In this section, we compare the *announced, less stringent* scenario with the *announced, more stringent policies* scenario. The *announced, more stringent policies* scenario adjusts the benchmarks in non-binding LETS to ensure a binding marginal cost across the country under all modelled sensitivities. Figure 19 shows how a binding carbon price affects Canada's projected emissions in 2030.

**Tighter benchmarks can significantly increase effectiveness.** In Alberta, the strengthened carbon pricing system with tighter benchmarks delivers significantly more emissions reductions: approximately 22 Mt more in 2030 than in the scenario where the TIER benchmarks are not tightened. If existing TIER coverage is maintained in the presence of an oil and gas emissions cap similar to the one modelled here (in other words, if the oil and gas sector participates in both policies), credit supply in 2030 would need to contract significantly to ensure a binding carbon price.

**Tighter benchmarks can offset—but may not eliminate—adverse policy interactions**. In both B.C. and Saskatchewan, the results of the *announced, more stringent policies* scenario are counterintuitive: the strengthened benchmarks indirectly lead to a small increase in emissions, largely in the oil and gas sector. This increase is a result of policy interactions. In the *announced, more stringent* scenario, the strengthened carbon pricing system in Alberta drives down the cost of credits under the federal oil and gas emissions cap, leaving the oil and gas sector in B.C. and Saskatchewan with less incentive to abate.[55]

55 The design of the B.C. OBPS reinforces this dynamic. The B.C. OBPS does not cover "useful venting." For modelling purposes, Navius Research assumed that the B.C. OBPS excludes the venting of formation carbon dioxide, whereas these emissions are covered under the federal oil and gas emissions cap. Where the price of credits under the oil and gas emissions cap is low—as in the ***announced, more stringent*** scenario—the oil and gas sector in B.C. has less incentive to abate these venting emissions.

This result shows that with an oil and gas emissions cap in place, oil and gas sector emissions outside of Alberta will be sensitive to the design of Alberta's carbon pricing system, because it will have material effects on the cost of complying with the oil and gas emissions cap, above and beyond the other provinces' existing carbon pricing policies. The outcome in this scenario is efficient, nonetheless. The small emissions increases in B.C. and Saskatchewan are significantly offset by the larger emissions decrease in Alberta. Overall, national emissions are 18 Mt lower compared to the non-binding scenario.

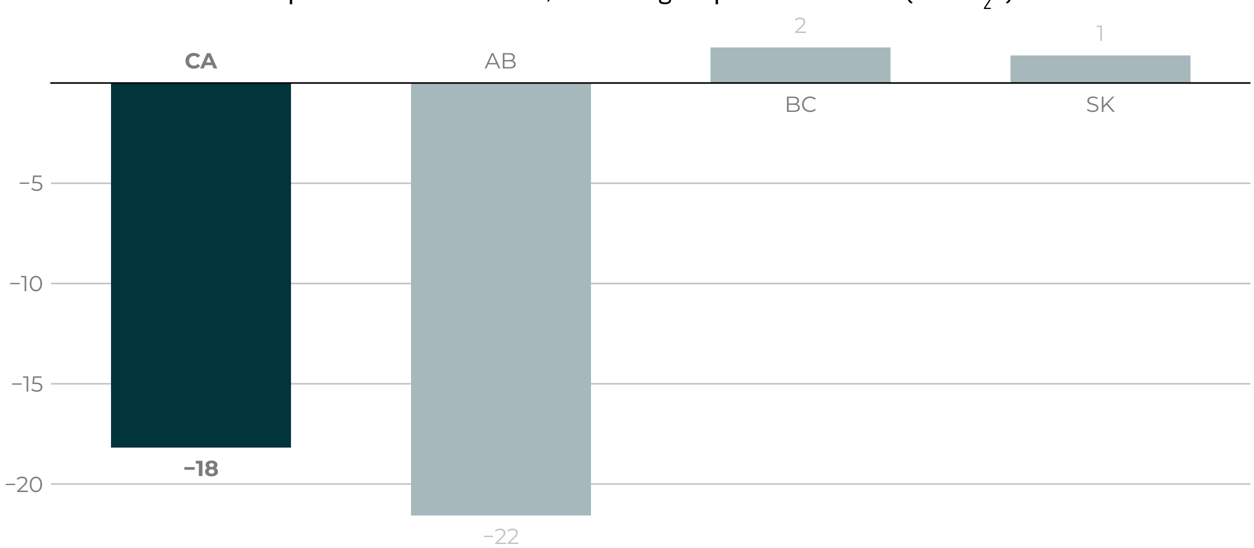
**Careful analysis will be needed to understand policy interactions and market function.** In B.C., there is uncertainty as to what level of benchmark tightening, or other policy interventions, could address the risk we identify here. B.C. has not yet published a benchmark for the LNG sector,[56] which has the potential to be very influential for credit market balance. Furthermore, the B.C. system places a 30 per cent limit on the amount of compliance that can be achieved with tradeable credits, meaning that compliance deficits would need to substantially exceed credit issuance for the credits to be priced at the federally scheduled level.

In Navius' modelling, a hypothetical uniform benchmark applies to the LNG sector. In the model, the sector electrifies and earns credits. In our modelled scenario, for the B.C. credit market to have a net credit demand in 2030, credit allocations would need to be reduced by about 2.8 Mt, representing about 13 per cent of covered LETS emissions, or a full 70 per cent reduction below the level of credit issuance in the *announced, less stringent* scenario.

Figure 19:

## Additional emissions reductions in the *announced, more stringent policies* scenario

Emissions reductions compared to the announced, less stringent policies scenario (Mt $CO_2e$)




Note: Based on a projection from integrated modelling.

**In addition to delivering more emissions reductions, tighter benchmarks would increase the costs of carbon pricing.** Figure 20 shows the national average cost of carbon

56 No OBPS-compliant LNG facility is currently operating.

for large-emitter sectors after benchmark tightening in Alberta, British Columbia, and Saskatchewan. The national average costs in this scenario are higher than in the *legislated policies* scenario but are still relatively low. Five out of seven sectors (excluding electricity) see average costs of $20 per tonne or lower, and one of these is still crediting on average. The most significant change is in the electricity sector, primarily because average costs in Alberta are higher in the scenario—though the sector in the province still credits substantially, keeping the national average cost far below zero.

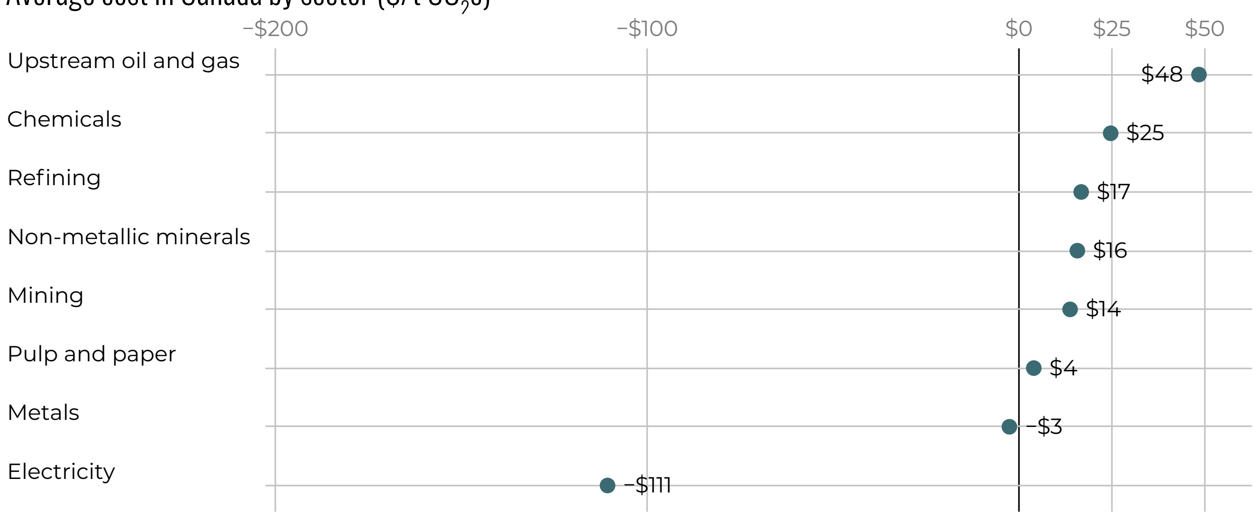
Average cost is only one of several indicators of cost and competitiveness risk, as we have noted above. We include these costs here to help show a broader picture of the effects of tighter benchmarks.

Benchmark tightening is only one way to address the risk of non-binding systems, so the average costs presented here represent only one possible outcome of more stringent carbon pricing. Regulators may have other options to maintain the price signal, such as adjusting benchmarks differently than assumed here, addressing policy interactions or introducing market stability mechanisms.

Figure 20:

**Average costs in large-emitter sectors in 2030, *announced, more stringent policies* scenario**

Average cost in Canada by sector ($/t $CO_2$e)




Note: Based on a projection from integrated modelling.

### 6.3.3 Market size differences are a risk to overall effectiveness

Canada's large-emitter trading markets are not only distinguished by design and composition. They are also different sizes. There are nine large-emitter trading markets in Canada, some large and many small.[57] In general, larger trading markets contain a greater diversity

57 The four backstop jurisdictions constitute one market. The remaining markets are in Alberta, British Columbia, New Brunswick, Nova Scotia, Newfoundland and Labrador, Ontario, Quebec (which is part of the WCI market), and Saskatchewan. The Northwest Territories pricing system for large emitters is a carbon tax and therefore

of facilities and sectors, and therefore provide more opportunities for facilities to trade allowances and abate cost-effectively.

Figure 21 shows the number of facilities and the quantity of emissions covered in these nine markets. We observe the following:

- As part of WCI, Quebec offers emitters access to the largest trading market in North America. Note that the WCI and Quebec figures include emissions from fuels sold by distributors, since fuel distributors are covered by the cap-and-trade systems, unlike in other LETS. Alberta has the largest trading market within Canada.
- Because it covers fewer jurisdictions than before, the federal OBPS is a much smaller market than it was at the time of the 2020 Independent Assessment. Nonetheless, through the federal OBPS, emitters in backstop jurisdictions still have access to a market that is a multiple of the size of their jurisdiction alone.
- LETS markets in the non-backstop Atlantic provinces contain relatively few facilities. The small size of these markets may make it more challenging for some facilities to trade for emissions allowances.

The small size of some LETS credit markets introduces another challenge to maintaining the marginal cost incentive on tradeable credits. Small markets have the potential to have limited liquidity, which may cause credit-generating facilities to value their credit generation at less than the rational level, if they expect to have challenges selling them.

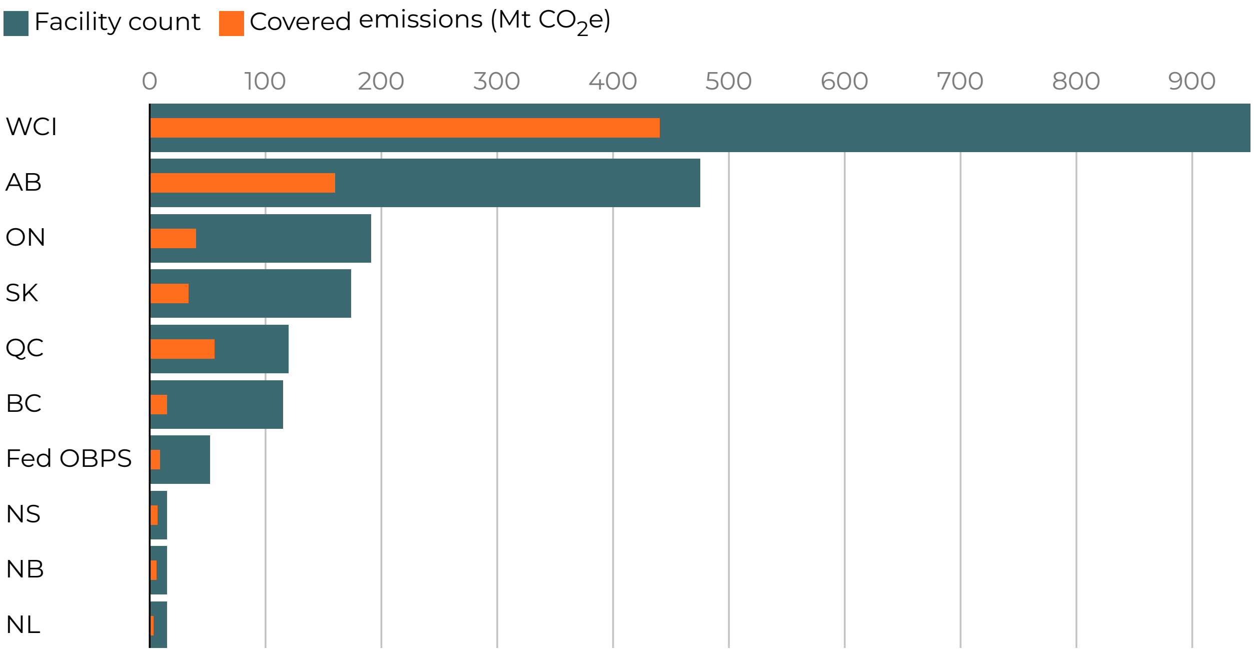
For the 2024 Independent Assessment, we did not assess the extent to which these factors may affect marginal abatement incentives at credit-generating facilities in small LETS markets due to a lack of data on credit pricing and firm-level data on credit holdings. Examining the firm-level Greenhouse Gas Reporting Program emissions data reveals a moderate-to-high level of concentration in nine of 13 jurisdictions,[58] which suggests that this is an area for future research.

does not include a trading mechanism.

58 Calculating a Herfindahl-Hirschman Index (HHI) with 2021 Greenhouse Gas Reporting Program data for reported emissions found nine of 13 provinces and territories to have indices above 1,500, and seven to have indices above 2,500. An index of less than 1,000 is generally taken to represent a competitive market. The only regions with HHIs for reported emissions below 1,000 were Alberta, B.C., Ontario, and Quebec.

Figure 21:

## Comparing trading market size of different large-emitter trading systems



# Carbon pricing and small and medium-sized enterprises

Small and medium-sized enterprises (SMEs) are defined as facilities with fewer than 500 employees, and make up about 85 per cent of national GDP. Unlike industrial facilities in the large-emitter trading systems (LETS), SMEs have, until very recently, not benefited from revenue recycling.[59] Assumed high pass-through of carbon costs to consumers (mitigated by household rebates and subsidies in many jurisdictions), along with low emission and trade intensities, have justified the exclusion of SMEs from LETS, as well as Quebec's decision not to rebate carbon proceeds under the fuel charge or grant free allowances under its cap-and-trade system.

However, some SMEs likely face challenges due to higher emission intensities and the associated carbon costs from paying the full fuel charge while operating in highly competitive and trade-exposed markets. Others, particularly in service industries, may be able to pass on their carbon costs, transferring the burden downstream in the economy and sending a signal throughout supply chains that carbon management pays dividends.

In this section, we assess the competitiveness risk of SMEs at the national level, using risk assessment approaches typically applied to large emitters. We evaluate the claim that SMEs are not at risk of competitiveness loss and therefore do not require special measures, such as rebating proceeds or using benchmarks to lower the average cost of carbon pricing. Our analysis concludes that there is significant variability in carbon exposure across sectors, with some sectors facing high operational risks, as well as competitiveness risk, due to carbon pricing. The new revenue recycling approach for SMEs covered by the federal fuel charge helps mitigate some of the competitiveness risk, however.

This assessment covers 23 *SME-dominant* sectors, defined as economic sectors where most facilities have fewer than 500 employees (see Table 12 for the list). Some establishments in SME-dominant sectors may not be SMEs, and some may participate in LETS under opt-in provisions. For this analysis, we do not separate these out, due to data limitations.

SME competitiveness risk is evaluated using historical data and modelled projections:

- **Competitiveness risk assessment using historical data**: Typical emissions-intensive and trade-exposed (EITE) tests are applied to historical national SME data to determine the exposure risk level of a sector.

59 Many LETS have allowed SMEs to opt into LETS if conditions are met, typically related to competing with large emitters that are included in LETS.

- **Model projections to 2030**: Projections assess the impact of current carbon-pricing systems on macroeconomic indicators for SME-dominant sectors, as well as a scenario that models the updated federal approach to return some fuel charge proceeds on a per-employee basis.

## 7.1 Competitiveness risk assessment using historical data

Historical SME emissions and economic data are applied to established EITE tests to compare the relative carbon cost exposure across 23 SME-dominant sector groups. These tests are commonly used in Canadian carbon pricing systems to determine eligibility for inclusion in LETS. The purpose of applying these tests is to gauge the level of risk across sectors, rather than to suggest automatic inclusion in LETS based on an EITE score.

Two sets of tests are applied nationally to the 23 SME-dominant sectors:

- **EITE tests:** Applied to SME national historical data, these tests identify the exposure risk level of a sector. While easily applied using existing historical data, they tend to overstate likely impacts by focusing on direct emissions and ignoring revenue recycling, subsidies, and abatement costs.
- **Profit and sales tests**: These tests analyze historical SME data, considering compliance emissions and the ability to pass on costs. They estimate compliance costs and indirect carbon costs, including direct emissions, purchased energy, and supply chain impacts, and account for tax interactions and cost pass-through to customers.

### 7.1.1 Approach to EITE tests

Tests and thresholds vary by jurisdiction, based on local preferences. Our selected EITE tests include one from the federal OBPS and Ontario's approach (Environment and Climate Change Canada 2022c; Government of Ontario 2019). These two tests are indicative of the tests used in many different jurisdictions, including Alberta's TIER Regulation (Government of Alberta 2020).

Applying these tests involves matching emissions data with historical output and value-added figures to estimate emissions intensity, which is then paired with trade intensity and compared against EITE thresholds. National economic data are sourced from Statistics Canada, while emissions estimates come from the Institute's Canadian Emissions Intensity Database (Statistics Canada 2022; Stiebert 2023). Note that in this application of the tests, service industries like air transport use the value of services in the trade exposure metric, and not the value of traded goods.

The federal OBPS test calculates direct carbon costs (direct emissions times the carbon price) to estimate the emissions intensity of value added (a measure of GDP). In our application of this test, the minimum national carbon price in 2024 and 2030 is used to calculate emissions intensity. The Ontario test compares direct emissions (with no carbon cost) against value added:

| | Emissions Intensity | Trade Exposure |
|---|---|---|
| Federal OBPS | Direct carbon cost / Gross value added[60] | (Exports + imports) / (Sales + imports) |
| Ontario | Direct emissions / Gross value added | |

With the emissions intensity and trade exposure calculated, the results are compared against threshold values to categorize each sector's degree of risk. The federal OBPS thresholds identify sectors with high and very high risk, while Ontario categorizes sectors into three groups: low, medium, and high risk.

### 7.1.2 Approach to profit and sales tests

The objective of the tests is to estimate the compliance costs and indirect carbon costs that are passed through to facilities, tracking changes in sales and profits for these facilities or sectors. Thresholds identify potential carbon cost vulnerabilities, revealing if significant carbon costs need to be mitigated.

This application of the tests is static, as it uses historical data and does not capture market equilibrium effects related to price and market share impacts (the modelled projections in section 7.2 capture those). For compliance costs, the tests consider the cost of the fuel charge on direct emissions and the indirect carbon costs embodied in purchased energy. In this static application of the test, the carbon price rises to $170 in 2030, while sector emissions are held constant at current levels. Output and operating margin (profits) are similarly held constant at current levels, as reported by Statistics Canada.

The tests also account for tax reductions that transfer some share of compliance costs to the government and the ability of some facilities to pass on costs to customers, reducing the average cost of the carbon price.[61] Revenue recycling, technology subsidies, and abatement costs are not included, and therefore the estimates presented here likely overestimate the SME competitiveness impact from paying the full carbon price.

In both tests, the estimated compliance costs are divided by baseline profit and by revenue to develop two ratios of competitiveness risk. The test thresholds include:

- **A significant operating profit margin impact:** if the estimated carbon cost as a share of profit is greater than 10 per cent;[62] and,
- **A significant sales impact:** if the estimated carbon cost as a share of revenue is greater than 3 per cent of revenues.

60 Gross value added (GVA) is like gross domestic product, which is the dollar value of all goods and services minus input costs, but GVA adds the cost impact of subsidies and taxes on production.

61 A Monte Carlo simulation varied the cost pass through with ranges between 0 and 100% and an average of 60% (informed by a review of cost pass-through by sector from the literature). Each sector's trade intensity was used to select a central value for the Monte Carlo distribution (probability density function) with higher levels of trade intensity resulting in a lower ability to pass on costs and vice-versa.

62 The EU ETS uses a 5 per cent threshold relative to gross value added, which is analogous to gross operating margin used in this test.

## 7.1.3 Results

Table 12 presents the results of the EITE, profit, and revenue tests. The index of carbon intensity is provided as a comparator against the emission intensity of the large emitters, while the trade exposure compares exports and imports to final demand for the sector. The Ontario EITE test ranks the relative sectors as low, medium, or high potential exposure, whereas the last column indicates the year in which a sector may be determined to be at high risk using one federal OBPS test (discussed above). The profit and revenue tests for the 2024 and 2030 carbon price are also provided.

The results reveal diverse levels of carbon exposure, with the following sectors most at risk. Note that there are many reasons why these sectors are not included under LETS. Chief among them are that they are not large point-source emitters, they do not compete in highly competitive global commodity markets, and they have a high ability to pass on costs (especially in service sectors like transport). Sector results include:

- **Water transportation:** Extremely high carbon intensity (3.3 times that of large emitters) and trade intensity (38 per cent), while the sales test shows high risk (1.6 per cent in 2024, 3.3 per cent in 2030) as does the profits test (29 per cent in 2030).
- **Truck transportation:** High carbon intensity (1.2 that of large emitters) and significant trade intensity (22 per cent), with the sales test indicating risk (0.9 per cent in 2024, 2 per cent in 2030) and the profit test (20.3 per cent in 2030) showing high vulnerability to carbon costs.
- **Rail transportation:** High carbon intensity (1.4 that of large emitters) and trade intensity (37 per cent), with the sales test indicating high risk (1.7 per cent in 2024, 3.6 per cent in 2030) supported by a high profit test score (8.4 per cent in 2030).
- **Forestry:** Relatively high carbon intensity (0.9 that of large emitters) with moderate trade intensity (5 per cent), facing moderate sales test score (0.6 per cent in 2024, 1.2 per cent in 2030) and high profit impact score (9.1 per cent in 2030).
- **Textile products and clothing manufacturing:** Lower carbon intensity (0.08 that of large emitters) but extremely high trade intensity (91 per cent), with modest impacts indicated by sales test (0.06 per cent in 2024, 0.13 per cent in 2030) and profit test (1.1 per cent in 2030), making it somewhat vulnerable to international competition.
- **Computer and electronic product manufacturing:** Very low carbon intensity (0.02 that of large emitters) with very high trade intensity (90 per cent), facing minor impacts given sales test (0.04 per cent in 2024, 0.09 per cent in 2030) and profit test (0.6 per cent in 2030), but highly exposed to international markets.
- **Machinery manufacturing:** Low carbon intensity (0.05 that of large emitters) with high trade intensity (80 per cent), with minor impacts indicated by sales test (0.08 per cent in 2024, 0.16 per cent in 2030) and profit test (1.2 per cent in 2030), indicating a moderate vulnerability to carbon pricing.

Table 12:

## Characteristics of SME-dominant sectors and competitiveness test results

| Sector | Carbon intensity index (large emitters =1) | Trade exposure | Ontario EITE score | ECCC (EI>3% & TE>20%)[63] | Sales test > 3%? | | Profit test > 10%? | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2024 | 2030 | 2024 | 2030 |
| **Services** | 0.03 | 10% | Medium | - | 0.04% | 0.09% | 0.3% | 0.6% |
| **Agriculture** | 0.5 | 43% | Medium | 2023 | 0.3% | 0.6% | 1.8% | 3.8% |
| **Forestry** | 0.9 | 5% | Low | - | 0.6% | 1.2% | 4.3% | 9.1% |
| **Construction** | 0.06 | 0% | Low | - | 0.13% | 0.3% | 2.0% | 4.2% |
| **Light manufacturing** | | | | | | | | |
| Food manufacturing | 0.16 | 46% | Medium | - | 0.10% | 0.2% | 0.9% | 1.9% |
| Beverage and tobacco product manufacturing | 0.09 | 35% | Medium | - | 0.07% | 0.15% | 0.3% | 0.7% |
| Textile products and clothing manufacturing | 0.08 | 91% | Medium | - | 0.06% | 0.13% | 0.5% | 1.1% |
| Wood product manufacturing | 0.17 | 50% | Medium | - | 0.08% | 0.18% | 1.4% | 3.1% |
| Plastics and rubber products manufacturing | 0.04 | 62% | Medium | - | 0.01% | 0.03% | 0.1% | 0.2% |
| Other, non-metallic mineral products | 0.04 | 60% | Medium | - | 0.6% | 1.3% | 3.7% | 7.8% |
| Steel product manufacturing from purchased steel | 0.3 | 63% | Medium | 2030 | 0.3% | 0.6% | 3.7% | 7.8% |
| Foundries | 0.3 | 37% | Medium | 2030 | 0.13% | 0.3% | 1.9% | 4.0% |
| Fabricated metal product manufacturing | 0.09 | 51% | Medium | - | 0.06% | 0.12% | 0.5% | 1.1% |
| Machinery manufacturing | 0.05 | 80% | Medium | - | 0.08% | 0.16% | 0.6% | 1.2% |
| Computer, electronic product and equipment, appliance and component manufacturing | 0.02 | 90% | Medium | - | 0.04% | 0.09% | 0.3% | 0.6% |
| Transportation equipment manufacturing | 0.04 | 80% | Medium | - | 0.03% | 0.07% | 0.2% | 0.4% |
| Other manufacturing | 0.05 | 73% | Medium | - | 0.06% | 0.12% | 0.6% | 1.3% |

63 There are a number of these ratios used to test for risk, some of which have been updated. The use of this test is provided for illustrative purposes and does not imply these sectors should be classified as EITE for inclusion in LETS.

| Sector | Carbon intensity index (large emitters =1) | Trade exposure | Ontario EITE score | ECCC (EI>3% & TE>20%)[63] | Sales test > 3%? | | Profit test > 10%? | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 2024 | 2030 | 2024 | 2030 |
| **Transport** | | | | | | | | |
| Air transportation | 1.0 | 28% | Medium | 2023 | 0.5% | 1.14% | 1.5% | 3.1% |
| Rail transportation | 1.4 | 37% | High | 2023 | 1.7% | **3.6%** | 4.0% | 8.4% |
| Water transportation | 3.3 | 38% | High | 2023 | 1.6% | **3.3%** | **13.6%** | **28.9%** |
| Truck transportation | 1.2 | 22% | High | 2023 | 0.9% | 2.0% | 9.6% | **20.3%** |
| Transit and ground passenger transportation | 0.4 | 25% | Medium | 2030 | 0.4% | 0.9% | 2.6% | 5.4% |
| Other transportation, excluding warehousing | 0.09 | 14% | Medium | - | 0.07% | 0.14% | 0.4% | 0.8% |

Note: Based on a projection from integrated modelling.

## 7.2 Model projections of revenue recycling impact

In 2024, the federal government created the Canada Carbon Rebate for Small Business to return fuel charge proceeds to SMEs in jurisdictions covered by the federal fuel charge (for more information about the rebate, see Section 2.6.1). To assess the economic impacts of the rebate, we simulated a *SME-rebating* scenario where 8 per cent of fuel charge revenue is recycled annually to SMEs in 2021–25 and 5 per cent in 2026–35. We compared this scenario to a modelled reference case where all revenue is rebated to households.

In the *SME-rebating* scenario, the share of the annual fuel charge rebate is allocated to SME sectors on a per-employee basis, reflecting the rebate's design, which returns fuel charge proceeds to firms at a flat rate per employee. In our modelling, large emitters in SME-dominant sectors but covered by LETS are excluded from the fuel charge and the rebating.

It's important to note that these results are not intended to indicate the overall competitiveness risk of the carbon price for these sectors, but rather to examine whether rebating improves their financial position. Many of these sectors have high cost pass-through because they operate in domestic markets and can pass carbon costs along to supply chains and consumers. As a result, the financial impact on their operations may not be that significant.

Regarding the impacts of carbon pricing on SMES, we find that:

- SME-dominant sectors decarbonize slower than the overall economy, with emissions per unit of GDP declining but at a slower rate than the Canadian average. This slower decarbonization effect is due to emissions intensity differences, policy targeting, and the availability of low-cost abatement options.
- The manufacturing and construction sectors face higher costs indirectly through supply chains because carbon pricing increases the price of intermediate goods. In contrast, transportation and service sectors see smaller increases in the price of non-fuel intermediate goods.

Regarding the impacts of revenue recycling to SMEs, we find that:

- Recycling revenue to SMEs results in small increases to national GDP (~0.04 per cent, $1 billion in 2030) by reducing household transfers and providing labour subsidies to industry, enhancing competitiveness and labour participation (Table 13).
- SME-dominant sectors receive $0.01-$0.14 per $1 of fuel charge paid in 2030, with significant variation. Sectors benefiting most include services, construction, agriculture, and certain manufacturing industries. Sectors with higher emissions per employee, like transportation and food manufacturing, see lower benefits, because the rebate is flat and does not scale to their higher carbon costs. Sector-specific results include:
    - In 2030, the forestry sector stands out with the highest fuel charge paid per employee and the lowest percentage rebate received compared to the amount paid, at 1.1 per cent.
    - Foundries also show a notably high fuel charge paid per employee, with a low percentage rebate of 0.4 per cent.
    - The transportation sector shows significant outliers, with the overall transportation category having a rebate share of just 0.4 per cent. Within this sector, rail transportation has the highest fuel charge paid per employee and a rebate share of 0.3 per cent. Water transportation and truck transportation both have high fuel charges paid per employee with very low percentage rebates, of 0.2 per cent and 0.3 per cent respectively. Transit and ground passenger transportation also pay a high fuel charge per employee with a low rebate percentage of 0.5 per cent. The high cost –pass-through in the transportation sector likely ameliorates much of the sector's carbon cost impact.

Table 13:

## Impact of revenue recycling on SME-dominant sectors

| Sector | Change in GDP with rebate | | Rebate in 2030 as a percentage of fuel charge paid |
|---|---|---|---|
| | 2025 | 2030 | |
| **Services** | **0.04%** | **0.03%** | **11%** |
| **Agriculture** | **0.07%** | **0.06%** | **9%** |
| **Forestry** | **0.15%** | **0.09%** | **1.1%** |
| **Construction** | **0.08%** | **0.03%** | **7%** |
| **Light manufacturing** | **0.11%** | **0.08%** | **5%** |
| Food manufacturing | 0.10% | 0.10% | 3% |
| Beverage and tobacco manufacturing | 0.08% | 0.07% | 4% |
| Textile products and clothing manufacturing | 0.18% | 0.14% | 11% |
| Other manufacturing | 0.10% | 0.08% | 4% |
| Wood product manufacturing | 0.04% | 0.04% | 2% |
| Plastics manufacturing | 0.09% | 0.06% | 6% |
| Other non-metallic mineral products | 0.12% | 0.08% | 0.7% |
| Steel product manufacturing from purchased steel | 0.09% | 0.05% | 7% |
| Foundries | 0.12% | 0.07% | 0.4% |
| Fabricated metal product manufacturing | 0.12% | 0.08% | 11% |
| Machinery manufacturing | 0.20% | 0.12% | 10% |
| Computer, electronic product and equipment, appliance and component manufacturing | 0.15% | 0.12% | 14% |
| Transportation equipment manufacturing | 0.09% | 0.05% | 8% |
| **Transportation** | **0.08%** | **0.06%** | **0.4%** |
| Air transportation | 0.05% | 0.04% | 0.7% |
| Rail transportation | 0.10% | 0.07% | 0.3% |
| Water transportation | 0.07% | 0.04% | 0.2% |
| Truck transportation | 0.10% | 0.07% | 0.3% |
| Transit and ground passenger transportation | 0.08% | 0.07% | 0.5% |
| Other transportation, excluding warehousing and storage | 0.07% | 0.04% | 1.2% |
| **Total economy** | **0.05%** | **0.04%** | **n/a** |

Note: Based on a projection from integrated modelling.

8

# Conclusion

Carbon pricing has now been in effect across the whole of Canada for five years. Though carbon pricing systems have evolved almost continuously in that time, we observe two constants about their effectiveness and stringency. First, though carbon pricing is far from the country's only climate policy, these systems perform uniquely important roles in fulfilling climate policy objectives. Second, even as carbon pricing systems have become stronger over time, they must continue to evolve to remain effective.

These observations are founded on the indicators presented in this report, which evaluate the coverage, price stringency, emissions reductions, and competitiveness impacts of carbon pricing systems across Canada. Table 14 summarizes these indicators, which fulfill our mandate to assess the effectiveness and stringency of carbon pricing. Overall, we conclude that:

- **Carbon pricing is effective:** Carbon pricing delivers significant emissions reductions out to 2030. The contribution of carbon pricing systems represents a large part of the emissions reductions expected from the country's climate policies; between one and third and one half of the reductions projected from current measures. Large-emitter trading systems play the leading role in these reductions.
- **Systems have harmonized since our last assessment**: Carbon pricing systems are better aligned across the country compared to our last report, with more similar coverage and price stringency. This harmonization can be partly credited to the federal government's 2022 assessment of carbon pricing systems against the federal benchmark criteria. This finding emphasizes the utility of national minimum standards for carbon pricing systems, and the value of future reviews of these systems.
- **Some large-emitter systems may need further revision to remain effective:** Though LETS are more stringent today than in the past, our analysis shows that LETS markets could diverge in the future, and that some are at risk of becoming less effective. As more emitters generate and accumulate credits in large-emitter trading systems, and as additional federal and provincial policies are implemented, some carbon pricing systems are at risk of developing an oversupply of credits. This oversupply would cause lower marginal costs and make systems less effective. Where this risk exists, systems may need to be revised to stay effective.
- **Large-emitter systems are mitigating competitiveness impacts:** Design choices that limit the cost exposure for large emitters, revenue recycling programs, and other

subsidies are effective at mitigating negative competitiveness impacts in general, and in some cases they enhance competitiveness. While select sectors face some negative impacts on their output or profitability, most sectors see muted impacts or even the potential to earn net returns from carbon pricing.

- **Opacity is a barrier to effectiveness:** We had access to more and better data to conduct this assessment compared to its predecessor, but our analysis was still restricted by confidentiality concerns and the limited public data that illustrate the functioning of credit markets. Greater transparency, particularly with respect to compliance data and credit prices, would improve market function and support effectiveness.

When it comes to carbon pricing, Canada is making progress—and still has more work to do. Ongoing adjustments and careful monitoring will be necessary to ensure that carbon pricing systems remain effective at driving emissions reductions and addressing competitiveness challenges. The federal interim review, which this assessment is designed to inform, will be instrumental in ensuring that carbon pricing can continue to play its leading role in Canada's clean energy transition.

Table 14:

## Summary of findings

| Indicator | Location in report | Findings |
|---|---|---|
| Coverage | Section 4.1.1 | **Coverage compared to total emissions:** Carbon pricing covers approximately 77 per cent of emissions at a national level, excluding LULUCF, and between 41 and 84 per cent of emissions in individual provinces and territories.<br><br>Carbon pricing systems in 2024 have broader coverage than they did when we conducted our last assessment in 2020–21. The notable exception to this trend is the temporary carbon price exemption for some fuels used for heating. |
| | Section 4.1.2 | **Coverage compared to the coverage standard:** We developed the coverage standard to better compare coverage across jurisdictions. The coverage standard adjusts our coverage estimate by excluding any emissions sources that are never covered by carbon pricing anywhere in Canada. Measured by the coverage standard, jurisdictions cover between 53 and 98 per cent of their emissions with carbon prices.<br><br>The coverage standard also serves as a measure of best practice. If every province applied carbon pricing to every source of emissions that is covered in at least one jurisdiction in Canada, then carbon pricing could cover up to 91 per cent of the country's emissions. |

| Indicator | Location in report | Findings |
| --- | --- | --- |
| Stringency | Sections 4.2.1, 4.2.3, and 6.3.1 | **Marginal cost alignment:** The marginal cost is the primary indicator of the strength of the incentive that carbon pricing provides to reduce emissions. The marginal cost incentive is better aligned across Canada compared to our last assessment, generally meeting the 2024 federal price of $80 per tonne.<br><br>There are some exceptions. Offsets somewhat depress the marginal cost in Alberta and Quebec and may depress the marginal cost in British Columbia, depending on how many offsets become available. Quebec's marginal cost is lower than in other jurisdictions, likely in part because of an overhang in allowance supply. Evidence suggests that the market price of tradeable credits in Alberta in 2024 is even lower than we estimated, around $50 per tonne, and this may also be true in other jurisdictions.<br><br>There is a risk that some carbon pricing systems may not preserve the marginal cost in 2030. Our projections show that carbon pricing could interact adversely with some additional climate policies, causing an oversupply of credits that would erode the price signal. We observe this risk in three jurisdictions: Alberta, British Columbia, and Saskatchewan. These systems may need to be made more stringent to preserve their effectiveness at reducing emissions. |
| | Sections 4.2.2, 4.2.3, and 6.2.2 | **Average cost for large emitters:** The average cost is mainly relevant for assessing the stringency of large-emitter trading systems, which are designed to reduce costs for trade-exposed large emitters in order to protect their competitiveness.<br><br>Nationally, the average cost of carbon for large emitters is roughly $10 per tonne in 2024, one-eighth the carbon price of $80 per tonne. Across all jurisdictions, the average cost ranges from $5 per tonne to $22 per tonne. These average costs are also better aligned than in the last assessment.<br><br>Low average costs persist in modelling projections. By 2030, carbon pricing systems will be more stringent due to higher carbon costs and tighter performance standards. We project that some sectors will, on average, generate net returns from carbon pricing. Even for the most exposed sector—upstream oil and gas—we project that the average cost nationally would be $29 per tonne in 2030 under existing tightening provisions, still just a fraction of the carbon price. |
| Emissions reductions | Section 5 | **Overall effectiveness:** The main purpose of carbon pricing is to reduce greenhouse gas emissions. Our projections find that carbon pricing is effective at doing so. In the *legislated policies* scenario, which reflects all current major federal and province carbon policies, carbon pricing is responsible for between a third and a half of all emissions avoided by climate policy in 2030. Large-emitter trading systems deliver the bulk of these emissions reductions. |
| | Section 6.3 | **Risks to the effectiveness of large-emitter trading systems:** The future effectiveness of some LETS is at risk because of projected over-crediting and policy interactions, which can erode the marginal cost incentive. In this report's announced, *less stringent policies scenario*, the carbon pricing systems in Alberta, British Columbia, and Saskatchewan fail to maintain the marginal cost, and therefore reduce fewer emissions.<br><br>There are various policy options to address these risks, and all require the reconciling of market function and policy objectives. For example, tighter benchmarks can make LETS more effective but could lead to other policy interactions or adverse competitiveness impacts. Differences in the size and diversity of carbon markets further influence the overall effectiveness of LETS. |

| Indicator | Location in report | Findings |
| --- | --- | --- |
| Competitive-ness | Section 6.2 | **Competitiveness impacts for large emitters:** The average cost analysis discussed above is one indicator of how carbon pricing accounts for the competitiveness concerns of large emitters. As we noted, large emitters generally face low average costs, and some will be able to earn net returns from carbon pricing.<br><br>Sales and profit tests for large emitter analysis largely echo our average cost findings, showing that many sectors can generate net returns from carbon pricing while few face substantive negative impacts on their output because of carbon costs. Nonetheless, competitiveness challenges remain in some sectors, highlighting areas for policy refinement.<br><br>A growing number of Canada's trading partners are implementing carbon pricing regimes, though some competitiveness risk remains due to misalignment between Canada's carbon price and international markets. |
| | Section 6.2 | **Impacts of all policies, including subsidies and regulations:** The proceeds from carbon pricing and other subsidies mitigate these competitiveness risks, even when accounting for increased regulatory costs and Scope 3 supply-chain carbon costs. Once we account for the impacts of legislated federal and provincial policies, including subsides and regulations, we find that no large-emitting sector faces a profit impact where significant financial hardship is likely, while some sectors see improved financial performance compared to a scenario without climate policies. Overall impacts on profit margins are small. |
| | Section 7 | **Impacts on small and medium-sized enterprises:** Carbon pricing impacts SMEs differently than large emitters. While SMEs contribute less to overall emissions, their ability to absorb costs and invest in emissions-reducing technologies can be limited. The assessment highlights that SMEs often face higher relative costs compared to larger firms. However, targeted subsidies and incentives can alleviate some of these financial pressures. The proposed federal rebate for SMEs can offset some of the costs associated with carbon pricing, though the most emissions-intensive businesses will still see greater cost impacts. |

# Acknowledgments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# Annex

## Navius Research modelling report

### Introduction

The Canadian Climate Institute (the Institute) has been commissioned by Environment and Climate Change Canada (ECCC) to undertake the 2024 Independent Assessment of Carbon Pricing Systems. To expand upon the assessment completed in 2020 (Sawyer et al. 2021), the Institute commissioned Navius Research to provide forward-looking economic modelling to evaluate the various provincial carbon pricing systems across the country.

Navius Research used our in-house model, gTech-IESD, to simulate a set of scenarios, with and without carbon pricing, in order to evaluate the impact of these systems on emissions and fore- cast the supply and demand balance of tradeable compliance credits between 2020 and 2035. Comparing these model scenarios allows the Institute to answer the following research questions:

- What quantity of emissions reductions (or forgone emissions growth) can be attributed to carbon pricing systems, for both industrial pricing systems and charges on consumer fuels?
- How do the emissions reductions attributable to carbon pricing overlap and interact with other legislated and proposed regulatory measures?
- What is the expected marginal and average prices for emissions with legislated carbon pricing systems going forward to 2030?
- Will large-emitter trading systems (LETS), in their currently legislated form, be stringent enough to maintain a net demand for tradeable credits?
- What degree of additional tightening (if any) would ensure that LETS are binding?

This document presents the modelling approach used by Navius to inform the Institute's assessment, as well as a discussion of uncertainties and limitations in Navius' approach.

### Scenario design

Navius modelled the impact of carbon pricing by simulating a set of scenarios with and without pricing policies in place and comparing the difference in emissions between them.

Table A provides the policy scenarios used in the carbon pricing review.

These scenarios allow us to evaluate avoided emissions due to the fuel charge and the federal OBPS (individually) against multiple baselines, with increasingly stringent non-pricing climate policies; evaluate how federal OBPS benchmarks may need to change (if at all) to ensure the $170/t price remains binding; and examine the supply and use of compliance credits between sectors in different policy scenarios.

The policy scenarios are divided into the following three categories:

1. **No policy**. This is a counterfactual scenario in which all legislated climate policies are removed and the model simulates what could have happened had these policies not been in place. Carbon pricing has the largest effect in this scenario where it is the only climate policy in place.
2. **Legislated policies**. This includes currently legislated federal and provincial policies, spending allocated in a federal budget, and specific industrial projects that are in the planning phase. The comparison of emissions with and without carbon pricing in the legislated scenario evaluates the impact of carbon pricing in addition to non-pricing policies (e.g., fuel efficiency requirements) that have already been legislated.[64]
3. **Announced policies**. This reflects policy proposals that are either a stringency increase for an existing policy or new federal policies that have not yet been legislated but for which intent of implementation has been officially announced. This evaluates the impact of carbon pricing holding all the other regulatory measures proposed by the federal government constant.

For detailed descriptions of each policy included in the legislated and announced policy scenarios, please refer to this document, which covers the modelled federal and provincial policies, respectively.

Table A:

## Modelling scenarios for carbon pricing review

| Number | Scenario name | Description |
|---|---|---|
| 1 | No policy | No climate policies, intended to reflect how emissions would have changed since 2015 had existing policies all been removed. No carbon pricing or cap and trade systems or complementary regulations. |
| 2 | No policy, with fuel charge only | No policies, except a fuel charge rising to $170/t in 2030 (and the WCI cap and trade system in Quebec). The difference between (2) and (1) is the impact of the fuel charge (and the WCI system in Quebec). |
| 3 | No policy, with carbon pricing | No policies, except a fuel charge and provincial LETS price rising to $170/t in 2030. The difference between (3) and (2) is the impact of the provincial LETS, if no other regulatory measures existed.<br>The difference between this scenario and (1) estimates the maximum abatement potential of carbon pricing with no other interacting regulatory measures. |
| 4 | Legislated policies, no carbon pricing | Includes all legislated policies, but without carbon pricing. This will serve as a baseline for how emissions would have grown had carbon pricing not been in place, but other climate policies were (e.g., fuel economy standards). |
| 5 | Legislated policies, fuel charge only | Includes all legislated policies with a federal fuel charge rising to $170/t by 2030 and the WCI cap and trade system in Quebec. The difference between (5) and (4) is the emissions impact that can be attributed to the fuel charge without other proposed ERP policies in place. |

64 If comparing model outputs for the legislated policies scenario to actual emissions data for 2020 or 2021, please note that the gTech-IESD model is not representative of the temporary shock associated with the COVID-19 pandemic. The model is intended to reflect long-term trends in energy use and emissions.

| Number | Scenario name | Description |
|---|---|---|
| 6 | Legislated policies | Includes all legislated policies including the fuel charge and LETS at $170/t by 2030. The difference between (6) and (5) is the emissions impact that can be attributed to the LETS without other ERP policies in place. LETS benchmarks are fixed at their legislated values, meaning the credit price could be below $170/t. |
| 7 | Announced policies, no carbon pricing | Includes all announced policies, but without carbon pricing. This will serve as a baseline for how emissions would have changed had carbon pricing not been in place while the rest of Canada's ERP was implemented in full. |
| 8 | Announced policies, fuel charge only | Includes all announced policies with a federal fuel charge rising to $170/t by 2030 and the WCI cap and trade system in Quebec. The difference between (7) and (8) is the emissions avoided by the fuel charge above –and beyond what would have been achieved by non-pricing policies. |
| 9 | Announced policies | Includes all announced policies including the fuel charge and LETS at $170/t by 2030. The difference between (8) and (9) is the minimum emissions impact that can be attributed to the LETS. LETS benchmarks are fixed at their legislated values, meaning the credit price could be below $170/t. |
| 10 | Announced policies with binding LETS | Identical to scenario (9), but with LETS benchmarks reduced enough such that there is a net deficit of credits, and the credit price is equal to the backstop price. The difference between (9) and (10) provides an estimate of the extent to which LETS benchmarks could be tightened to maintain a credit price of $170/t in 2030, following implementation of all ERP policies. |

Each of the policy scenarios outlined above were modelled with five different sensitivities, representing a range of oil prices and costs for low-carbon technologies. This is intended to conduct a sensitivity analysis on exogenous modelling assumption used by Navius. Global oil prices and low-carbon cost assumptions were varies as shown in Table B below.

Table B:

## Sensitivity matrix

| | | Global oil price | | |
|---|---|---|---|---|
| | | **Low (CER global net zero)** | **Reference (CER current)** | **High (EIA reference)** |
| **Low carbon technology cost** | **Low** | 3. Low oil / low tech cost | | 2. High oil / low tech cost |
| | **Reference** | | 1. Reference | |
| | **High** | 5. Low oil price / high tech cost | | 4. High oil price / high tech cost |

Reference and low oil price forecasts were taken from the Canada Energy Regulator's Energy Future 2023 *Current Measures* and *Global Net Zero* scenarios, respectively (Canada Energy Regulator 2023). The high oil price forecast was taken from the U.S. Energy Administration's Annual Energy Outlook 2023 reference oil price forecast (U.S. Energy Information Administration 2023).

Low-carbon technology cost sensitivities vary costs for wind and solar, battery electric vehicles, hydrogen fuel cells, hydrogen production, heat pumps, carbon capture and storage, and second-generation biofuel production. All low-carbon technology costs are varied together, allowing for a representation of an upper and lower range in low-carbon technology cost uncertainty.

## Macroeconomic assumptions

Core macroeconomic growth assumptions for calibration of gTech-IESD are: 1) labour force and productivity growth, sourced from the Office of the Parliamentary Budget Officer and 2) oil and gas prices and production, sourced from the Canada Energy Regulator. These assumptions are presented below. For a more fulsome overview of the functionality and structure of Navius' gTech-IESD model, please refer to public model documentation, available on Navius' Canada Energy Dashboard website.

### *Labour force growth*

Sub-national labour force and productivity growth rates, core to the long-term GDP growth rate in gTech-IESD, are sourced from the Parliamentary Budget Officer's Fiscal Sustainability Report for all Canadian jurisdictions in the model (Barkova et al. 2023).[65] Model inputs for population growth rate and model outputs for reference case GDP are shown in Table C below. gTech-IESD GDP outputs are heavily influenced by population and productivity growth assumptions derived from the PBO, but will not align perfectly with the GDP forecast published in the PBO's outlook due to differing assumptions for other economic shocks (e.g., changing oil prices, industrial developments) that affect GDP.

### *Oil and gas prices and production*

Reference case prices and production of oil and natural gas are based on the "Current Measures" projection in the Canada Energy Regulator (CER)'s *Canada's Energy Future 2023* data appendices (Canada Energy Regulator 2023). The long-term price for Brent crude oil remains constant at around 75 USD/bbl from 2030-onwards (see Table D, below). Post-2030, the price of Henry Hub natural gas rises gradually to a peak of 4.4 USD/MMBtu by the end of the projection in 2050 (Table D). Reference case production in Canada's primary oil and gas producing provinces (and their significant sectors) are provided in Table E and Table F below. Low oil prices are based on the "Global Net Zero" projection in the CER's Energy Future 2023, and high prices are based on the US Energy Administration's Annual Energy Outlook 2023 reference oil price forecast (U.S. Energy Information Administration 2023).

65 The PBO outlook provides one aggregated growth rate for the three territories. This was applied for GDP growth, with a post-modelling adjustment applied to re-allocate mining activity between territories, to account for expected growth in the Yukon mining sector and expected mine closures in the Northwest Territories.

Table C:

## Reference case growth rates for population and real GDP (2015 constant dollars) in gTech-IESD

| | 2021–25 | 2025–30 | 2030–35 | 2035–40 | 2040–45 | 2045–50 |
|---|---|---|---|---|---|---|
| **Alberta** | | | | | | |
| GDP growth | 3.85% | 2.64% | 2.54% | 2.37% | 2.17% | 2.08% |
| Population growth | 3.0% | 1.8% | 1.7% | 1.6% | 1.4% | 1.2% |
| **British Columbia** | | | | | | |
| GDP growth | 2.55% | 2.00% | 1.41% | 1.37% | 1.31% | 1.18% |
| Population growth | 1.8% | 0.7% | 0.7% | 0.7% | 0.6% | 0.5% |
| **Manitoba** | | | | | | |
| GDP growth | 2.89 | 2.38% | 2.25% | 2.20% | 1.94% | 2.19% |
| Population growth | 1.6% | 1.0% | 1.1% | 1.0% | 0.9% | 0.8% |
| **New Brunswick** | | | | | | |
| GDP growth | 1.00% | 0.06% | 0.20% | 0.46% | 0.47% | 0.44 |
| Population growth | 0.3% | -0.2% | -0.1% | -0.2% | -0.3% | -0.3% |
| **Newfoundland and Labrador** | | | | | | |
| GDP growth | -0.19 | 2.03% | -0.76% | -0.34% | 0.57% | 0.49% |
| Population growth | -0.3% | -1.1% | -1.0% | -1.0% | -1.0% | -1.0% |
| **Nova Scotia** | | | | | | |
| GDP growth | 0.43% | 0.64% | 0.52% | 0.54% | 0.56% | 0.52% |
| Population growth | 0.4% | -0.2% | -0.1% | -0.1% | -0.2% | -0.3% |
| **Ontario** | | | | | | |
| GDP growth | 2.76% | 2.20% | 2.02% | 1.92% | 1.83% | 1.72% |
| Population growth | 1.9% | 0.9% | 0.8% | 0.8% | 0.6% | 0.5% |
| **Prince Edward Island** | | | | | | |
| GDP growth | 2.78% | 1.76% | 1.47% | 1.52% | 1.46% | 1.35% |
| Population growth | 2.3% | 1.1% | 0.9% | 0.7% | 0.5% | 0.4% |
| **Quebec** | | | | | | |
| GDP growth | 1.98% | 1.15% | 1.15% | 1.22% | 1.24% | 1.23% |
| Population growth | 0.8% | 0.2% | 0.3% | 0.4% | 0.4% | 0.4% |
| **Saskatchewan** | | | | | | |
| GDP growth | 3.03% | 2.87% | 2.70% | 2.31% | 1.99% | 1.83% |
| Population growth | 2.5% | 1.6% | 1.5% | 1.2% | 0.8% | 0.6% |
| **Territories** | | | | | | |
| GDP growth | 1.92% | 1.25% | 1.47% | 1.60% | 1.32% | 1.30% |
| Population growth | 1.0% | 0.9% | 0.8% | 0.6% | 0.5% | 0.5% |

Table D:

## Oil and natural gas prices in gTech-IESD

| Sensitivity | | Unit | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|
| Reference | Oil price (Brent) | 2022 US$/bbl | 80 | 75 | 75 | 75 | 75 | 75 |
| Reference | Natural gas price (Henry Hub) | 2022 US$/MMBtu | 3.8 | 3.7 | 3.9 | 4.1 | 4.3 | 4.4 |
| High | Oil price (Brent) | 2022 US$/bbl | 87 | 90 | 93 | 96 | 98 | 101 |
| Low | Oil price (Brent) | 2022 US$/bbl | 72 | 35 | 32 | 29 | 26 | 24 |

Table E:

## Reference case oil production in gTech-IESD (thousands of barrels per day)

| | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|
| **Alberta** | | | | | | | | |
| Conventional light | 398 | 343 | 544 | 657 | 757 | 891 | 946 | 944 |
| Conventional heavy | 131 | 100 | 97 | 102 | 112 | 132 | 142 | 142 |
| Mined bitumen | 1,161 | 1,487 | 1,662 | 1,662 | 1,651 | 1,619 | 1,619 | 1,619 |
| In situ bitumen | 1,380 | 1,497 | 1,853 | 2,092 | 2,241 | 2,194 | 2,097 | 2,050 |
| Upgraded bitumen | 971 | 1,092 | 1,216 | 1,216 | 1,204 | 1,168 | 1,168 | 1,168 |
| **Saskatchewan** | | | | | | | | |
| Conventional light | 237 | 156 | 111 | 93 | 81 | 73 | 66 | 58 |
| Conventional heavy | 249 | 251 | 371 | 398 | 423 | 436 | 429 | 413 |
| **Newfoundland and Labrador** | | | | | | | | |
| Conventional light[66] | 172 | 285 | 250 | 361 | 303 | 208 | 130 | 81 |

66 All oil production in Newfoundland and Labrador in gTech-IESD is represented as “Conventional Light.”

Table F:

## Reference case natural gas production in gTech-IESD (billion cubic feet per day)

| | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|
| British Columbia | 4.2 | 5.4 | 6.8 | 8.7 | 9.4 | 10.0 | 10.8 | 11.6 |
| Alberta | 10.3 | 9.4 | 9.9 | 9.3 | 9.3 | 10.1 | 10.7 | 11.3 |
| Saskatchewan | 0.4 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.2 |

## Carbon pricing policies

Prior to simulating the scenarios outlined above, Navius and the Canadian Climate Institute conducted a detailed review of legislated provincial, territorial, and federal carbon pricing policies and updated the parameters used to represent these policies in the gTech-IESD model. Navius prepared a summary of each policy for respective governments for comment, including policy coverage, sectoral benchmarks, tightening rates, and other relevant considerations based on the regulations and associated standards in each province. Comments from provincial, federal, and territorial governments were then used to adjust the input parameters in the model.

Where available, Navius used historic sectoral compliance data to calibrate model benchmarks to achieve a similar compliance obligation as a share of covered emissions for major sectors. Revenue from industrial carbon pricing systems is assumed to be recycled into a fund to subsidize low-carbon technologies in industry in the model.[67]

67 An exception to this is Newfoundland and Labrador, which has a fixed schedule for credit allocation to its electricity utility that may be adequately large to supply the entire market requirement. Due to the complexity of endogenously simulating recycling revenue to the electricity sector in the model, the net proceeds of the Newfoundland and Labrador OBPS were combined with fuel charge revenues and transferred to households.

## How is carbon pricing simulated in gTech-IESD?

gTech-IESD includes a stock turnover model of energy-consuming and emissions-producing technologies, including more than 300 technology archetypes across 70 end-uses. Technologies compete for market share within each end-use, gaining market share inversely proportional to their levelized capital costs, operating expenses, fuel costs, carbon costs, other policy costs, and an “intangible” cost intended to reflect known consumer preferences.

Fuel charge policies are modeled as a fixed-price excise tax on emissions produced by energy-consuming technologies in the model. This increases the levelized cost of these technologies, resulting in a lower market share for newly installed stock.

OBPS-style policies are modeled as a tradeable credit that are endogenously priced in the model based on the supply and demand of credits.

- Output-based allocations are provided to industry per quantity of production based on the combustion and process emissions intensity for covered end uses in 2015, times a user-provided reduction factor (the benchmark).
- Energy consuming and emissions-producing technologies covered by the policy consume credits proportional to emissions, increasing the levelized cost of these technologies, resulting in a lower market share for newly installed stock of these technologies.
- The government can provide an unlimited quantity of credits at the specified fund price, the revenues from which are used to subsidize low-carbon technologies.

gTech-IESD solves for the quantity of fund credits that will be purchased to ensure the modeled credit price remains below the fund price. If the output-based allocations are adequately high relative to covered emissions, the technology fund credits will not be accessed, and the credit market will clear with a price below the fund price, based on the marginal cost of abatement to balance the credit market.

Cap-and-trade policies are modeled by issuing free allocations of some quantity of credits to industry based on production and a benchmark emissions intensity, and the remaining credits under the cap being auctioned, with the model solving for the credit price based on the marginal cost of abatement needed for emissions to be less than the cap. Like the OBPS-style polices, the WCI cap and trade system is also simulated with a price ceiling on credits, at which the regulator can issue an unlimited quantity of credits at a fixed price. The model does not consider inter-temporal banking of credits.

Table G and Table H below present the individual carbon pricing policies that were modelled for this analysis.

Table G:
## Modelled fuel charge policies

| Jurisdiction | Policy | Considerations |
|---|---|---|
| Alberta, Manitoba, New Brunswick, Newfoundland and Labrador, Nova Scotia, Ontario, PEI, Saskatchewan, Yukon, Nunavut | Federal fuel charge under the *Greenhouse Gas Pollution Pricing Act* | Recycled to households as fixed transfers. |
| British Columbia | B.C. *Carbon Tax Act* | Navius' modelling assumption is that revenue from the first $30/t of carbon tax (households and industry) is recycled to 81% general government revenue, and 19% income taxes (relative to 2015 levels). Carbon tax revenue from households above $30/t are recycled to the lowest four quintiles of household income. Carbon tax revenue from non-large final emitter industry is used for general revenue. While this is the modelling assumption, BC government policy is that revenues are to be used from the climate action tax credit, tax cuts, and CleanBC programming only. |
| Northwest Territories | NWT *Petroleum Products and Carbon Tax Act* | Recycled to households as fixed transfers. |
| Quebec | *Quebec Regulation respecting a cap-and-trade system for greenhouse gas emission allowances* | Used to subsidize low-carbon technologies, renewable electricity generation, and transit, with 20% used for general government revenue and corporate income tax reductions. |

Table H:

# Industrial carbon pricing policies included in gTech-IESD

| Jurisdiction | Policy | Considerations |
|---|---|---|
| Alberta | Alberta Technology Innovation and Emissions Reduction (TIER) Regulation<br>AB Reg. 133/2019 for benchmarks for electricity and hydrogen<br>*Standard for developing benchmarks Version 2.2 for all other sectors* (Government of Alberta 2023b)[68] | TIER provides uniform benchmarks for electricity generation technologies (including renewables).<br>TIER covered emissions includes imputed emissions from electricity consumption (included in both benchmarks and compliance obligations). |
| British Columbia | B.C. Output-Based Pricing System<br>Benchmarks from s. 54 of Schedule 3 of B.C. OIC 70/24, amending the Greenhouse Gas Emissions Reporting Regulation (Government of British Columbia 2024d). Benchmarks for LNG based on information provided by the Government of British Columbia to Navius Research. | Navius' modelling assumption is that revenue from the first $30/t of carbon tax (households and industry) is recycled to 81% general government revenue, and 19% income taxes (relative to 2015 levels). Carbon tax revenue from households above $30/t are recycled to the lowest four quintiles of household income. Carbon tax revenue from non-large final emitter industry is used for general revenue. While this is the modelling assumption, BC government policy is that revenues are to be used from the climate action tax credit, tax cuts, and CleanBC programming only. |
| Manitoba | Federal Output-Based Pricing System<br>Non-electricity benchmarks based on Table 3 of SOR/2019-266 Regulatory Analysis Impact Statement (Government of Canada 2019b), adjusted to align with provincial emissions intensity data provided by ECCC. | |
| New Brunswick | New Brunswick Output-Based Pricing System<br>Benchmarks taken from Tables 1 and 2 of Schedule A of the regulations. | New Brunswick's OBPS effectively does not price industrial process or on-site cogeneration emissions because the benchmark for these emissions is set using present-year emissions. These emissions are treated as excluded from the policy in the model. |
| Newfoundland and Labrador | Newfoundland and Labrador Management of Greenhouse Gas Regulations under the Management of Greenhouse Gas Act<br>Facility-specific benchmarks used in the model based on Schedule A. | gTech-IESD does not include Newfoundland and Labrador's requirement that the first 20% of emissions intensity reductions be achieved internally or paid for at 4x the backstop price. |
| Northwest Territories | NWT *Petroleum Products and Carbon Tax Act*<br>Benchmarks based on s. 6.2 (4) of the regulations. | |
| Nova Scotia | Nova Scotia Output-Based Pricing System<br>Benchmarks taken from Schedule 1-3 of the *Output-Based Pricing System Reporting and Compliance regulations.* | Nova Scotia's OBPS effectively does not price industrial process or on-site cogeneration emissions because the benchmark for these emissions is set using present-year emissions. These emissions are treated as excluded from the policy in the model. |

68 The benchmark for oil sands in-situ was reduced by 10 per cent relative to that in the Standard for developing benchmarks in order to calibrate the net compliance obligation of the sector to published data by the Alberta government for the 2020 year.

| Jurisdiction | Policy | Considerations |
|---|---|---|
| Nunavut | Federal Output-Based Pricing System<br>Benchmark based on provincial emissions intensity data provided by ECCC. | |
| Ontario | Ontario Greenhouse Gas Emissions Performance Standards<br>Benchmarks based on greenhouse gas Emissions Performance Standards and Methodology for the Determination of the Total Annual Emissions Limit (Government of Ontario 2022a), and compliance data provided by Ontario for sectors that are covered by Method A. | |
| Prince Edward Island | Federal Output-Based Pricing System<br>Benchmark was calculated based provincial emissions intensity data provided by ECCC which aggregated compliance obligations for manufacturing in PEI and Manitoba. | |
| Quebec | Quebec linked cap-and-trade with California via *Regulation respecting a cap-and-trade system for greenhouse gas emission allowances.* | Quebec's cap and trade program is linked with California. This is modelled as a joint market with one simulated market clearing price between the two regions.<br>California's regulations allow the state to hold "price ceiling sales" if the credit price reaches are certain level.<br>Industrial participation in the cap-and-trade system is turned on in unison in the model with retail fuel compliance (both part of the same policy mechanism). |
| Saskatchewan | Saskatchewan Output-Based Pricing System<br>Table 1, Table 2 of Saskatchewan (Government of Saskatchewan 2023b). | Compliance credits by carbon capture and storage were not tradeable in Saskatchewan's legislated policy until 2024. CCUS credits are available to be traded in the modelling, except in the 2020 model period. |
| Yukon | Federal Output-Based Pricing System<br>Benchmark emissions intensity assumed to align with Nunavut. | Yukon does not have any federal OBPS-regulated facilities in the 2021 data provided by ECCC, but there are proposed off-grid metal mines that would comply with the policy. One uniform benchmark for metal mining in the territories was used, based on the historic data provided by ECCC. |

## Discussion of uncertainty and limitations

Forward-looking modelling is inherently uncertain, and all methods have limitations and sources of uncertainty. This section provides an overview of model uncertainties, limitations, and areas for future work that were identified while completing this analysis.

## *General modelling limitations*

Independent of the design of carbon pricing policies, there are numerous model input assumptions where other approaches may be equally reasonable and yield different outcomes. Key examples of these uncertainties are:

- Macroeconomic drivers: we have relied on data from the Canada Energy Regulator and the Office of the Parliamentary Budget Officer for oil prices and production, population growth, and labour force productivity (as outlined above). Using different sources for these core drivers (such as population forecasts from provincial governments) would result in total emissions being higher or lower, or differently distributed between the provinces.
- Technology costs: gTech-IESD contains more than 300 technology archetypes for energy-consuming technologies, each of which has an assumption for its cost and emissions intensity. gTech-IESD does not include undefined backstop emissions abatement technologies. Furthermore, for many low-carbon technologies in the model, we make assumptions about the degree to which cumulative adoptions will cause future technology costs to be lower. Uncertainty in technology costs is partially captured in our sensitivity analysis, but still, the bounds of these sensitives are an input assumption based on Navius' research.

gTech-IESD does not include emissions from land-use, land-use change, and forestry, nor is it able to explicitly simulate changes to land-use policy and planning (e.g., municipal zoning policies).

Furthermore, regulatory policies and provincial policies were modelled with the same assumptions with and without carbon pricing. Each non-pricing policy has unique uncertainties associated with policy compliance that could affect the outcome of the analysis of carbon pricing but were not varied within the scope of this project. For example, the federal Clean Fuel Regulations allow for credit generation by electric vehicles but require specific charging infrastructure to be adopted in order to generate credits (chargers must be sub-metered). The exogenous assumption for the share of electric vehicles that can generate credits is an influential assumption that could merit an entire analysis to itself, but a single assumption is used across all scenarios in this project.

## *Compliance use limits*

gTech-IESD, in its current form, is not able to simulate limits on the share of a firms' OBPS compliance that can be completed with tradeable credits from other firms (implicitly the limit on this is 100% in the model). This has the potential to overestimate the marginal abatement incentive, especially for firms below their benchmarks that would be generating credits. This limitation is most relevant in British Columbia's OBPS, which places a 30% limit on how much of a firm's compliance can be achieved with purchased credits from another facility below its benchmark. Other OBPS systems have much higher limits (75% - 100% allowable).

If this were to be added to the model and the constraint were to be binding, it would create an outcome where the marginal abatement incentive for firms below their benchmark would be lower than firms above their benchmark, resulting in a lower incentive to reduce emissions and higher modelled emissions. Adding this constraint to gTech-IESD to explicitly allow for simulation of compliance use limits is an area for future work.

### *Treatment of new facilities*

In sectors covered by optional or mandatory facility-specific benchmarks, newly constructed facilities are given a benchmark based on their initial few years of operation. As such, there is a substantially reduced carbon pricing incentive to design and build cleaner facilities for new industry in sectors with facility-specific benchmarking, because the benchmark is a function of one's own emissions.

gTech-IESD is not a facility-specific model, and instead represents sectors as a whole, with a uniform marginal abatement incentive applied across the whole sector. This is a limitation which may cause the model to overestimate the efficacy of industrial carbon pricing systems with facility-specific benchmarks.

### *Small industrial sectors*

As mentioned above, gTech-IESD is not a facility-specific model and simulates industrial sectors based on the average composition of different energy service inputs (e.g., high temperature heat, electric motors, pipeline compression) for industrial sectors as a whole, with unique energy consumption profile for about 90 sectors. This structure is a limitation for smaller regions, such as many of the Atlantic provinces, where industrial "sectors" in the model are frequently representing only one or a few individual facilities. In this case, a modelled outcome where the sector partially decarbonizes is unlikely, because if the sector is only one facility, it is likely to be a binary outcome. Similarly, if new facilities are being developed that have materially different production methods with different emissions intensities, the model will not capture this.

### *Offsets*

gTech-IESD's scope as an energy-economy model covers all energy use in Canada and emissions in IPCC source categories for energy, industrial processes and product use, agriculture, and waste. The model does not include emissions associated with land-use, land-use change, and forestry, or a representation of carbon offset programs that would be available for OBPS compliance.

The lack of offsets and land use emissions is a model limitation that would affect in which sector policies cause decreases in greenhouse gas emissions, as the purchase of offsets is a direct substitute for payments into the technology fund for OBPS policies. Explicitly modelling an offset program would result in higher emissions from covered non-land-use sectors, and lower emissions from land-use. The direction of any net bias due to this limitation depends on relative efficacy in reducing emissions of technology fund payments versus procurement of land-use offsets. If purchases of land-use offsets were to provide a higher quantity of additional greenhouse gas abatement per tonne of avoided technology fund compliance than provided by higher subsidies due to higher payments into the tech fund, net emissions would be lower (i.e., gTech-IESD would underestimate the impact of carbon pricing). If the technology fund were to provide higher additional greenhouse gas reductions per unit of compliance compared to offsets, net emissions would be higher (i.e., gTech-IESD would overestimate the impact of carbon pricing). Examining the incremental effects of technology fund payments relative to land-use offsets is an area for future research.

### *Credit banking and borrowing*

Markets for tradeable credits for compliance with OBPS policies are assumed to clear within each model period in gTech-IESD, resulting in a credit price that is either equal to the fund price, or in the case of an OBPS system with high enough benchmarks, a price lower than the fund price established by the marginal cost of abatement in covered sectors needed to balance the market for credits.

However, compliance credits in all OBPS systems are bankable, meaning a credit generated in 2023 could be sold in 2028 to avoid a higher fund payment (because the fund price increases $15 per year). This suggests that firms below the benchmark could have a higher marginal incentive to reduce emissions than firms above the benchmark. Credits are also subject to political risk. If the policy were to be cancelled by a future government and firms left uncompensated for their credits, this would depress their value. Depending on the market assessment of this risk, this could lead to firms below the benchmark having lower marginal incentives. gTech-IESD captures neither of these real-world dynamics, and the net effect on policy impact would depend on which effect is larger (expectations of future price increases or policy risk).

### *Data for territories*

Navius' base version of its gTech-IESD model is calibrated to emissions from Canada's National Inventory Report (NIR) for all regions for internal consistency. However, comparing NIR sectoral estimates for territorial emissions to other sources (from territorial governments or the federal Greenhouse Gas Reporting Program) demonstrates substantial data quality issues in the sectoral and total emissions estimates for the territories. These data quality issues are large enough that the data is not reliable for policy analysis. For example, NIR estimates for Nunavut are missing ~500 kt of mining sector emissions that were reported to the federal GHGRP, and Yukon's NIR stationary combustion emissions in buildings are different by a factor of four from estimates published by the territorial government based on fuel tax receipts.

Given the already limited data quality and the comparatively small quantities of emissions, Navius' base version of gTech-IESD simulates the territories as one aggregated region. For this analysis, individual territories were subsequently disaggregated as a post-modelling exercise based on sectoral emissions in the NIR. Navius has a separate model that simulates each of the territories individually that has been used for work with the territorial governments and has been calibrated to territorial data sources for energy use and emissions. For future work involving the analysis of federal policies on territorial emissions, it would be preferable to use a version of the model calibrated to territorial data sources (despite leading to internally inconsistent data sources), given the data quality challenges in the NIR.

Accordingly, model outputs for the territories should be viewed as more uncertain than the larger economies in the provinces for which higher quality data is available in the NIR.