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Independent Assessment of Carbon Pricing Systems in Canada

Modeling Appendix

SUBMITTED TO

Canadian Climate Institute

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SUBMITTED BY

Navius Research Inc.
Box 48300 Bentall
Vancouver BC V7X 1A1

Contact@NaviusResearch.com

About Us

Navius Research Inc. is an independent and non-partisan consultancy based in Vancouver. We operate proprietary energy-economy modeling software designed to quantify the impacts of climate change mitigation policy on greenhouse gas emissions and the economy. We have been active in this field since 2008 and have become one of Canada's leading experts in modeling the impacts of energy and climate policy. Our analytical framework is used by clients across the country to inform energy and greenhouse gas abatement strategy.

We are proud to have worked with:

- Most provincial and territorial governments, as well as the federal government.
- Utilities, industry associations and energy companies.
- Non-profit and research organizations with an interest in energy, climate change and economics.

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1. Introduction

The Canadian Climate Institute (CCI) has been commissioned by Environment and Climate Change Canada (ECCC) to undertake the 2024 independent assessment of carbon pricing systems across Canada. To expand upon the assessment completed in 2020[1], CCI commissioned Navius Research to provide forward-looking economic modeling 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 forecast the supply and demand balance of tradeable compliance credits between 2020 and 2035. Comparing these model scenarios allows CCI 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 under 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 systems are binding?

This document presents the modeling approach used by Navius to inform CCI's assessment, as well as a discussion of uncertainties and limitations in Navius' approach. Results from Navius' modeling are presented in CCI's report titled *2024 Independent assessment of carbon pricing in Canada*[2].

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[1] Sawyer, D., S. Stiebert, R. Gignac, A. Campney, and D. Beugin. 2021. 2020 Expert Assessment of Carbon Pricing Systems. Canadian Climate Institute. Available from: https://publications.gc.ca/site/eng/9.900084/publication.html

[2] Linden-Fraser, R., D. Sawyer, S. Harrison, and S. Stiebert. 2025. 2024 Independent Assessment of Carbon Pricing Systems. Canadian Climate Institute. Available at: https://climateinstitute.ca/wp-content/uploads/2025/02/2024-Independent-expert-assessment-carbon-pricing.pdf

2. Scenario design

Navius modeled 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 1 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 LETS (individually) against multiple baselines with increasingly stringent non-pricing climate policies, evaluate how LETS 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[3].

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.

[3] 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.

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

Table 1: Modeling 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 systems rising to $170/t in 2030. The difference between (3) and (2) is the impact of the LETS, if no other regulatory measures existed. 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.
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 systems	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 system 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 modeling assumption used by Navius. Global oil prices and low-carbon cost assumptions were varies as shown in Table 2 below.

Table 2: 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[4] *Current Measures* and *Global Net Zero* scenarios respectively. The high oil price forecast was taken from the US Energy Administration's Annual Energy Outlook 2023 reference oil price forecast[5].

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.

[4] Canadian Energy Regulator (2023). *Macro Indicators*. Available from: https://apps.rec-cer.gc.ca/ftrppndc/dflt.aspx?GoCTemplateCulture=en-CA

[5] U.S. Energy Information Administration. *Annual Energy Outlook*. Available From: https://www.eia.gov/outlooks/aeo/data/browser/#/?id=12-AEO2023&cases=ref2023~highmacro~lowmacro~highprice~lowprice~highogs~lowogs~highZTC~lowZTC~aeo2022ref&sourcekey=0

3. 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[1].

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 Office's Fiscal Sustainability Report[6] for all Canadian jurisdictions in the model[7]. Model inputs for population growth rate and model outputs for reference case GDP are shown in Table 3 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[8]. The long-term price for Brent crude oil remains constant at around 75 USD/bbl from 2030-onwards (see Table 4 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 4). Reference case production in Canada's primary oil and gas producing provinces (and their significant sectors) are provided in Table 5 and Table 6 below. Low oil prices are based on the "Global Net Zero" projection in the

[6] Parliamentary Budget Office, 2022 Fiscal Sustainability Report Supplementary Data. Available from: https://www.pbo-dpb.ca/en/publications/RP-2223-012-S--fiscal-sustainability-report-2022--rapport-viabilite-financiere-2022

[7] The PBO outlook provides one aggregated growth rate for the three territories. This was applied for GDP growth, with a post-modeling 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 NWT.

[8] Canada Energy Regulator (2023). Canada's Energy Future 2023: Energy Supply and Demand Projections to 2050. Available from: https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2023/index.html

CER's Energy Future 2023, and high prices are based on the US Energy Administration's Annual Energy Outlook 2023 reference oil price forecast[9].

Table 3: Reference case growth rates for population and real GDP (2015 constant dollars) in gTech-IESD[10]

	2021-2025	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050
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%

[9] U.S. Energy Information Administration. *Annual Energy Outlook*. Available From: https://www.eia.gov/outlooks/aeo/data/browser/#/?id=12-AEO2023&cases=ref2023~highmacro~lowmacro~highprice~lowprice~highogs~lowogs~highZTC~lowZTC~aeo2022ref&sourcekey=0

[10] Parliamentary Budget Office, 2022 Fiscal Sustainability Report Supplementary Data. Available from: https://www.pbo-dpb.ca/en/publications/RP-2223-012-S--fiscal-sustainability-report-2022--rapport-viabilite-financiere-2022

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 4: Oil and natural gas prices in gTech-IESD[11]

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 5: Reference case oil production in gTech-IESD (thousands of barrels per day)[12]

	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								

[11] Canada Energy Regulator (2023). Canada's Energy Future 2023: Energy Supply and Demand Projections to 2050. Available from: https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2023/index.html

[12] Ibid.

Conventional Light[13]	172	285	250	361	303	208	130	81

Table 6: Reference case natural gas production in gTech-IESD (billion cubic feet per day)[14]

	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

[13] All oil production in Newfoundland and Labrador in gTech-IESD is represented as "Conventional Light".

[14] Canada Energy Regulator (2023). Canada's Energy Future 2023: Energy Supply and Demand Projections to 2050. Available from: https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2023/index.html

4. Carbon pricing policies

Prior to simulating the scenarios outlined in Section 2 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[15].

Table 7 and Table 8 below present the individual carbon pricing policies that were modeled for this analysis.

[15] 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 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.

LETS 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 LETS 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 7: Modeled fuel charge policies

Region	Policy	Revenue recycling assumption
Alberta, Manitoba, New Brunswick, Newfoundland and Labrador, Nova Scotia, Ontario, PEI, Saskatchewan, Yukon, Nunavut	Federal fuel charge under the *Greenhouse Gas Pollution Pricing Act*[16]	Recycled to households as fixed transfers.
British Columbia	BC *Carbon Tax Act*[17]	Navius' modeling 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 modeling 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*[18]	Recycled to households as fixed transfers.
Quebec	Quebec *Regulation respecting a cap-and-trade system for greenhouse gas emission allowances*[19]	Used to subsidize low-carbon technologies, renewable electricity generation, and transit, with 20% used for general government revenue and corporate income tax reductions.

Table 8: Industrial carbon pricing policies included in gTech-IESD

Region	Policy	Considerations
Alberta	Alberta Technology Innovation and Emissions Reduction (TIER) Regulation AB Reg. 133/2019[20] for benchmarks for electricity, hydrogen, and sold industrial heat. *Standard for developing benchmarks Version 2.2* for all other sectors[21] [22].	TIER provides uniform benchmarks for electricity generation technologies (including renewables). TIER covered emissions includes imputed emissions from electricity consumption (included in both benchmarks and compliance obligations).
British Columbia	BC Output-Based Pricing System	BC's policy includes a 30% maximum on the share of a firm's compliance that can be

[16] Greenhouse Gas Pollution Pricing Act (2018). Available from: https://laws-lois.justice.gc.ca/eng/acts/G-11.55/FullText.html

[17] Carbon Tax Act (SBC 2008). Available from: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/08040_01

[18] Government of the Northwest Territories. *PETROLEUM PRODUCTS AND CARBON TAX ACT, RSNWT 1988,c.P-5.* Available from: https://www.justice.gov.nt.ca/en/files/legislation/petroleum-products-carbon-tax/petroleum-products-carbon-tax.a.pdf

[19] *Government of Québec. Regulation respecting a cap-and-trade system for greenhouse gas emission allowances, Q-2, r. 46.1. Available from: https://www.legisQuébec.gouv.qc.ca/en/document/cr/Q-2,%20r.%2046.1?&target=*

[20] AB Reg. 133/2019. Available from: https://kings-printer.alberta.ca/1266.cfm?page=2019_133.cfm&leg_type=Regs&isbncln=9780779843916

[21] Government of Alberta (January 2023). *Standard for developing benchmarks Version 2.2.* Available from: https://www.alberta.ca/technology-innovation-and-emissions-reduction-regulation

[22] The benchmark for oil sands in-situ was reduced by 10% 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. This calibration to observed data increases the stringency of the TIER system in the model. The underlying cause 10% difference is expected to stem from Navius' modeling of high-performance benchmarks for heat or electricity for cogeneration in the in-situ sector, whereas TIER applies the high-performance benchmark only to heat/electricity "imported by the large emitter or opted-in facility during the year" as per s. 9(1) of the regulation. The in-situ benchmark was the only calibration adjustment made form the values in the *Standard for developing benchmarks,* as this was the modeled sector demonstrating a material difference from the published compliance position.

	Benchmarks from s. 54 of Schedule 3 of BC OIC 70/24, amending the Greenhouse Gas Emissions Reporting Regulation.[23] Modeled benchmarks for LNG were based on placeholder information provided by the Government of British Columbia to Navius Research.	met with tradeable credits. This is not included in the modeling.
Manitoba	Federal Output-Based Pricing System Non-electricity benchmarks based on Table 3 of SOR/2019-266 Regulatory Analysis Impact Statement[24], adjusted to align with provincial emissions intensity data provided by ECCC.	
New Brunswick	New Brunswick Output-Based Pricing System[25] Benchmarks taken from Tables 1 and 2 of Schedule A of the regulations.	New Brunswick's OBPS does not price industrial process or on-site cogeneration emissions via benchmarking against 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[26] 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. Large enough fixed allocations are provided to

[23] BC OIC 70/2024 (February 16, 2024). Available from: https://www.bclaws.gov.bc.ca/civix/document/id/oic/oic_cur/0070_2024

[24] Government of Canada (2019). SOR/2019-266 Regulatory Analysis Impact Statement. Available from: https://gazette.gc.ca/rp-pr/p2/2019/2019-07-10/html/sor-dors266-eng.html

[25] Government of New Brunswick. *NB Reg 2021-43.* Available from: https://canlii.ca/t/b9fg

[26] Government of Newfoundland and Labrador. *Management of Greenhouse Gas Regulations under the Management of Greenhouse Gas Act.* Available from: https://www.assembly.nl.ca/Legislation/sr/regulations/rc180116.htm

		the electricity sector that the assumption for revenue recycling in 2030 is that revenue is recycled to the electricity sector.
Northwest territories	NWT *Petroleum Products and Carbon Tax Act*[27] Benchmarks based on s. 6.2 (4) of the regulations[28].	
Nova Scotia	Nova Scotia Output-Based Pricing System Benchmarks taken from Schedule 1-3 of the *Output-Based Pricing System Reporting and Compliance regulations*[29].	Nova Scotia's OBPS does not price industrial process or on-site cogeneration emissions via benchmarking against present-year emissions. These emissions are treated as excluded from the policy in the model.
Nunavut	Federal Output-Based Pricing System Benchmark based on provincial emissions intensity data provided by ECCC.	
Ontario	Ontario Greenhouse Gas Emissions Performance Standards[30]	

[27] Government of the Northwest Territories. *PETROLEUM PRODUCTS AND CARBON TAX ACT, RSNWT 1988,c.P-5.* Available from: https://www.justice.gov.nt.ca/en/files/legislation/petroleum-products-carbon-tax/petroleum-products-carbon-tax.a.pdf

[28] Government of the Northwest Territories. *PETROLEUM PRODUCTS AND CARBON TAX REGULATIONS, RRNWT 1990,c.P-3.* Available at: https://www.justice.gov.nt.ca/en/files/legislation/petroleum-products-carbon-tax/petroleum-products-carbon-tax.r1.pdf

[29] Government of Nova Scotia. *Output-Based Pricing System Reporting and Compliance Regulations (January 30, 2024). Available from: https://novascotia.ca/just/regulations/regs/2024-024.pdf*

[30] O. Reg. 241/19: Greenhouse Gas Emissions Performance Standards. Available from: https://www.ontario.ca/laws/regulation/190241

	Benchmarks based on GHG Emissions Performance Standards and Methodology for the Determination of the Total Annual Emissions Limit[31], and compliance data provided by Ontario for sectors that are covered by Method A.	
Prince Edward Island	Federal Output-Based Pricing System 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*[32].	Quebec's cap and trade program is linked with California. This is modeled as a joint market with one simulated market clearing price between the two regions. California's regulations allow the state to hold "price ceiling sales" if the credit price reaches are certain level. 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 Table 1, Table 2 of Saskatchewan *Management and reduction of greenhouse*	Compliance credits by carbon capture and storage were not tradeable in Saskatchewan's legislated policy until 2024. CCUS credits are available to be

[31] Government of Ontario (2022), GHG Emissions Performance Standards and Methodology for the Determination of the Total Annual Emissions Limit. Available for download from: https://www.ontario.ca/page/emissions-performance-standards-program

[32] *Government of Québec. Regulation respecting a cap-and-trade system for greenhouse gas emission allowances, Q-2, r. 46.1. Available from: https://www.legisQuébec.gouv.qc.ca/en/document/cr/Q-2,%20r.%2046.1?&target=*

	gasses (standards and compliance), 2023[33].	traded in the modeling, except in the 2020 model period.
Yukon	Federal Output-Based Pricing System Benchmark emissions intensity assumed to align with Nunavut.	Yukon does not have any 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.

[33] Government of Saskatchewan M-2.01 Reg 4. Available from: https://publications.saskatchewan.ca/#/products/120897

5. Discussion of uncertainty and limitations

Forward-looking modeling 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 modeling 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 in Section 3 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 including undefined backstop emissions abatement technologies. Further, 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).

Further, regulatory policies and provincial policies were modeled 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' LETS 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 firms' compliance can be achieved with purchased credits from another facility below its benchmark. Other LETS 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 modeled 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 over-estimate 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 modeled 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 LETS 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 LETS policies. Explicitly modeling 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 GHG 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 GHG 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 LETS 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 a LETS 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 LETS 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-modeling 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.

Appendix A: Federal policies

This appendix contains the list of federal policies that were included in the modeled scenarios. The Legislated policies scenario includes only legislated policies, while the Announced policies scenario includes ERP policies that Navius has characterized as both "developing" (where draft regulations or similarly detailed proposals are available) and "announced" (where additional assumptions about coverage and stringency were required to model the policy).

Legislated Policies

Legislated federal policies included in the model, other than carbon pricing, are described below.

Policy	Description
Multi-sectoral	
Investment tax credit for Carbon Capture, Utilization, and Storage[34]	This policy is an investment tax credit for 50% of upfront costs for carbon capture, utilization, and storage, 60% for Direct Air Capture, and 37.5% for related transportation infrastructure capital investments. The government expects this policy to cost about $2.6 billion dollars between 2022 and 2026, and $1.5 billion annually from 2027 to 2030. The tax credit rates will be reduced by 50% starting in 2031 and phased out after 2040.
Tax Credit for Clean Hydrogen Investment[35]	Budget 2023 introduces details on the Clean Hydrogen Investment Tax Credit (ITC), which subsidizes eligible project costs by between 15% and 40%, depending on the life cycle carbon intensity (CI) of the hydrogen produced. The ITC will cover between 15% and 40% of eligible project costs, with the projects that produce the cleanest hydrogen receiving the highest levels of support (assuming labor requirements are met):

[34] Government of Canada. (2022). Budget 2022. Tax Measures: Supplementary information. Available from: Archived - Tax Measures: Supplementary Information | Budget 2022 (canada.ca).

[35] Government of Canada. (2023). Budget 2023. Available from: https://www.budget.canada.ca/2023/pdf/budget-2023-en.pdf

Policy	Description
	■ 40% for hydrogen with a CI smaller 0.75 kg/kg H2 ■ 25% for hydrogen with a CI between 2kg and 0.75kg ■ 15% for hydrogen with a CI between 4kg and 2kg ■ 0% for hydrogen with a CI greater 4kg The tax credit is phased out starting in 2034, whereby property that becomes available for use in 2034 can receive half the credit rate and property that becomes available after 2034 can no longer receive the tax credit.
Tax Credit for Clean Technology Investment[36]	The 2022 Fall Economic Statement and Budget 2023 provide details on the Clean Technology Investment Tax Credit. The Tax Credit refunds 30% of capital investments by taxable entities (e.g., excluding Crown Corporations) in low-carbon electricity (including nuclear), electricity storage systems, low-carbon heat and electricity equipment, and industrial off-road zero emission vehicles. It is available for technologies purchased between 2023 and 2034.
Tax Credit for Clean Electricity Investment[37]	In addition to the 30% investment tax credit (ITC) for taxable entities, Budget 2023 introduces a 15% ITC for eligible investments made by non-taxable entities (e.g., Crown Corporations). The ITC is available for investments in non-emitting electricity systems, including nuclear and abated natural gas, storage, and interprovincial transmission equipment. The tax credit is available for projects constructed between 2023 and 2034.
Canada Infrastructure Bank Spending[38]	The Healthy Environment and Healthy Economy federal climate plan states that the Canada Infrastructure Bank (CIB) has a long-term investment target of $5 billion for clean power projects. It further outlines that the CIB has committed $1.5 billion for zero emission buses, $2.5 billion for low-carbon power projects, including storage, transmission, and renewables, over 3 years, and $2 billion for commercial building retrofit upfront costs. The ERP mentions that

[36] Government of Canada. (2023). Budget 2023. Available from: https://www.budget.canada.ca/2023/pdf/budget-2023-en.pdf

[37] Government of Canada. (2023). Budget 2023. Available from: https://www.budget.canada.ca/2023/pdf/budget-2023-en.pdf

[38] Government of Canada. (2020). A Healthy Environment and a Healthy Economy. Available from: https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/climate-plan/healthy_environment_healthy_economy_plan.pdf & Environment and Climate Change Canada. (2022). 2030 Emissions Reduction Plan. Available from: https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/erp/Canada-2030-Emissions-Reduction-Plan-eng.pdf

Policy	Description
	CIB will receive a total of $35 billion with priorities to invest in green infrastructure ($5 billion), public transit ($5 billion) and clean power ($5 billion). Budget 2023 announced that the CIB will invest at least $10 billion through its Clean Power priority area, and at least $10 billion through its Green Infrastructure priority area.
Low carbon fuel fund[39]	The Healthy Environment and Healthy Economy Plan and Budget 2021 announced that $1.5 billion will be provided over five years to support the production and use of low carbon fuels.
Buildings	
Energy efficiency regulations[40]	Federal standards exist for space conditioning equipment, water heaters, household appliances, and lighting products. Major standards include a minimum annual fuel utilization efficiency of 95% for natural gas furnaces, a minimum energy factor of 0.61 for gas water heaters and ban of incandescent light bulbs.
Greener Homes Grant[41]	$2.6 billion for residential energy efficiency improvements over seven years. 700,000 grants of up to $5,000 to help homeowners make energy efficient retrofits to their homes.
Greener Homes Loan Program[42]	Budget 2021 also allocated $4.4 billion on a cash basis ($778.7 million on an accrual basis over five years, starting in 2021-22, with $414.1 million in future years), to the Canada Mortgage and Housing Corporation to provide interest-free loans up to $40,000 to low-income homeowners for home retrofits. Budget 2022 allocates an additional investment of $458.5 million into the low-income loan program.

[39] Government of Canada. (2021). Budget 2021. Available from: https://www.budget.gc.ca/2021/home-accueil-en.html

[40] Natural Resources Canada. (n.d.). Canada's Energy Efficiency Act and Energy Efficiency Regulations. Available from: www.nrcan.gc.ca/energy/regulations-codes-standards/6861

[41] Government of Canada. (2020). Fall Economic Statement. Supporting Canadians and Fighting Covid-19. Available from: https://www.budget.gc.ca/fes-eea/2020/report-rapport/toc-tdm-en.html

[42] Government of Canada. (2021). Budget 2021. Available from: https://www.budget.gc.ca/2021/home-accueil-en.html & Government of Canada. (2022). Budget 2022. Available from: https://budget.gc.ca/2022/report-rapport/chap1-en.html#2022-1

Policy	Description
Increase energy efficiency in community buildings[43]	The A Healthy Environment and a Healthy Economy plan proposed to invest $1.5 billion over three years for repairs and efficiency upgrades in community buildings and for building new energy efficient community buildings.
Transportation	
Clean Fuel Regulation[44]	The Clean Fuel Regulation is a performance-based fuel supply standard with annual reduction requirements. The regulations requires liquid fossil fuel suppliers to reduce the lifecycle greenhouse gas intensity (CI) of their fuels, starting with 3.5 gCO2e/MJ in 2023 and increasing annually until reaching 14 g CO2e/MJ in 2030.
Regulations Amending the Heavy-duty Vehicle and Engine Greenhouse Gas Emission Regulations[45]	The national government has proposed amending the Heavy-Duty Vehicle Emissions Standard to increase the vehicle emission stringency for vehicles manufactured in model years 2018 to 2027.
Regulations Amending the Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations[46]	New passenger vehicles and light-commercial vehicles/light trucks sold in Canada must meet fleet-wide GHG emission standards between 2012 and 2016, and between 2017 and 2025. Fleet targets for passenger cars are aligned with US regulation.
Renewable Fuels Regulation[47]	Specifies a minimum renewable content of 5% for gasoline and 2% for diesel, by volume. This will become part of the Clean Fuel Regulation (CFR) once the CFR comes into force in 2023.

[43]Government of Canada. (2020). A Healthy Environment and a Healthy Economy. Available from: https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/climate-plan/healthy_environment_healthy_economy_plan.pdf

[44] Government of Canada. (2022). Clean Fuel Regulations: SOR/2022-140. Canada Gazette, Part II, Volume 156, Number 14. Available from: https://www.gazette.gc.ca/rp-pr/p2/2022/2022-07-06/html/sor-dors140-eng.html

[45] Government of Canada. (2018). Regulations Amending the Heavy-duty Vehicle and Engine Greenhouse Gas Emission Regulations and Other Regulations Made Under the Canadian Environmental Protection Act, 1999: SOR/2018-98. http://gazette.gc.ca/rp-pr/p2/2018/2018-05-30/html/sor-dors98-eng.html

[46] Government of Canada. (2018). Regulations Amending the Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations. http://www.gazette.gc.ca/rp-pr/p2/2014/2014-10-08/html/sor-dors207-eng.html

[47] Government of Canada. (2013). Renewable Fuels Regulations: SOR/2010-189. Available from: https://laws-lois.justice.gc.ca/eng/regulations/SOR-2010-189/index.html

Policy	Description
Light-Duty ZEV Subsidy[48]	Light-duty vehicle subsidies are available at $2,500 for short-range plug-in hybrids and $5,000 for long-range plug-in hybrids, hydrogen vehicles, and battery electric vehicles. The government committed an additional $1.7 billion over five years, starting in 2022-23, with $0.8 million in remaining amortization, to Transport Canada to extend the Incentives for Zero-Emission Vehicles (iZEV) program until March 2025.
Light-duty Vehicle Emissions Standard[49]	The ZEV mandate will require at least 20% of all new light-duty vehicle sales to be ZEVs by 2026, 60% by 2030, and 100% by 2035. This sales target does not include exported vehicles. At the end of each compliance period, regulated suppliers must present sufficient credits to comply with the reduction requirement. Credits are produced through the sale of ZEVs whereby the number of credits per vehicle depend on the all-electric range: ■ A battery electric vehicle, fuel cell vehicle, or plug-in hybrid electric vehicle (PHEV) with an all-electric range of 80 kms or more receives one credit. ■ In 2026, PHEVs with an all-electric range of 16-49km receive 0.15 credits and none thereafter. ■ Until 2028, PHEVs with an all-electric range of 50-79km receive 0.75 credits and none thereafter. The contribution of PHEV credits towards the sales target is limited to 45% for model year 2026, 30% for model year 2027 and 20% for model years 2028 and beyond.
Heavy-Duty Zev Subsidy[50]	Funding of $547.5 million over four years, starting in 2022/23, will be available to Transport Canada to launch a new purchase inventive program for medium- and heavy-duty zero-emission vehicles which provides rebates of up to $200,000.

[48] Government of Canada. (2022). Eligible vehicles. Available from: https://tc.canada.ca/en/road-transportation/innovative-technologies/zero-emission-vehicles/light-duty-zero-emission-vehicles/eligible-vehicles.

[49] Government of Canada. (2022). Canada Gazette, Part I, Volume 156, Number 53: Regulations Amending the Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations. Available from: https://www.gazette.gc.ca/rp-pr/p1/2022/2022-12-31/html/reg1-eng.html

[50] Government of Canada. (2022). Medium and heavy-duty zero-emission vehicles. Available from: https://tc.canada.ca/en/road-transportation/innovative-technologies/zero-emission-vehicles/medium-heavy-duty-zero-emission-vehicles .

Policy	Description
ZEV Charging Infrastructure Subsidy[51]	Federal funding of $400 million over five years, starting in 2022/23, is committed to funding the deployment of zero-emission vehicle (ZEV) charging infrastructure in sub-urban and remote communities through the Zero-Emissions Vehicle Infrastructure Program (ZEVIP).
Large Truck Retrofits[52]	The ERP includes a $199.6 million subsidy for retrofitting large trucks currently on the road.
Electricity Generation	
Regulations Amending the Reduction of Carbon Dioxide Emissions from Coal-fired Generation of Electricity Regulations[53]	This policy requires coal-fired power plants to be closed by 2030 unless they emit less than 420 tonnes CO_2e/GWh.
Regulations Limiting Carbon Dioxide Emissions from Natural Gas-fired Generation of Electricity[54]	This policy limits the emissions intensity of natural-gas fired electricity generation to 420 tonnes CO_2e/GWh.
Industry	
Regulations Respecting Reduction in the Release of	Oil and gas facilities must adopt methane control technologies and practices.

[51] Government of Canada. (2022). Budget 2022. Available from: https://budget.gc.ca/2022/report-rapport/chap1-en.html#2022-1

[52] Environment and Climate Change Canada. (2022). 2030 EMISSIONS REDUCTION PLAN Canada's Next Steps for Clean Air and a Strong Economy. Available from: En4-460-2022-eng.pdf (publications.gc.ca)

[53] Government of Canada. (2018). Regulations Amending the Reduction of Carbon Dioxide Emissions from Coal-fired Generation of Electricity Regulations: SOR/2018-263. Available from: https://laws-lois.justice.gc.ca/eng/regulations/SOR-2012-167/page-2.html#h-4

[54] Government of Canada. (2018). Regulations Limiting Carbon Dioxide Emissions from Natural Gas-fired Generation of Electricity: SOR/2018-261. Available from: https://laws-lois.justice.gc.ca/eng/regulations/SOR-2018-261/index.html

Policy	Description
Methane and Certain Volatile Organic Compounds[55]	
Net Zero Accelerator[56]	A Healthy Environment and a Healthy Economy announced an investment of $3 billion over 5 years for the Net Zero Accelerator, which provides funding for development and adoption of low-carbon technologies in all industrial sectors. Budget 2021 provided an additional $5 billion over seven years for the Net Zero Accelerator.

Developing Federal Policies

This section lists key policies that are considered "developing" and are included in the Announced policies scenario.

Policy	Description
Clean Electricity Regulations[57]	The Clean Electricity Regulations (CER), as proposed in Gazette Part I, are a prescriptive regulation limiting the emissions intensity of fossil fuel electricity generators to an annual average of 30 tCO2e/GWh. CCS projects can emit at 40 tCO2e/GWh under certain circumstances. This will apply to generators with a capacity factor of more than 5%. It is not a tradeable performance standard; all regulated units must meet the standard. The emissions standard would apply to most units starting on January 1st, 2035. The following cases would have more time to comply: Units commissioned prior to 2025, except for coal-fired units, would have until 20 years after their commissioning (compliance starting in 2044 for a unit commissioned in 2024), or between 2035 and 2040 for units that were coal-to-gas conversions, based on the emissions intensity of these units. The proposed regulations would apply to an electricity generation unit that meets all three of the following criteria:

[55] Government of Canada. (2020). Regulations Respecting Reduction in the Release of Methane and Certain Volatile Organic Compounds (Upstream Oil and Gas Sector): SOR/2018-66. Available from: https://laws-lois.justice.gc.ca/eng/regulations/SOR-2018-66/index.htm

[56] Government of Canada. (2021). Budget 2021. Available from: https://www.budget.gc.ca/2021/home-accueil-en.html.

[57] Government of Canada. (2023). Canada Gazette, Part I, Volume 157, Number 33: Clean Electricity Regulations. Available from: https://www.gazette.gc.ca/rp-pr/p1/2023/2023-08-19/html/reg1-eng.html

Policy	Description
	■ Uses any amount of fossil fuels to generate electricity, ■ Has a capacity of 25 MW or greater, ■ operates more than 450 hours per year (otherwise a 150kt CO2e/year emission ceiling applies instead), and ■ Is connected to the NERC-regulated electricity system (i.e., the main North American grid, which doesn't include the territories, remote communities, or off-grid industry).
75% reduction in oil and gas methane emissions[58]	The federal government announced its commitment to implement regulations that will reduce methane emissions from the oil and gas sector by at least 75% below 2012 levels by 2030. This builds on the federal government's current methane regulations, which seek to achieve a 40% to 45% reduction in methane emissions in the upstream oil and gas sector below 2012 levels by 2025.

Announced Policies

This section lists key policies that are considered "announced" and are included in the Announced policies scenario. As there is a high level of uncertainty regarding the policy design of announced policies, our characterization of these policies is illustrative. Our analysis shows the level of GHG reductions that could be achieved if these policies were implemented with the policy design as described in the assumptions section in the list below.

Policy
GHG emissions cap on the oil and gas sector[59,60]

[58] Environment and Climate Change Canada. (2022). 2030 EMISSIONS REDUCTION PLAN Canada's Next Steps for Clean Air and a Strong Economy. Available from: En4-460-2022-eng.pdf (publications.gc.ca)

[59] Government of Canada. (2022). Options to cap and cut oil and gas sector greenhouse gas emissions to achieve 2030 goals and net-zero by 2050 – discussion document. Available from: Options to cap and cut oil and gas sector greenhouse gas emissions to achieve 2030 goals and net-zero by 2050 – discussion document - Canada.ca

[60] CTV News. (2023). Canada plans to finalize emissions cap by mid-2024, minister says. Available from: Canada emissions cap: Finalized plan by mid-2024, Guilbeault says | CTV News

Policy	
Description	The federal government has announced its intention to cap greenhouse gas (GHG) emissions from the oil and gas sector. On December 6th, 2023, Environment and Climate Change Canada published a regulatory framework to cap oil and gas sector GHG emissions. The framework proposes a national emissions cap-and-trade system with an upper bound on GHGs from the oil and gas sector which will be phased in between 2026 and 2030. The framework distinguishes between the “emissions cap level” and the “legal upper bound”. The emissions cap level is proposed to be set between 106 and 112 Mt CO2e. The legal upper limit is proposed to be set between 131 and 137 Mt CO2e. The oil and gas sector will be issued emissions allowances at the emissions cap level. However, the oil and gas sector is allowed to emit more than the cap, up to the upper bound, through the use of other eligible “flexible” compliance units. Flexible compliance units can be either 1) purchased by paying into a decarbonization fund (the unit price is to be set at the estimated price necessary to achieve the upper bound) or 2) offset credits under Canada’s GHG Offset Credit System or a recognized provincial offset credit system. Emission allowances would be tradeable between covered facilities and bankable for up to six years (two three-year compliance periods). Emission allowances are proposed to be allocated as free allowances (free of charge) to the covered facilities in the first compliance period.
Assumptions	The announced oil and gas emissions cap is simulated as a tradable performance standard which requires the oil and gas sector to reduce its emissions intensity and allows for compliance credit trading between oil and gas sectors. Carbon intensity benchmarks are calculated to be consistent with the emissions cap. The emissions cap covers emissions from upstream oil and gas activities and LNG production and is set at 128 Mt CO2e, starting in 2030. The currently proposed framework includes a 110 MtCO2e emissions cap plus 25 Mt CO2e in other 'flexibility' compliance credits (i.e., offset credits or payment into a decarbonization fund). This leads to an upper bound of ~135 Mt CO2e as this is the true limit for oil and gas emissions under the currently proposed cap. The 25 Mt in flexibility compliance credits could lead to up to 25 Mt in reductions elsewhere and are not explicitly simulated in this analysis. To account for this, this analysis assumes free allowances are provided for all emissions covered under the cap, including the 25 Mt in credits that can be purchased through payments into a decarbonization fund or offsets. The cap is set at 128 Mt rather than the upper bound of ~135 Mt, as we estimate indirect emissions from grid electricity consumption to be around 7 Mt in 2030. Our analysis does not implicitly include these indirect emissions and therefore assumes a lower emissions cap to reflect the narrower emissions coverage.

Policy	
	Methane emissions are "covered" by the cap, meaning that these emissions count towards the 128 Mt cap, but methane reductions cannot generate compliance credits under the cap. In this analysis, we assume that the oil and gas cap is allowed to overlap with federal and provincial large-emitter trading systems (LETS). This means that there are no restrictions to generating compliance credits under the LETS and the oil and gas emissions cap for the same reduction action, such as implementation of carbon capture and storage. As a result, an influx of non-incremental LETS credits due to the oil and gas emissions cap could lead to the carbon price under the LETS being non-binding.
Medium- and Heavy-duty Vehicle Emissions Standard[61,62]	
Description	The ERP announced plans to develop a medium- and heavy-duty ZEV sales mandate with the goal of achieving 35% ZEV sales by 2030 and 100% by 2040 in selected medium- and heavy-duty categories, based on feasibility. Furthermore, interim targets for pre-2030 years are being explored. The Government has stated that it is examining proposed rules from the U.S. Environmental Protection Agency on emissions from heavy-duty vehicles. The US EPA is planning to announce their heavy-duty vehicle emissions standard in July 2024.
Assumptions	The simulated medium- and heavy-duty vehicle emissions standard is based on California's Advanced Clean Trucks Regulation. California's medium- and heavy-duty emissions standards require that 30% of heavy- and 50% of medium-duty new vehicle sales be ZEVs in 2030, and 40% and 75% in 2035, respectively. Each year, vehicle manufacturers need to retire a certain number of credits in compliance with these targets. Credits are generated through the sale of low-carbon emission vehicles and can be traded. For full battery electric and fuel cell electric vehicles, the number of credits generated depends on the vehicles' weight class. For plug-in electric vehicles, credit generation also depends on electric range.
National Net-zero Emissions Building Strategy[63]	

[61] Government of Canada. (2021). Discussion paper on heavy-duty vehicles and engines in Canada: transitioning to a zero-emission future. Available from: Discussion paper on Heavy-duty vehicles and engines in Canada: transitioning to a zero-emission future - Canada.ca

[62] Government of Canada. (2022). Fifth annual meeting of the Bilateral Dialogue on Motor Vehicle Regulations. Available from: https://www.international.gc.ca/trade-commerce/trade-agreements-accords-commerciaux/agr-acc/ceta-aecg/2022-11-23-summary-sommaire.aspx?lang=eng

[63] Environment and Climate Change Canada. (2022). 2030 Emissions Reduction Plan. Available from: En4-460-2022-eng.pdf (publications.gc.ca)

Policy	
Description	The ERP mentions that $150 million will be invested to develop the Canada Green Buildings Strategy, a national net zero by 2050 buildings strategy. As part of the strategy, regulatory standards to phase out fossil-fuel heating in buildings will be developed. The Green Buildings Strategy aims to reduce building emissions by 37% from 2005 levels by 2030 and to achieve net-zero by 2050.
Assumptions	The announced national net-zero emissions building strategy is simulated as a federal regulation which bans the installation of new and replacement oil and gas heating systems[64] in residential and commercial buildings by 2026.
Waste methane capture[65,66,67]	
Description	The ERP states the federal government's intention to create landfill methane regulations with the goal of reducing waste emissions through waste methane capture and treatment. Canada's 2022 Methane Strategy mentions that the government intends to "[develop] new regulations to increase recovery and destruction of methane from large municipal solid waste landfills by about 50% by 2030 from 2019 levels". It also mentions that the regulation will aim for "[reduction] of about 50% per year by 2030, from the 2019 level". The government plans to have draft regulations by 2024 and final regulations coming in force in 2025.

[64] This analysis does not account for the cost of electric panel upgrades which may be necessary when replacing a furnace with an electric heating system in an existing building. This does not impact findings on GHG policy impacts but may underestimate the cost of switching to an electric heating system in existing buildings.

[65] Environment and Climate Change Canada. (2022). FASTER AND FURTHER: Canada's Methane Strategy. Available from: https://publications.gc.ca/collections/collection_2022/eccc/En4-491-2022-eng.pdf

[66] Government of Canada. (2022). Reducing methane emissions from Canada's municipal solid waste landfills: discussion paper. Available from: Reducing methane emissions from Canada's municipal solid waste landfills: discussion paper - Canada.ca

[67] Environment and Climate Change Canada (2022). 2030 Emissions Reduction Plan. Available from: https://publications.gc.ca/collections/collection_2022/eccc/En4-460-2022-eng.pdf

Policy	
Assumptions	This policy is simulated as a waste methane capture regulation which requires that in each province a minimum of 50% of total landfill methane emissions be destructed through either flaring or methane capture and utilization by 2030.

Appendix B: Provincial Policies

Legislated provincial climate and energy policies (other than provincial carbon pricing systems) included in this analysis are described below. This list focuses on policies that achieve additional action within that province; provincial regulations that achieve equivalency with federal requirements (e.g., methane regulations) are not included in this list. The same suite of provincial policies was used in both the Legislated and Announced policies scenarios.

Province	Policy	Description
Alberta	Renewable Electricity Act[68]	Legislation establishing a target that 30% of electricity produced in Alberta come from renewable sources by 2030. Interim targets of 15% by 2022, 20% by 2025, and 26% by 2028 have been established.
Alberta	Carbon capture and storage investments[69]	Alberta has contributed funding to several CCS projects, including the Shell Canada Energy Quest Project and the Alberta Carbon Trunk Line.
Alberta	Renewable Fuels Standard[70]	Alberta requires a minimum annual average of 5% and 2% renewable content in gasoline and diesel respectively.
British Columbia	Clean Energy Act[71]	A minimum of 93% of provincial electricity generation must be provided by clean or renewable sources. The Clean BC Roadmap to 2030[72]. announced plans to increase electricity from renewable sources to 100% of supply by

[68] Alberta. (2020). Renewable Electricity Act. Statutes of Alberta, 2016 Chapter R-16.5. Available from: https://www.qp.alberta.ca/1266.cfm?page=r16p5.cfm&leg_type=Acts&isbncln=9780779814060.

[69] Natural Resources Canada. (2018). Shell Canada Energy Quest Project. Available from: www.nrcan.gc.ca/energy/funding/cef/18168. & Natural Resources Canada. (2016). Alberta Carbon Trunk Line (ACTL). Available from: www.nrcan.gc.ca/energy/publications/16233.

[70] Alberta Regulation 29/2010. (2020). *Renewable Fuels Standard Regulation.* Available from: https://www.alberta.ca/renewable-fuels-standard-resources

[71] Government of British Columbia. (2010). Clean Energy Act. Available from: http://www.bclaws.ca/civix/document/id/lc/statreg/10022_01

[72] British Columbia. (2021). cleanBC. Roadmap to 2030. Available from: https://www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/cleanbc_roadmap_2030.pdf

Province	Policy	Description
		2030 through phase out of remaining gas-fired facilities by 2030.
British Columbia	Low Carbon Fuel Requirement Regulation (part of the Low Carbon Fuel Standard)[73]	British Columbia introduced this policy in 2008. This regulation requires a decrease in average carbon intensity of transportation fuels by 10% by 2020 and by 30% by 2030 relative to 2010. Fuel suppliers can meet the second requirement by acquiring credits generated from fueling electric vehicles. The Clean BC Roadmap to 2030[68]. announced plans to expand coverage to marine and aviation fuels.
British Columbia	Zero Emission Vehicle Standard[74]	Requires a minimum share of light-duty vehicles sold in BC to be zero-emission. This mandate achieves 10% electric vehicles sales by 2025, 30% by 2030 and 100% by 2040. The Clean BC Roadmap to 2030[68]. announced plans to accelerate the light-duty ZEV sales targets under the ZEV mandate to 26% by 2026, 90% by 2030 and 100% by 2035.
British Columbia	Light-Duty ZEV subsidies[75]	Provides incentives at $1,500 for short-range plug-in hybrids and $3,000 for long-range plug-in hybrids, battery electric vehicles, and hydrogen vehicles. It is unclear how long the incentives will be available for; the province has extended the policy multiple times since funding ran out since its introduction.
British Columbia	Technology and Retrofit Incentive Programs[76]	Programs offering incentives for energy efficiency measures in residential, commercial, and industrial buildings. CleanBC Better Homes programs include rebates for households including the Indigenous Community Heat Pump Incentive (funding for heat pump installation in residential and community buildings in Indigenous communities), rebates for heat pumps, electric service upgrades, and new construction programs for the construction of

[73] Government of British Columbia. (2020). Greenhouse Gas Reduction (Renewable and Low Carbon Fuel Requirements) Act, SBC 2008, c. 16. Available from: https://www.bclaws.ca/civix/document/id/complete/statreg/08016_01

[74] Government of British Columbia. (2019). Zero-Emission Vehicle Act. SBC 2019, Chapter 29. Available from: https://www.bclaws.ca/civix/document/id/complete/statreg/19029

[75] Government of British Columbia. (2020). Go Electric Passenger Vehicle Rebates. Available from: https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/transportation-energies/clean-transportation-policies-programs/clean-energy-vehicle-program/passenger-vehicles

[76] cleanBC. Better Homes. Available from: https://betterhomesbc.ca/ & cleanBC. Better Buildings. Available from: https://betterbuildingsbc.ca/.

Province	Policy	Description
		high-performance electric homes. The Better Buildings program provides incentives for commercial buildings including: support for upgrades, heating equipment conversions, low interest financing and ISO 5001 incentive (co-managed with federal government), and implementation of energy management systems in industrial facilities.
British Columbia	PST Exemption[77]	Use of electricity in residential and industrial buildings is exempt from provincial sales tax.
British Columbia	Industrial Electrification[68]	Supply electricity to power natural gas extraction in the Peace region, and other large industrial operations.
British Columbia	Landfill Gas Management Regulation	Simulated as a requirement to reduce landfill methane emissions by 75%.
Manitoba	Biofuels Mandate Amendment[78]	Renewable fuel content requirement at 10% for gasoline and 5% for diesel by volume.
Manitoba	Coal phase-out[79]	Manitoba Hydro phased out its last coal-fired generating unit in 2018.
Manitoba	Keeyask Hydro-electricity Project[80]	A hydro project with a capacity of a 695-megawatt (MW).
New Brunswick	Renewable Portfolio Standard[81]	The renewable portfolio standard requires NB Power to ensure that 40% of in-province electricity sales are from renewable energy by 2020. Imports of renewable energy from other jurisdictions qualify for compliance, as do energy efficiency improvements.

[77] Government of British Columbia. (2017). Provincial Sales Tax (PST). Tax Rate. Available from: https://www2.gov.bc.ca/gov/content/taxes/sales-taxes/pst.

[78] Government of Manitoba. (2020). Biofuels Mandate and Renewable Fuels in Manitoba. Available from: https://reg.gov.mb.ca/detail/3340256

[79] Manitoba Hydro. (n.d.). Generation Stations. Available from: https://www.hydro.mb.ca/corporate/facilities/generating_stations/

[80] Manitoba Hydro. (n.d.). Keeyask Generating Station. Available from: https://www.hydro.mb.ca/projects/keeyask/

[81] Government of New Brunswick. (2015). New Brunswick Regulation 2015-60 under the Electricity Act (O.C. 2016-263). Available from: www.gnb.ca/0062/acts/BBR-2015/2015-60.pdf

Province	Policy	Description
New Brunswick	Electric vehicle rebates	NB Power provides rebates of $5,000 and $2,500 for battery electric vehicles and short-range plug-in hybrid vehicles, respectively.
Newfoundland and Labrador	Muskrat Falls Hydro Project[82]	A hydro project with a capacity of 824 MW.
Newfoundland and Labrador	Electric vehicle rebates	NL Hydro provides rebates of $2,500 and $1,500 for battery electric vehicles and plug-in hybrid vehicles, respectively.
Northwest Territories	Electric vehicle rebates	The Arctic Energy Alliance offers rebates of $5,000 for battery electric and plug-in hybrid electric vehicles.
Nova Scotia	Cap on GHG emissions from electricity generation[83]	This policy requires emissions from the electricity sector to decline to 4.5 Mt by 2030.
Nova Scotia	Renewable Portfolio Standard[84]	This renewable portfolio standard requires that 25% of electricity consumption be provided from renewable resources in 2015, increasing to 40% by 2020 and 80% in 2030.
Nova Scotia	Maritime Link[85]	This transmission line will connect Nova Scotia to hydroelectric generation from Newfoundland Labrador (and in particular, to the Muskrat Falls hydroelectric project).
Nova Scotia	Electric vehicle rebates	Nova Scotia provides rebates of $3,000 and $2,000 for battery electric vehicles and short-range plug-in hybrid vehicles, respectively.
Prince Edward Island	Electric vehicle rebates	PEI provides rebates of $5,000 and $2,500 for battery electric vehicles and short-range plug-in hybrid vehicles, respectively.

[82] Naclor Energy. (2019). Muskrat Falls Project: Project Overview. https://muskratfalls.nalcorenergy.com/project-overview/

[83] Government of Nova Scotia. (2013). Greenhouse Gas Emissions Regulations made under subsection 28(6) and Section 112 of the Environment Act. Available from: www.novascotia.ca/JUST/REGULATIONS/regs/envgreenhouse.htm

[84] Government of Nova Scotia. (2020). Renewable Electricity Regulations made under Section 5 of the Electricity Act. Available from: https://novascotia.ca/just/regulations/regs/elecrenew.htm

[85] Emera Newfoundland & Labrador. (2014). Maritime Link. Available from: http://www.emeranl.com/en/home/themaritimelink/overview.aspx

Province	Policy	Description
Ontario	Coal Phase-out[86]	Ontario phased out its last coal-fired generating unit in 2014. In 2019, approximately 94% of Ontario's electricity generation was emissions free. Commitments were made under the Cessation of Coal Regulation (2007) and Ending Coal for Cleaner Air Act (2015). In 2014, the Atikokan Generating Station was converted from coal to biomass.
Ontario	Nuclear Power-plant Refurbishment[87]	Refurbishment of 10 nuclear power plants which together will provide more than 9,800 MW emissions-free capacity. Long term project in place that has been ongoing since 2016.
Ontario	Cleaner Transportation Fuels: Renewable Content Requirements for Gasoline and Diesel Fuels (O. Reg 663/20)[88]	Regulation specifying a minimum renewable fuel content of 4% for diesel, by volume. Renewable diesel life cycle GHG emissions are required to be at least 70% lower than standard petroleum diesel. Specifies a minimum renewable fuel content for gasoline of a specified amount, which increases each calendar year: 11% in 2025, 13% in 2028, 15% in 2030. Gasoline must have an average of 50% less life cycle GHG emissions than standard petroleum gasoline (previously was 45%). This is a new regulation as of November 25 2020, that replaces the now revoked O. Reg. 535/05 (Greener Gasoline) and O. Reg. 97/14 (Greener Diesel).
Ontario	Steel project decarbonization investments[89]	Two major steel companies in Ontario, ArcelorMittal and Algoma, announced that they will upgrade their steel plants, which will result

[86] Government of Ontario. (2020). The End of Coal. Available from: https://www.ontario.ca/page/end-coal#:~:text=Ontario%20enshrined%20its%20commitment%20in,to%20generate%20electricity%20in%20Ontario & https://www.opg.com/powering-ontario/our-generation/biomass/

[87] Government of Ontario. (2018). Chapter 2. Ensuring a Flexible Energy System. Available from: https://www.ontario.ca/document/ontarios-long-term-energy-plan-2017-order-council-21202017/chapter-2-ensuring-flexible-energy-system#section-8

[88] Ontario. (2020). Increasing renewable content in fuels. Available from: https://ero.ontario.ca/notice/013-4598#:~:text=Regulatory%20impact%20statement,of%20greenhouse%20gas%20emission%20reductions.

[89] ArcelorMittal. (2021). ArcelorMittal and the Government of Canada announce investment of CAD$1.765 billion in decarbonisation technologies in Canada. Available from: https://corporate.arcelormittal.com/media/press-releases/arcelormittal-and-the-government-of-canada-announce-investment-of-cad-1-765-billion-in-decarbonization-technologies-in-canada & Algoma. (2021). Government of Canada Endorses Algoma Steel's Transformation Plan for Green Steel. Commitment of up to $420 Million. Available from: https://algoma.com/government-of-canada-endorses-algoma-steels-transformation-plan-for-green-steel-commitment-of-up-to-420-million/ & Government of Canada. (2022).

Province	Policy	Description
		in greenhouse gas reductions of about 3 Megatonnes in each plant.
Québec	Renewable Natural Gas Regulation[90]	This regulation requires a minimum renewable fuel content of 1% in distributed natural gas in Québec as of 2020, rising to 2% in 2023, and 5% in 2025. A recently developed amendment will increase the minimum renewable fuel content to 7% in 2028 and 10% in 2030.
Québec	Biofuels mandate[91]	In 2019, Québec released a draft regulation that would require a minimum blend of 10% renewable fuel in gasoline and 2% in diesel by volume starting in 2021 and rising to 15% for gasoline and 4% for diesel by 2025.
Québec	Zero Emission Vehicle Standard[92]	Automakers that sell over 4,500 vehicles in the province are required to meet a minimum zero-emission vehicle credit quota. The credit requirement is set to rise from 3.5% in 2018 to 22% of non-ZEV sales by 2025. A recently developed amendment will change the credit accounting system and ZEV sales targets for the years 2025 and thereafter. Under the revised system, the sale of one new light-duty zero emission vehicle equals one credit. The minimum sales targets for post 2025 have been set to increase from 12.5% in 2025 to 65% in 2030 and 100% in 2035.

Government investing in Hamilton's steel industry to support good jobs and significantly reduce emissions. Available from: https://www.canada.ca/en/innovation-science-economic-development/news/2021/07/government-investing-in-hamiltons-steel-industry-to-support-good-jobs-and-significantly-reduce-emissions.html

[90] Gouvernement du Québec. (2019). Québec encadre la quantité minimale de gaz naturel renouvelable et met en place un comité de suivi. Available from https://www.quebec.ca/nouvelles/actualites/details/quebec-encadre-la-quantite-minimale-de-gaz-naturel-renouvelable-et-met-en-place-un-comite-de-suivi#:~:text=Il%20pr%C3%A9cise%20%C3%A9galement%20la%20progression,5%20%25%20%C3%A0%20compter%20de%202025. & Gazette Officielle Du Québec, 22 juin 2022, 154e année, no 25. Règlement modifiant le Règlement sur le prélèvement du Comité paritaire de l'entretien d'édifices publics, région de Montréal. Available from: https://cdn-contenu.quebec.ca/cdn-contenu/environnement/territoire/Documents/AIR_PojetRG_Quantite_gaz_naturel_renouvelable_MERN.pdf?1655990587

[91] Gouvernement du Québec. (2019). Projet de règlement. Volume minimal de carburant renouvelable dans l'essence et le carburant diesel. Available from: https://cdn-contenu.quebec.ca/cdn-contenu/adm/min/energie-ressources-naturelles/publications-adm/lois-reglements/allegement/PR_Volume_minimal_carburant_renouvelable_MERN.pdf?1570737693.

[92] Québec. (2017). chapter A-33.02, r. 1. Available from: https://www.legisquebec.gouv.qc.ca/en/document/cr/A-33.02,%20r.%201/ & Gazette Officielle Du Québec, January 26, 2022, Vol. 154, No. 4. Available from: http://www2.publicationsduquebec.gouv.qc.ca/dynamicSearch/telecharge.php?type=1&file=105485.pdf

Province	Policy	Description
Québec	Electric Vehicle Incentives[93]	Provides incentives between $4,000 and $8,000 for the purchase of a zero-emission vehicle.
Québec	Québec New Oil Heating Ban[94]	The province is banning the installation of oil heating systems in new buildings starting 2021 and the installation in existing buildings will start in 2023.
Québec	Québec Chauffez Vert Program[95]	Québec is expecting to spend 179 million between 2022 and 2027 on the Chauffez vert program, which provides financial support for replacing oil or propane heating with a renewable heating system.
Saskatchewan	Boundary Dam Carbon Capture Project[96]	This project stores and captures CO2 emissions from a 115 MW coal plant.
Saskatchewan	Ethanol Fuel (General) Regulations[97]	Regulation requiring a minimum renewable fuel content of 7.5% for gasoline by volume.
Saskatchewan	The Renewable Diesel Act[98]	Requirement for a minimum renewable content in diesel of 2%.
Yukon	Electric vehicle rebates	The Yukon government offers rebates of $5,000 for battery electric vehicles and $3,000 for short-range plug-in hybrid electric vehicles.

[93] Gouvernement du Québec. (2019). Discover electric vehicles. Available from: http://vehiculeselectriques.gouv.qc.ca/english/

[94] Gouvernement du Québec. (2022). Plan De Mise En Œuvre 2022-202. Available from: https://cdn-contenu.quebec.ca/cdn-contenu/adm/min/environnement/publications-adm/plan-economie-verte/plan-mise-oeuvre-2022-2027.pdf?1652278896

[95] Québec. (2022). Plan pour une économie verte 2030. Plan de mise en œuvre 2022 2027. Available from: https://cdn-contenu.quebec.ca/cdn-contenu/adm/min/environnement/publications-adm/plan-economie-verte/plan-mise-oeuvre-2022-2027.pdf?1652278896 & Québec. (n.d.). Chauffez vert. Available from: https://transitionenergetique.gouv.qc.ca/en/residential/programs/chauffez-vert

[96] SaskPower. (2019). Boundary Dam Carbon Capture Project. Available from: https://www.saskpower.com/our-power-future/infrastructure-projects/carbon-capture-and-storage/boundary-dam-carbon-capture-project

[97] Government of Saskatchewan. (2020). Ethanol Fuel (General) Regulations (E-11.1 Reg 1). Available from: https://publications.saskatchewan.ca/#/products/1064.

[98] Government of Saskatchewan. (2011). *The Renewable Diesel Act (Chapter R-10.001).*

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