The Economic Impact and GHG Effects of the Federal Government's Emissions Reduction Plan through 2030

Ross McKitrick

FRASER INSTITUTE

2024

July 2024 • Fraser Institute

The Economic Impact and GHG Effects of the Federal Government's Emissions Reduction Plan through 2030

Ross McKitrick

FRASER INSTITUTE 50 YEARS

Contents

Executive Summary 1

1 Introduction 3

2 Interim Progress Report 5

3 Modelling the Elements of the ERP through 2030 12

4 Results 20

Conclusions 28

References 29

Appendix: Major Studies That Have Examined the Impact of GHG-Related Policies 32

About the Author 34

Publishing Information 35

About the Fraser Institute 36

Editorial Advisory Board 37

Executive Summary

- The federal government has set a GHG emissions reduction target of at least 40% below 2005 levels by 2030, equivalent to 38.5% below 2022 levels.
- This report examines proposed policies aimed at achieving these goals and evaluates their potential impact, aiming to address the gap left by the federal government's lack of efforts in this matter.
- The paper uses a peer-reviewed macroeconomic model to assess the federal government's Emissions Reduction Plan (ERP), including carbon pricing, Clean Fuel Regulations, and other regulatory measures such as EV mandates.
- It is estimated that the ERP will reduce Canada's GHG emissions by about 26.5% between 2019 and 2030, reaching approximately 57% of the government's 2030 target, leaving a substantial gap.
- The implementation of the ERP is expected to significantly dampen economic growth, with a projected 6.2% reduction in Canada's economy (i.e., real GDP) compared to the base case by 2030.
- Income per worker, adjusted for inflation, is forecasted to stagnate during the 2020s and decrease by 1.5% by 2030 compared to 2022 levels.
- The ERP costs $6,700 per worker annually by 2030, which is more than five times the cost per worker compared to the carbon tax alone.
- Overall, while the federal ERP will contribute to reducing GHG emissions, it falls short of meeting the 2026 or 2030 targets and imposes significant economic burdens on Canadian households. Additionally, due to the high marginal cost of many regulatory measures, the ERP plan is costlier than it needs to be for what it will accomplish.

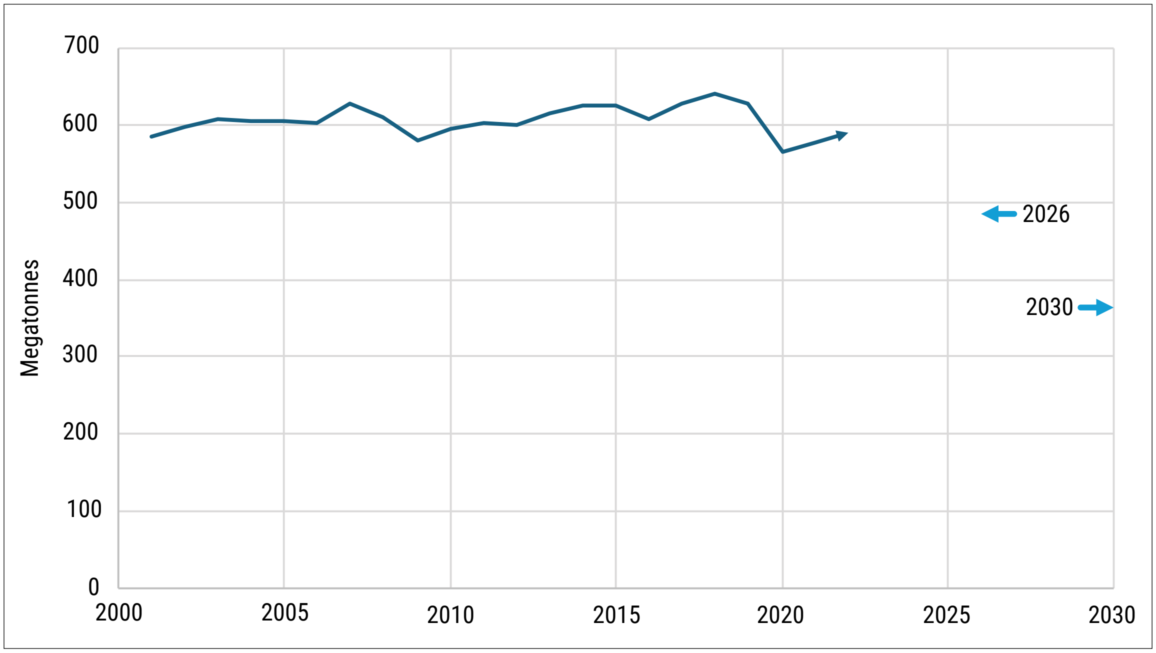
1 Introduction

In its 2022 Emissions Reduction Plan (ECCC, 2022, herein the "ERP") the Government of Canada has committed to the target of reducing greenhouse gas (GHG) emissions to at least 40% below 2005 levels by 2030 (38.5% below 2022 levels), with the interim target set at 20% below 2005 levels by 2026 (18% below 2022 levels).[1] In 2023, the government released a Progress Report (ECCC, 2023a, herein the "PR") updating its policy package and adding some details of its implementation. This report discusses the policy framework and presents an empirical assessment of the likely costs of reaching the 2030 target. In a separate report (McKitrick, 2024a) I provide a review of the main drivers of GHG emissions growth in Canada and the scale of changes needed to reach the 2026 and 2030 targets. In this report I present a critical review of the climate plan and an economic analysis of its likely effects on emissions and the economy through 2030. Costing out a massive policy proposal like the ERP is a difficult and complex undertaking, but is essential for Canadians to make an informed decision about which climate policies deserve support. This report aims to fill the gap left by the federal government's lack of efforts in this matter. I will focus on the key elements of the ERP, in particular the ones that lend themselves best to representation in an empirical economic model.

Figure 1.1 outlines the policy challenge. It shows total Canadian CO_2 emissions, which are the largest component of GHG emissions, from 2001 to 2022 in megatonnes. On the positive side, despite Canada's economy growing by 49% over this interval total CO_2 emissions did not grow and by 2022 were about the same as in 2001. A big drop (about 10%) coincided with the 2020 COVID-19 recession without which they might have ended up higher. It is clear that CO_2 emissions grew more slowly than the economy, or equivalently, that the emissions intensity of the economy declined over time. However, figure 1.1 also shows that the 2026 and 2030 targets lie well below their long-term trend and reaching them will require emissions to decline extremely quickly. This report will not examine the costs of reaching the 2026 target since it appears to be out of reach but will focus on the 2030 target.

1 The federal target is "40% to 45% below 2005 emissions" but for convenience in this report we will use the least stringent target (40%) throughout this report.

Figure 1.1: Canadian CO_2 Emissions 2001–2020 in Megatonnes—2026 and 2030 Emission Targets Indicated



Source: Energy Institute, 2024; author's calculations.

2 Interim Progress Report

Whereas mainstream economics has long argued that the most efficient climate policy is a carbon tax on its own, the PR boasts (ECCC, 2023a: iii) that the government has implemented over 140 climate policies, offering that number as evidence of the importance they place on the issue. However, the large number of different policies testifies more to an overall lack of focus than to a commitment to optimal policy making. Carbon pricing is part of the federal policy mix, but the profusion of accompanying regulations, subsidies, and mandates undermines any economic efficiency attained by the emission charge and ensures that the package as a whole will be relatively inefficient for what it accomplishes.

Most of the policies listed in the PR[2] are subsidy programs directed at a wide range of activities in the Canadian economy deemed conducive in some way to GHG reductions. The individual subsidy pools range in size from under $1 million up to $7 billion, the latter being the portion of the Canada Growth Fund (ECCC, 2023a: 88) earmarked to provide "contracts for difference" to guarantee the rate of return on abatement investments. The sheer number of such programs means the descriptions in the PR are cursory, and indeed in many cases further details may simply not have been worked out yet. For the purpose of this analysis I will focus only on the large, detailed components of the ERP, and I will not assess either the cost or effects of most of the subsidy programs.

2.1 Error in Cost Comparison Framework

Canadian Treasury Board guidelines require publication of a Cost-Benefit Analysis (CBA) when regulations are proposed with major cost implications (Treasury Board of Canada Secretariat, 2024). Neither the ERP nor the PR present a CBA. The motivation provided in the PR for the policy package is a series of anecdotes outlining the purported costs of climate change, chiefly associated with extreme weather events (e.g., "Imperative for climate action," ECCC, 2023a: 15–17), contrasted with the allegedly low costs of climate policies (pp. 17–19). The implication is that imposing the proposed policies will yield a net benefit, or as stated in the ERP (ECCC, 2022: 14) "the cost and impact of inaction on Canadians' lives and livelihoods is far too high."

However, even if we take all the numbers on these pages at face value, they amount to a comparison of the wrong things. The proper comparison is between the costs of Canadian

2 When discussing policies I will use "ERP" to denote the Emissions Reduction Plan in general, and "PR" to denote the Progress Report in particular, but the policies are the same between the two documents.

climate policies and the fraction of future climate change damages that will be avoided by implementing those policies, which is such a small number as to be practically zero.

Canada is only responsible for about 1.5% of global GHG emissions (Energy Institute, 2023). The federal policy aims only to reduce our emissions by 40% (or 0.6% of global emissions) as of 2030, some of which will be offset by increased emissions elsewhere. Realistically, Canada is proposing to reduce global GHG emissions by at most 0.5%.

Moreover, in standard climate models, temperature effects are not related to current CO_2 emissions but to current atmospheric concentrations which only adjust slowly in response to changes in emissions. Hence the fractional effect on the climate in the near-term is smaller than the emission reduction fraction. We can generate an approximate estimate of the impact of the proposed actions as follows: According to the National Inventory Report (ECCC, 2023b), Canada's 2005 GHG emissions were 732 megatonnes CO_2-equivalent ($MtCO_2e$) and 60% of this is 439 $MTCO_2e$, which implies the reduction target is 284 $MTCO_2e$ below the 2015 levels. According to Lomborg (2016) the US target under the Paris Treaty implies a reduction of about 1,260 $MTCO_2e$ relative to 2015 emissions. If the US achieved this by 2025 and capped its emissions thereafter, in a scenario with 4° C baseline global warming by 2100, global average temperatures as of 2100 would be reduced by 0.031° C compared to if the US did nothing. Prorating this by the size of Canada's proposed emission reduction we find the global average temperature would be reduced by 0.007° C (seven thousandths of a degree Celsius) as of 2100 compared to the case if Canada does nothing. And this assumes that Canada's emission cuts are not offset by increases elsewhere. This is about 0.2% of the projected warming.

Thus, the policies proposed in the ERP could only prevent, at most, a tiny fraction of future climate change, and therefore the benefits attributable even in theory to Canadian climate policies are not equal to the entire value of "climate damages," but only to less than 0.5% of them.

2.2 Misleading Climate Damages Claims

Furthermore, the claimed costs of climate change are presented in a misleading and overstated way. Adverse weather events and nominal damage values are reported without any contextual information regarding what might have happened in the absence of GHG emissions.

For instance, the PR (ECCC, 2023a: 19) states that combatting wildfires costs about $1 billion annually, implying this is entirely attributable to climate change. Yet forest fires have always been a feature of our landscape and are a natural and essential part of the forest ecosystem. Likewise, we have long incurred the costs of fighting them in order to protect communities and logging operations. Furthermore, wildfires appear to be less common now than in the past. Data from the Canadian Wildland Fire Information System shows that the number of wildfires grew from the 1960s to the end of the 1980s, then began to decline (figure 2.1). The annual area burned also peaked around 1990 then leveled off, though it remains quite variable. The official data record (accessed March 4, 2024) shown in figure 2.1 only goes up to 2021. The 2023 fire season was exceptionally active and will show record highs when it is tabulated, but as an illustration of how variable this record is, note that 2020 was the lowest year for area burned since 1965.

The report also refers to the June 2021 Pacific Northwest heat wave, which stretched from Oregon to BC and inland as far as Alberta. It is blamed for 619 deaths in BC, insinuating that this too was the result of climate change. But numerous scientific studies challenged such simplistic attribution statements, arguing that while climate change might have added a degree or two to the average temperatures during the heat wave, the event itself was caused by a rare combination of meteorological conditions that had nothing to do with global warming. The Oregon State Climate Assessment of 2023 stated:

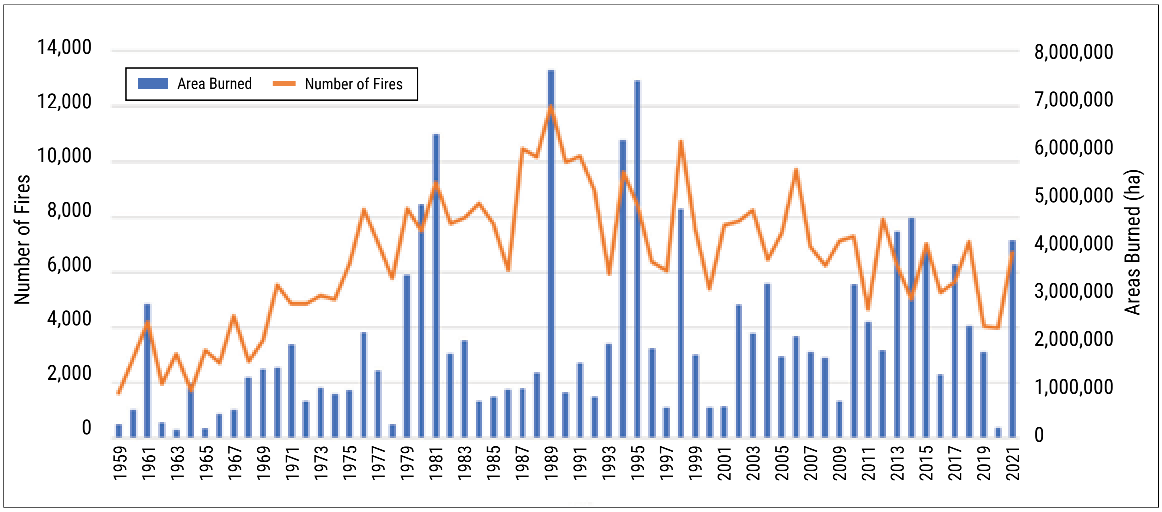
> The simplest and most straightforward way to interpret the effect of anthropogenic climate change on the severity of the June 2021 event is to assume that it elevated temperatures by an amount equivalent to the mean increase in temperature since anthropogenic climate change began… There is no evidence that the highly unusual combination of weather features that drove the heat dome were made more likely by climate change, and climate models do not project an increase in the frequency of high-pressure ridges over the Pacific Northwest. (Fleishman, 2023: 49)

A separate analysis criticized earlier claims that the heat wave would not have occurred in the absence of climate change, pointing out that the unprecedented heat dome was exceptionally unlikely irrespective of climate change:

> The statistical analysis presented here only supports an attribution statement that these temperatures were virtually impossible under any previously experienced meteorological conditions, with or without global warming. (Bercos-Hickey et al., 2022)

Another team of authors, after discussing the unusual combination of meteorological conditions that gave rise to the heat wave, concluded the event was simply "bad luck":

Figure 2.1: Annual Number of Wildfires and Area Burned in Canada, 1951 to 2021



Source: CWFIS, 2024.

> Assuming a similar event does not occur in the near future, and without a clear physical link to climate change, the most likely explanation remains that the weather event itself was "bad luck." While climate change added additional warming to the picture (approximately 1.5° C since 1960), the event would have been severe even without the climate change signal. (McKinnon and Simpson, 2022)

Thus, while the 2021 heat dome was a severe and harmful event, it is grossly prejudicial and misleading to suggest either that it was due to GHG emissions in general or to Canada's in particular, or to imply that had the ERP been in place earlier it would not have happened, or that implementation of the ERP will prevent heat waves in the future.

The PR also mentions the costs of floods (ECCC, 2023a: 19) and the potential for them to increase in the future. Flooding is associated with extreme precipitation events. But once again these are a naturally-occurring part of our weather and neither the Intergovernmental Panel on Climate Change (IPCC) nor *Canada's Changing Climate Report* (ECCC, 2019) says such events are increasing in Canada. The latter report concluded (2019: 156, emphasis in original) that there is only *medium confidence* that annual average precipitation has increased over time in Canada, and *low confidence* in the magnitude of the trend. As regards to extreme precipitation, it denied trends have even been detected, concluding (2019: 119) the observational record "has not yet shown evidence of consistent changes in short-duration precipitation extremes across the country." The most recent IPCC report concurred, stating: "In Canada, there is a lack of detectable trends in observed annual maximum daily (or shorter duration) precipitation" (IPCC, 2021: 1560).

The PR also repeats the claim (ECCC, 2023a: 21) that Canada is warming twice as fast as the global average, insinuating that this adds to the urgency of Canada reducing emissions. But many places in the world claim to be warming twice as fast as the global average, including China,[3] Northern Europe,[4] Russia,[5] Singapore,[6] Japan,[7] and others. The reason every country appears to be warming "faster than average" is that they are using a comparison of local warming against the entire planetary surface, 70% of which is ocean, and oceans warm much more slowly than the land.[8] Temperature data[9] from NASA shows that from 1980 to 2021 the land surface warmed about 1° C, and the ocean surface warmed about 0.3° C—using the 30/70 areal split, this yields a global average of about 0.5° C. Consequently, the land surface of Earth warmed about twice as fast as the global average (1° C versus 0.5° C) over this interval. Even if every country on Earth were warming at the same rate, each one could claim to be warming at twice the global average, simply because it is on land.

Alongside the misleading discussion of the costs of climate change, the PR offers little information about the costs of current or proposed climate policies. Section 1.3.1 (ECCC, 2023a: 17) is entitled "Economy-wide impacts of climate policies" but contains no information whatsoever about the economic impacts of the proposed package. It does admit that prices have gone up, including for food, housing, and energy, and that economic growth has slowed down, but it blames these things on COVID-19-related supply chain disruptions and the war in Ukraine. Nor does the PR provide a tally of the total fiscal commitments contained in the plan, even though the entries listed run into the billions of dollars. To the extent the report considers specific climate policies (sections 1.3.2 and 1.3.3) it glosses over them quickly and claims they offer Canadians economic benefits, not costs.

3 https://qz.com/368028/chinas-heating-up-twice-as-fast-as-the-rest-of-the-world/

4 https://www.theguardian.com/environment/2013/oct/02/ipcc-europe-warming-faster-global-average

5 https://www.themoscowtimes.com/2019/09/04/russia-is-warming-disproportionately-fast-environment-ministry-says-a67145

6 https://www.channelnewsasia.com/cnainsider/singapore-hot-weather-urban-heat-effect-temperature-humidity-906231

7 https://www.nippon.com/en/features/h00067/hot-and-getting-hotter.html

8 The land-ocean warming contrast, in which the land surface warms much more quickly than the ocean surface, has long been noted by climate scientists although the reasons for it are not settled (Toda et al., 2021).

9 https://data.giss.nasa.gov/gistemp/graphs_v4/graph_data/Temperature_Anomalies_over_Land_and_over_Ocean/graph.html

2.3 Overview of Proposed Emission Reduction Policies

The PR table (ECCC, 2023a: 55) shows that most provinces have adopted some form of GHG reduction targets—in six cases via legislation (British Columbia, Quebec, New Brunswick, Nova Scotia, Prince Edward Island, and the Yukon). So, the federal ERP is not a stand-alone initiative, instead it reflects shared priorities with at least some provinces.

The listing of federal measures begins on page 87 (ECCC, 2023a). Pages 87–91 outline the federal carbon pricing system including the Output-Based Pricing System mechanism and various refund pools for returning the revenue. Pages 91–92 describe mechanisms for the creation of GHG offset credits, such as through landfill methane recovery and destruction. The measures tend to be small in scale and are difficult to model at the macroeconomic level so they will not be included in the analysis below. Page 92 contains a description of the Clean Fuel Regulations (CFR) and some accompanying subsidy programs.

Numerous funding programs of various sizes are listed but their impacts on the economy and on GHG emissions are difficult to model due to the lack of specifics, so they will not be treated in the analysis below. The rules affecting electricity will be considered. The ERP imposes a phaseout of unabated coal plant emissions by 2030 (ECCC, 2022: 110) and a Net Zero requirement by 2035 (p. 114). The latter will be ignored in this analysis but the former will be examined on the assumption that it is phased in after 2027 (see Section 3.3.3 below).

Other major provisions which will be examined in the modeling section below include a Carbon Capture and Underground Storage (CCUS) investment tax credit (ECCC, 2023a: 99–100), a specific emissions cap and emission reduction targets for the oil and gas sector (pp. 98, 125), adoption of Net Zero building codes (pp. 100–101), an electric vehicle (EV) sales mandate (pp. 127–128), fuel efficiency requirements for Light Duty Vehicles (p. 202), and fertilizer use limits on farms (p. 141).

I will not examine the diverse spending programs, even though taken together they add up to many billions of dollars. The difficulty is the program descriptions do not provide measurable outcomes in terms of GHG reductions. For instance, on page 161 the "Strategic Innovation Fund" (SIF) is said to provide "transformative investments in all sectors of the economy to help Canada prosper in a global, knowledge-based economy." It goes on to say:

> SIF's Net Zero Accelerator (NZA) initiative will provide up to $8B to support large-scale investments in key industrial sectors across the country to ensure that Canada remains competitive in a net-zero economy and reduces GHG emissions. SIF-NZA

> supports investments that are aligned with provincial and territorial decarbonization priorities and considers regional environmental, industrial and economic needs. (ECCC, 2023a)

But the government has not listed the emission reductions it intends to achieve thereby. Page 167 lists a program called the "Active Transportation Fund" which makes $400M available over five years "to support a modal shift away from cars and toward active transportation" including "new and expanded networks of pathways, bike lanes, trails and pedestrian bridges, in addition to supporting active transportation planning and stakeholder engagement activities." Once again although the cost is specified, there is no way to assign a credible estimate of GHG reductions associated with it. Because so many of the programs in the PR fall into this pattern most of the policies are not included in the modeling exercise below.

2.4 Existing cost estimates

There are no existing published cost estimates computed on as comprehensive a basis as those presented herein. Numerous other groups have looked at costs of components of the ERP. These are discussed in the Appendix to this report.

3 Modelling the Elements of the ERP through 2030

The analysis will be done using the LFX Canadian model version 7.0, which is described in McKitrick (2023a,b, and 2024b). It is a 26-sector Computable General Equilibrium model of the Canadian economy designed to yield dynamic simulations at the provincial level on an annual resolution.

In the Base Case it is assumed that a carbon tax exists, beginning at $20 per tonne in 2019, rising to $29.40 in 2020, $38.50 in 2021, and $45.50 in 2022, remaining constant thereafter. The differences between the annual increments applied and $10 arise due to adjusting for observed inflation. Firms in all provinces are assumed to be assessed a fee via an Output-Based Pricing System (OBPS), whereby for firms in emissions-intense and trade-exposed sectors, only emissions beyond a threshold level are taxable, where the threshold is firm-specific based on a firm's emissions intensity. This can be shown to be equivalent to a variable refund per unit of output (McKitrick et al., 2019: Appendix B). The OBPS refund threshold is assumed to rebate 90% of a sector's emission charges. I also assume in the Base Case that Alberta phases out coal from electricity production in 2025 and replaces it with natural gas. It is also assumed that the Come By Chance refinery in Newfoundland is closed and all methane used in that province is imported. Labour supply growth rates by province were obtained for 2019–2023 from Statistics Canada (Table 14-10-0201-01). US GDP is assumed to grow at a real rate of 3.0% each year and world energy prices are assumed to remain constant, as are all income and consumption tax rates in Canada.

To make the policy analysis manageable, I will break the ERP into three components and analyze the parts cumulatively. I begin with the carbon pricing component, then add in the Clean Fuel Regulations (CFR), and then incorporate the other regulatory measures.

3.1 Carbon pricing component

This component has three elements:

3.11 Emission charge

The per-tonne carbon tax rises by $15 increments each year reaching $170 per tonne by 2030. The simulation model operates in 2019 dollars. In view of current and expected inflation rates the real value of the carbon tax will be lower than the nominal value. I apply projected changes in the Canadian Consumer Price Index to generate a revised rate path that increases steadily to a real value of $125 per tonne by 2030.

3.12 Revenue Recycling

Ninety percent of the fuel charge is returned to consumers and 10 percent is used to fund governmental spending initiatives. No attempt is made to direct the withheld 10% component specifically to "green or innovation" initiatives within the model since they are not resolved in the model structure, nor is it assumed any GHG emission reductions result from such spending.

3.13 Output-Based Pricing System (OBPS)

One hundred percent of the net OBPS revenues are invested in new spending initiatives. The OBPS is modelled as an output subsidy according to the derivation in McKitrick (2023b: Section 9). Per the ERP I assume a two percent tightening in stringency (i.e., increase in taxed fraction of emissions) in each year, post-2022. Any excess credits in the OBPS market post-2027 are cleared at the benchmark carbon price.

3.2 Clean Fuel Regulations Component

This part of the analysis implements the carbon pricing policies outlined above plus the Clean Fuel Regulations (CFR) which is quantified as follows: Liquid fossil fuel suppliers must reduce the carbon intensity of transportation fuels used in Canada to 80.0 grams of CO_2 eq./MJ (gasoline) or 79.0 grams of CO_2 eq./MJ (diesel) by 2030 compared to a base case of 95 grams of CO_2 eq./MJ. The CFR is implemented using the marginal cost schedule presented in McKitrick (2023b), Section 10. It yields a schedule which pairs emission intensity targets with associated changes in fuel production costs relative to the unregulated case.

It is assumed that gaseous fuels will be required to achieve a two percent reduction in carbon intensity due to the pre-existing CFR, which is held constant thereafter. No attempt is made to separately model required reduction in carbon intensity of jet fuel.

3.3 Regulatory Component

This analysis embeds the policies outlined in Section 3.2 plus the following regulatory measures.

3.3.1 Carbon Capture and Underground Storage (CCUS)

A CCUS tax credit is to be issued at level needed to get 15 Mt CO_2-equivalent reduction in emission each year between 2025 and 2030. The ERP tax credit, as of 2025, combined with assumed provincial and federal incentives leads to accelerated adoption of CCUS. The LFX model component that implements this is based on the survey of levelized cost estimates in Irlam (2017), which pairs emission reduction rates with associated costs per tonne of avoided emissions. Converting the US$ per-tonne cost rates into inflation-adjusted Canadian dollars and adjusting for the investment tax credit leads to the cost schedule shown in figure 3.1.

Figure 3.1 shows, on the vertical axis, the emission adjustment factor and, on the horizontal axis, the carbon price net of the tax credit. A 3rd-order polynomial curve is fitted through the data and yields the function shown in the top right corner. Because the curve accelerates downward above $100 per tonne, whereas the principle of diminishing returns would suggest it should level out, this curve may be over-optimistic in how much CCUS accomplishes at higher carbon prices, but it is nonetheless used as is.

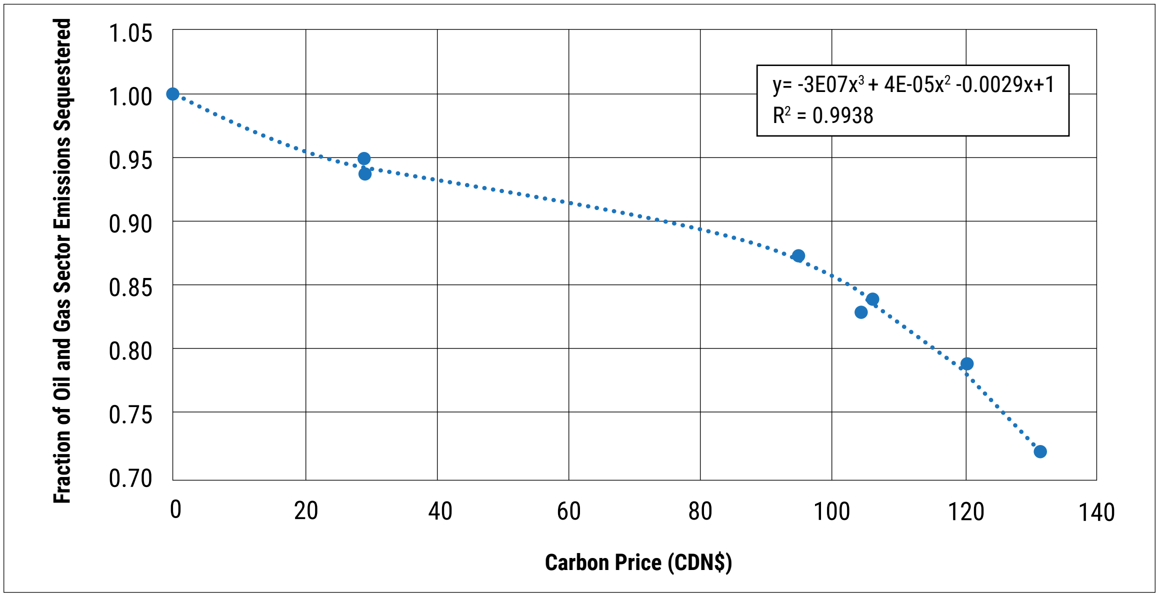
Substituting the carbon tax value in for x yields the emission factor y. A tax of, for example, $120.15 per tonne yields a predicted emissions factor of 0.78, which means CCUS adoption induced by the carbon price reduces the emissions from intermediate fossil fuel use in Canadian industry by 22%. Using this function, the model assumes that at a carbon tax of about $195 per tonne all intermediate industrial fossil fuel-related CO_2 emissions would be captured and stored.

3.3.2 Oil and Gas Sector Emission Reductions

The PR lists a requirement for the Oil and Gas sector to reduce methane emissions by 75% below 2012 levels by 2030 (ECCC, 2023a: 98) and 40–45% below 2012 levels by 2025 (p. 125), although the latter target appears to be moot in light of the equivalency agreements signed with BC, Alberta, and Saskatchewan (p. 165). The LFX model takes account of changes in methane leakage and flaring rates in response to market prices for natural gas. Because methane is marketable, it is worthwhile for the industry to incur costs to reduce leakage and waste depending on changes in the market price of natural gas. A model sub-component based on behavioural coefficients estimated in Marks (2022) captures this effect.

The ERP states that there is no intention on the part of the government for the methane cap or the sectoral GHG cap to result in output reductions not otherwise driven by

Figure 3.1: Carbon Capture and Underground Storage (CCUS) Cost Schedule



Data adapted from Irlam (2017).

changes in global demand. However, for output to remain at current levels or to grow while GHG emissions decline, would require decoupling output and emissions. If CCUS measures do not suffice to bring this about, the ERP does not say what, if any, flexibility options will be made available for the industry. On the assumption that some offsetting measure will be made available, the simulations assess on the Oil and Gas sector a fee equal to the difference between current and target GHG emissions beginning in 2025 times $195, which is the upper bound on CCUS costs as explained above.

3.3.3 Unabated Coal Phaseout in Electricity and Clean Electricity Standard

As of the start of 2030 coal-fired electricity will be outlawed (ECCC, 2023a: 110). The regulations specify "unabated" coal-fired power which means power stations with CCUS could potentially still operate. Once again, the PR and ERP offer no guidance as to the likely cost of achieving this target. Ontario was able to phase out coal by adding natural gas-fired capacity and extending the life of its nuclear fleet. Alberta is on track to phase out coal ahead of schedule by switching to natural gas (Scace, 2024). However, a difficulty for those provinces who have not already built natural gas plants is that accompanying the coal phaseout requirement is a proposed Clean Energy Standard (ECCC, 2022: 219) which requires net zero in the electricity sector by 2035. It is implausible to suppose that investors will be willing to build new natural gas-fired generators that will only operate between 2031 and 2035.[10] Neither is it feasible for other provinces still using coal (Saskatchewan, New Brunswick, and Nova Scotia) to build new nuclear plants by 2030. In the ERP, details about how the coal phaseout and Clean Energy Standards would work consist of vague statements like:

> To help connect regions with clean power, the Government will support de-risking and accelerating the development of transformational, nation-building inter-provincial transmission lines that connect supplies of clean power to locations that currently rely heavily on fossil fuels for power generation. (ECCC, 2022: 220)

Renewables such as wind and solar are intermittent and as such cannot provide either baseload or peaking power. A key problem with trying to replace coal power with nuclear or imported hydro is that neither of those sources are dispatchable,[11] so they cannot be used to manage hourly and daily fluctuations in demand. When utilities phase out dispatchable power generators without providing dispatchable replacements they create the risk of blackouts. To deal with this risk, many electricity users must install backup generators which are typically powered by fossil fuels like diesel, gas, or propane. The Independent Electricity System Operator (IESO, 2021) projected that trying to remove natural gas from the Ontario grid by 2030 would add about 60% to the cost of electricity and would create a significant risk of blackouts, which would thus trigger the need for private backup power systems. I will model the costs of this regulation using the following assumptions:

- Existing natural gas power plants will be assumed to be grandfathered in despite the 2035 Clean Energy Standard deadline for their shutdown.
- Saskatchewan, New Brunswick, and Nova Scotia will procure non-emitting electricity supply to replace coal beginning in 2030 at half the cost estimated by the IESO, thus raising the cost of power generation by 30%.
- The same year the following industrial sectors in the four affected provinces will need to allocate resources to procure standby backup power: Other (non-hydrocarbon) Mining, Construction, Food Production, Semi-durables, Refined Fuels, Other Petrochemicals, Cement and Concrete, Automotive Parts and Assembly, and Other Manufacturing. I will assume the required expenditures lead to a deadweight loss equal to 1% of annual total revenue every year from 2029 onwards.

10 This has not stopped commissioning of new natural gas-fired power plants, apparently in the expectation that the Net Zero requirement will not be enforced (see Zinchuk, 2024).

11 "Dispatchable" refers to power that can be ramped up or down instantly in response to changing demand condition on an electricity grid.

3.3.4 Electric Vehicle mandate

The EV sales mandate begins in 2026 with the requirement that 20% of passenger vehicle sales (including SUVs and pickup trucks) must be EVs, rising to 60% by 2030. The modeling methodology is explained in detail in McKitrick (2024b). For each province a base case EV sales fraction is determined using observed sales data up to 2022 and projections through 2030 on the assumption of a continuation of the 2015–2022 trend. EV sales in BC and Quebec were above the national average due to province-specific incentives and local buyer preferences, so the mandate does not bind in these provinces until 2027. Within each province the mandate takes the form of a gap between the market-determined EV sales fraction and the mandated fraction. The sales requirement induces the auto sector to raise the cost on internal combustion engine vehicles (ICEVs) thereby earning rents on that portion of the market, while losing revenue because of an overall reduction in vehicle demand and a higher cost of producing EVs. The production cost differential between EVs and ICEVs is assumed to shrink over time such that parity would be achieved by 2050. While the production cost of some EVs will likely reach parity with comparable ICEVs before then, cost parity is here defined broadly to include all aspects of vehicle ownership including convenience and speed of refueling, maintenance costs, and reliability in all weather conditions. Some of these pose longer term challenges in the Canadian context.

The government will allow firms involved in ICEV manufacture to buy credits from those involved in EV production. The model assumes such permits exist and are actively traded. The government has also capped the cost of permits at $20,000 each, in other words an ICEV manufacturer could continue to operate as long it remits $20,000 per vehicle for which it has not obtained a credit via an offsetting EV sale. The implicit permit price in the model does not reach this magnitude by 2030 so the price cap is not binding.

3.3.5 Corporate Average Fuel Economy (CAFE) Standards

More stringent CAFE standards impose costs on automakers and buyers alike. Firms must put resources into developing features that buyers did not themselves choose, and buyers face higher prices than they otherwise would. The price effect arises partly due to the forced over-investment in fuel efficiency, but also because sellers overcharge for large vehicles, encouraging buyers to opt for smaller cars so that the year-end fleet average complies with the requirements. These costs are especially redundant in the presence of a carbon tax, since the tax provides a sufficient signal for consumers to make the appropriate adjustments in their driving habits and car preferences. The carbon tax was originally conceived as a way of avoiding the need for the government to micromanage consumer decisions in this way. Layering new regulations on top of the tax can justifiably be seen as the worst of both worlds.

I will not attempt a detailed accounting of the costs imposed by the CAFE standards, only an approximate measure of the costs to automakers and consumers reflecting the deadweight loss of the forced overinvestment in fuel efficiency. These costs are assumed to be one-fifth of the increment in CAFE standards expressed as a cumulative percentage of marginal production costs, which work out as +0.3% in 2021 and 2022, +2% in 2023, +1% in 2024–2026 and +0.3% per annum for 2027–2030. This accumulates to a 6.7% increase in the purchase cost of new vehicles by 2030.

3.3.6 Building Energy Efficiency (BEE) Requirements

The ERP sets out a series of BEE requirements that are discussed in detail in McKitrick (2023a). Of particular note, there are annual improvement requirements in major building-related energy systems such as lighting and cooling, as well as specific requirements that, compared to 2019, new residential buildings must use 61% less energy by 2025 and 65% less by 2030, while commercial buildings must use 47% less energy by 2025 and 59% less energy by 2030 (ECCC, 2022: 201). The ERP also specifies an intention to apply new BEE standards to renovations of existing homes in addition to construction of new ones. The cost increases in construction follow the steps and construction cost increase function shown in McKitrick (2023a).

3.3.7 Fertilizer Use

The ERP (ECCC, 2022: 61) calls for farms to achieve a 30% reduction in fertilizer use below 2020 levels by 2030. Currently, according to the Statistics Canada input-output tables (Table 36-10-0478-01), Canadian farms spend about 12% of their total revenue on fertilizers.[12] Thirty percent of this would be about 3.6%. Since fertilizers are costly, farmers already have an incentive to minimize their use. It can therefore be assumed that the only reason they spend money buying and applying fertilizers is that they get at least as much back in extra revenue from the gain in output. Likewise, if farmers are blocked from purchasing a certain amount of fertilizer, the value of the lost output must exceed the savings from not buying the fertilizer.

To implement this policy in the model I will assume that farmers experience lower output through a loss of productivity. Specifically, I will assume that the cost of agricultural

12 This includes ammonia and other chemical fertilizers (10.3% in 2020) and imputed fertilizer produced on-farm (1.3% in 2020).

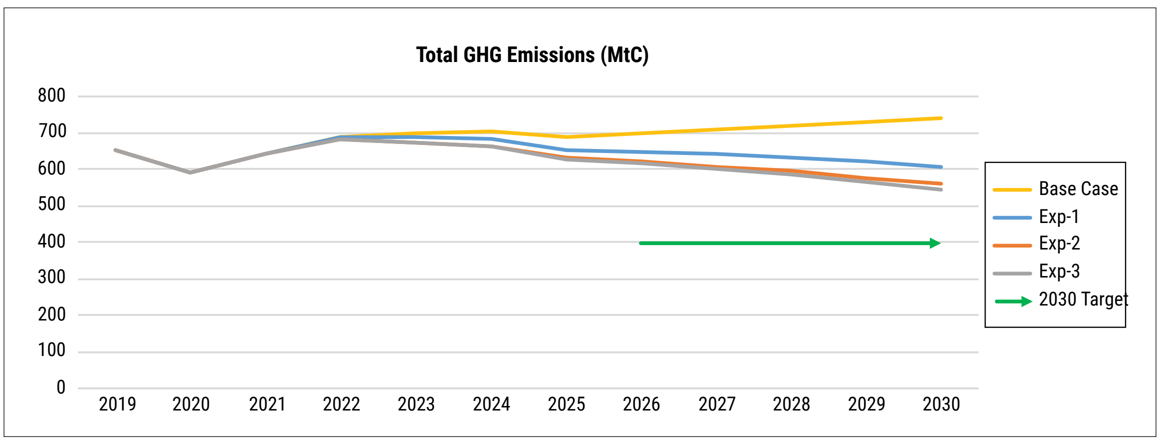
production rises by 4%, but this does not accrue as income anywhere else in the economy, instead it is a deadweight loss. Also, the policy will be phased in over four years beginning in 2027.

4 Results

Figures 4.1 and 4.2 summarize the national emission implications of the three policy experiments. The Base Case is shown as the top line (yellow).[13] The timeline starts at 2019 and runs to 2030. The reduction in emissions in 2020 due to the COVID-19 recession and lockdowns is shown.[14] Emissions bounce back through 2024.[15] The reduction in 2025 is due to the assumed Alberta coal phaseout. Note that it is represented in the model as occurring entirely in 2025, even though it was phased in over several years. Emissions then return to an upward path until 2030. The percent change in emissions under each policy experiment is shown in figure 4.2.

The carbon tax (blue line, Experiment 1) brings emissions down by 18.1% compared to 2019 levels (15.2% below 2005 levels) as of 2030. As shown in figure 4.1 this brings them down approximately to where they were in 2020. The CFR (Experiment 2) brings them down a further 6.1% while the Regulatory component (Experiment 3) brings them down

Figure 4.1: GHG Emissions under the ERP Policy Groups and the 2030 Target



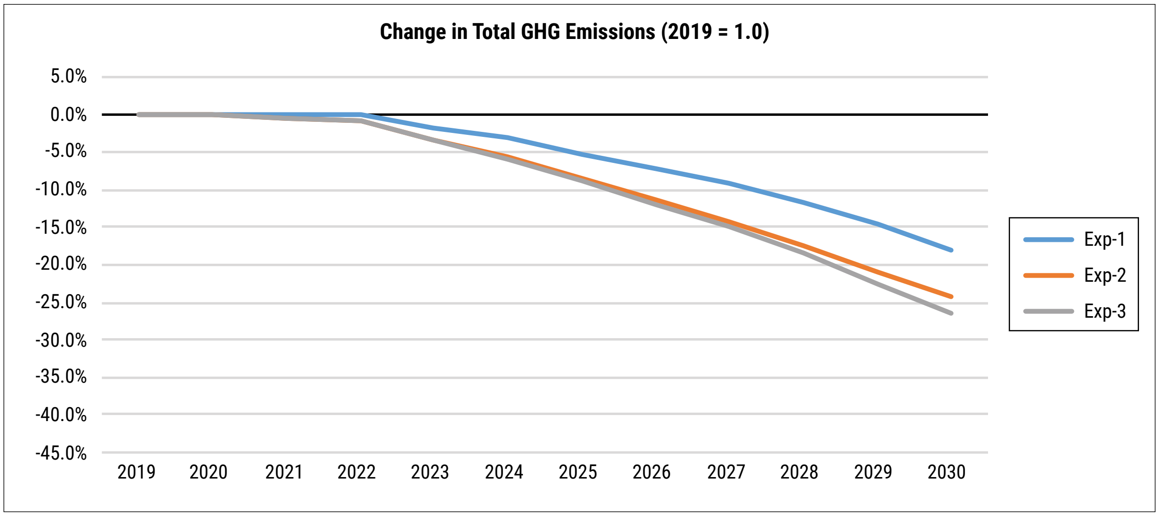
Source: Author's calculations.

13 The Base Case is calibrated so the 2019 GHG emissions level exactly corresponds to the amount from fuel burning in the National Emissions Inventory. Some types of emissions (such as methane due to Waste Management and CO_2 from cement production) are not represented here.

14 The model simulates a 9.6% reduction in emissions. Observed emissions fell by 9.9%.

15 Comparison with the National Emissions Inventory shows that the modelled emissions reduction during Covid matched well against the observed reduction, but the observed emissions recovery in 2021 was slower than in the model because transportation-related activity rebounded more quickly in the model than in the observed economy. As noted below the model projects a more rapid recovery from the Covid recession than was observed.

Figure 4.2: Relative GHG Emissions (2019 = 1.0) under the ERP Policy Groups



Source: Author's calculations.

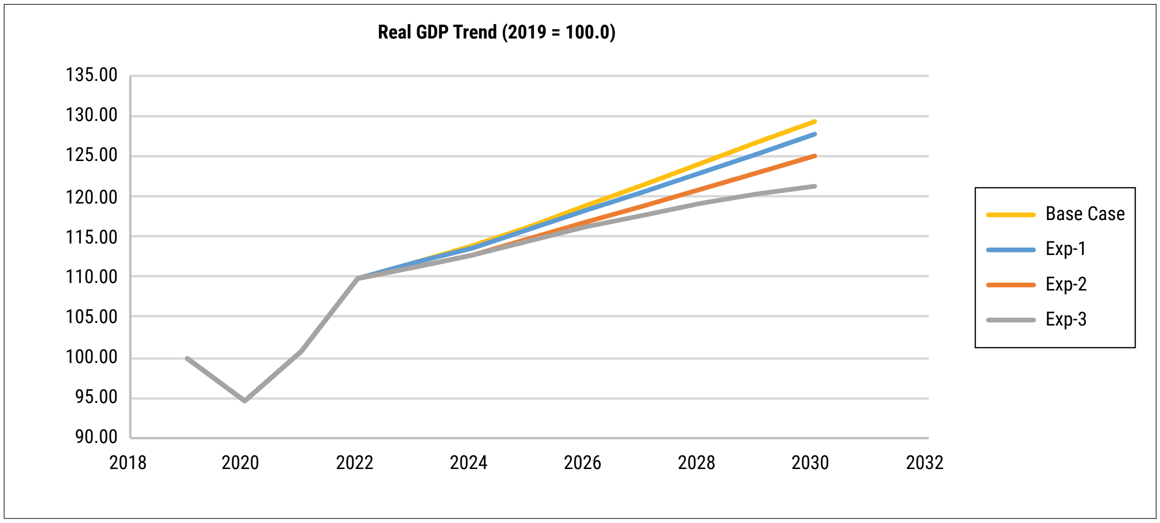
a further 2.3%, for a total reduction of 26.5%. Many of the regulatory measures, such as building codes and the EV mandate, are very slow to reduce emissions since they only affect future increments to the capital stock. The Oil and Gas sector emission mandates are assumed to be implemented in a way that allows for offsets so emissions do not go to zero in that sector. As shown, the full ERP takes Canada about 57% of the way to the government's target, leaving a considerable gap.

The effects on GDP are shown in figures 4.3 and 4.4.[16] Figure 4.3 shows that the economy continues to grow under all policy experiments, but at an increasingly dampened rate. In the base case the economy grows 29.3% by 2030 compared to 2019 (2.4% per year). Under Experiment 1 (carbon pricing) it grows by 27.8% (2.3% per year), under Experiment 2 by 25.0% (2.1% per year), and under Experiment 3 by 21.3% (1.8% per year). Comparative results are shown in figure 4.4. As of 2030 the GDP losses against the Base Case under the three policy experiments are, respectively, 1.2%, 3.3%, and 6.2%. The implications for individual earnings are shown in figure 4.5, which shows real income per worker relative to the Base Case. By 2030 Real Earnings under the three policy experiments decline

16 In the model simulation GDP drops 5.4% from 2019 to 2020, whereas the observed level dropped 4.9%. The post-Covid recovery was stronger in the model than observed. The 2021 modelled GDP growth rate was 6.5% whereas the observed growth rate was only 5.3% and the 2022 modelled growth rate was 9.0%, whereas the observed growth rate was only 3.9%. Possible reasons for the discrepancy include an assumed US growth rate after 2020 that was higher than observed and the model did not simulate the increase in world energy prices after 2021.

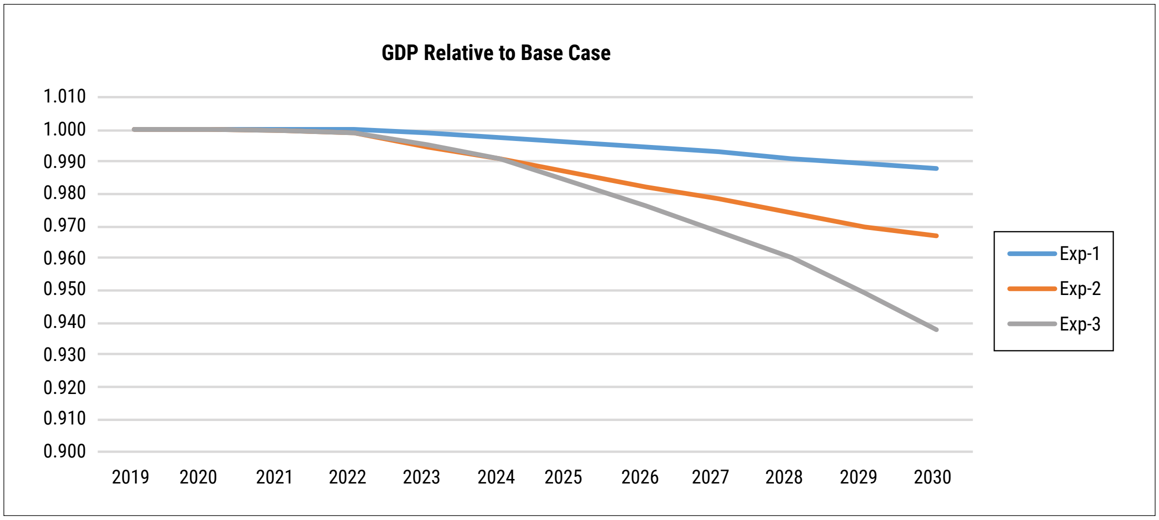
against the Base Case by 1.0%, 2.9%, and 5.5% respectively. The cumulative effect under Experiment 3 effectively counteracts all real income growth, so that as of 2030 earnings per worker are 1.6% below where they were in 2022.

Figure 4.3: Real GDP 2019–2030, Base Case and under the ERP policy groups



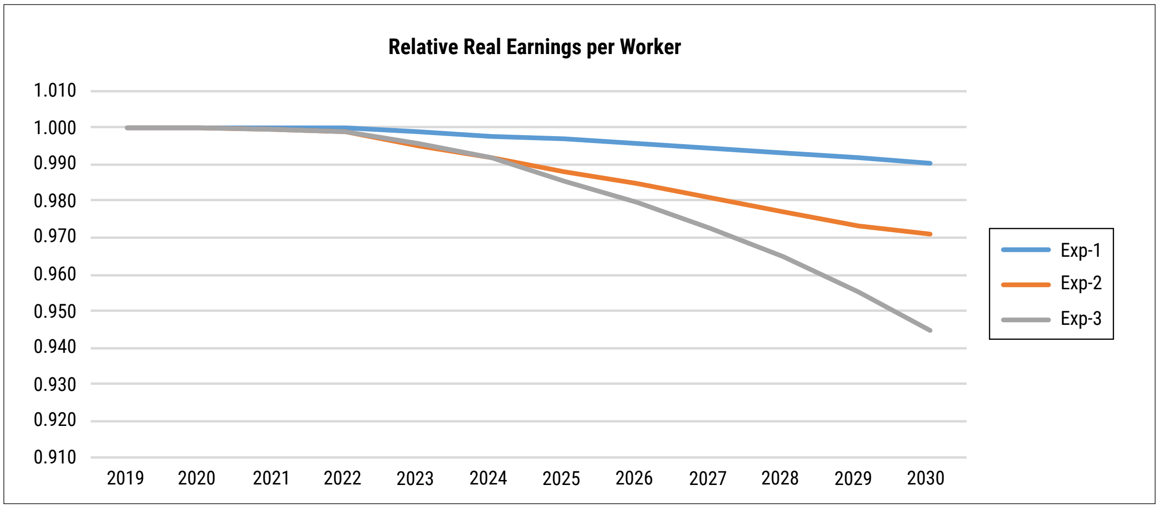
Source: Author's calculations.

Figure 4.4: Relative GDP (2019 = 1.0) under the ERP policy groups



Source: Author's calculations.

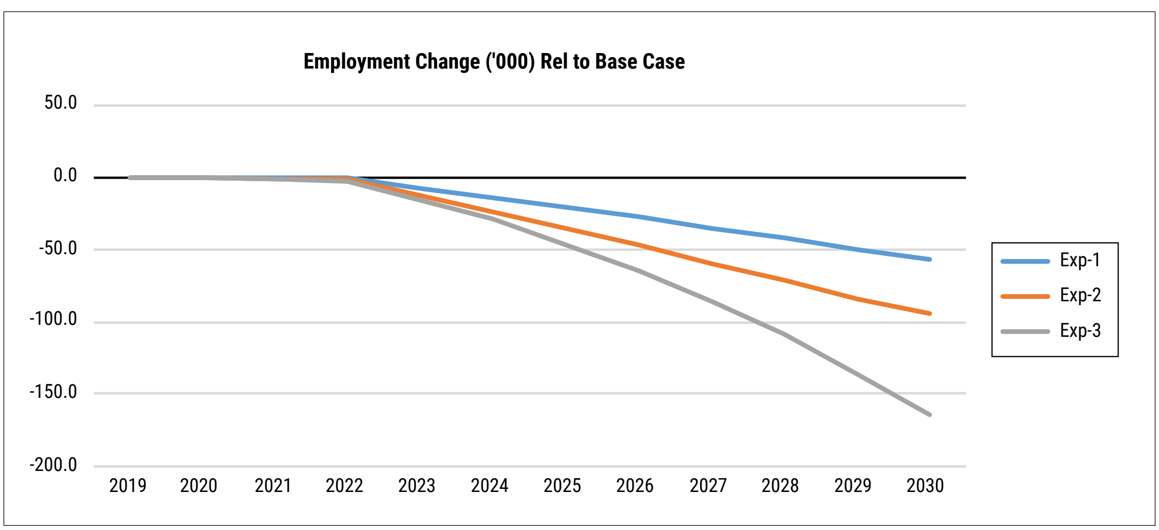
Figure 4.5: Real Earnings per Worker Relative to Base Case under the ERP Policy Groups



Source: Author's calculations.

Figure 4.6 shows the effect on equilibrium employment. Note that this is not unemployment since the labour market is assumed to clear every period in the model. This shows the reduction in labour demand and supply associated with the policy components. The carbon price alone yields a reduction of employment of about 57,000 jobs as of 2030 and a total reduction of 250,000 person-years employment over the 2021–2030 interval. The CFR increases the reduction to 94,000 jobs as of 2030 and 431,000 person-years over the decade. The whole policy package yields a reduction of 164,000 jobs as of 2030 and 653,000 person-years lost over the decade.

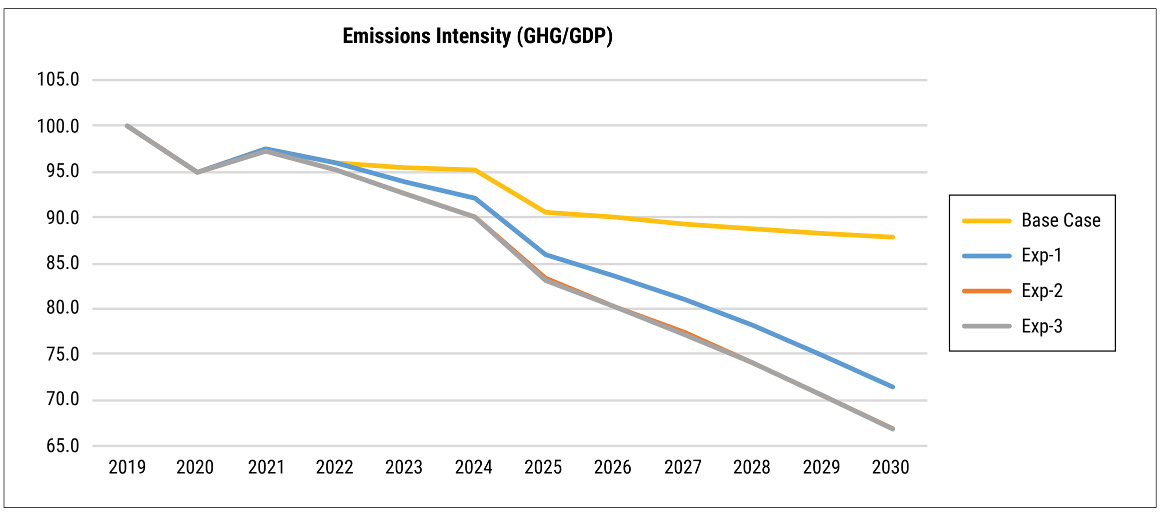
Figure 4.6: Employment Change ('000 jobs) under the ERP Policy Groups



Source: Author's calculations.

Figure 4.7 shows the effects on GHG Intensity (GHG per unit of real GDP). Under the Base Case emissions intensity declines by 12.2% from 2019 to 2030. This is about 1.1% annually which is a bit slower than the observed average from 2001 to 2022, which was 1.4% (McKitrick, 2024a). There is likely some form of background energy-saving technical change not represented in the model, so the Base Case emissions may be overstated. The carbon tax accelerates the decline in GHG Intensity, resulting in a decrease of 28.5% by 2030, a compound annual rate of 2.8%. This is much faster than the historical average in Canada but, as shown in figure 4.1, total emissions do not decline by nearly as much. They are driven upward by income and population growth, although under Experiment 3 real income peaks in 2022 and declines thereafter so population growth is the only factor driving emissions up. In Experiment 2 emissions intensity falls further by 2030, reaching 33.1% below the Base Case. In Experiment 3, real GDP falls about as quickly as emissions compared to Experiment 2, so the lines overlap: no improvement in emissions intensity is realized despite the costs.

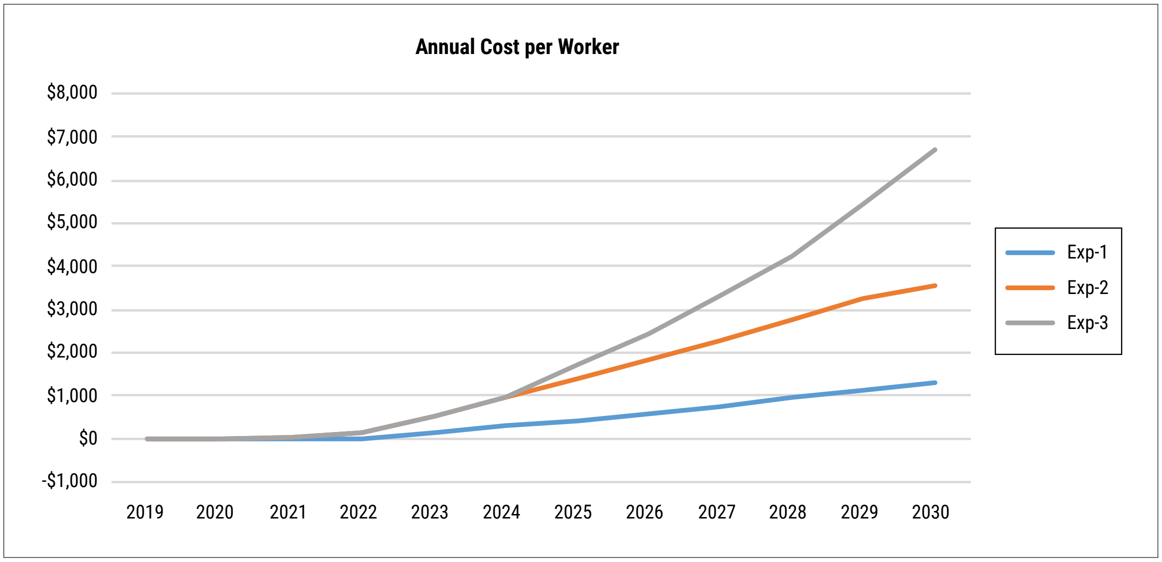
Figure 4.7: Emissions Intensity Relative to 2019 (=100.0), Base Case and under the ERP Policy Groups



Source: Author's calculations.

Figure 4.8 shows the annual costs per employed person (in 2019 dollars). The carbon tax policy costs $1,302 per worker annually by 2030, while Experiments 2 and 3 bring the totals up to $3,550 (2.7 times higher) and $6,700 respectively. Hence the complete policy package costs more than five times as much per worker as the carbon tax alone. These are exceptionally high costs and point to the difficulty any government will face in trying to maintain support for their implementation.

Figure 4.8: Annual Cost per Employed Person of ERP Policy Groups

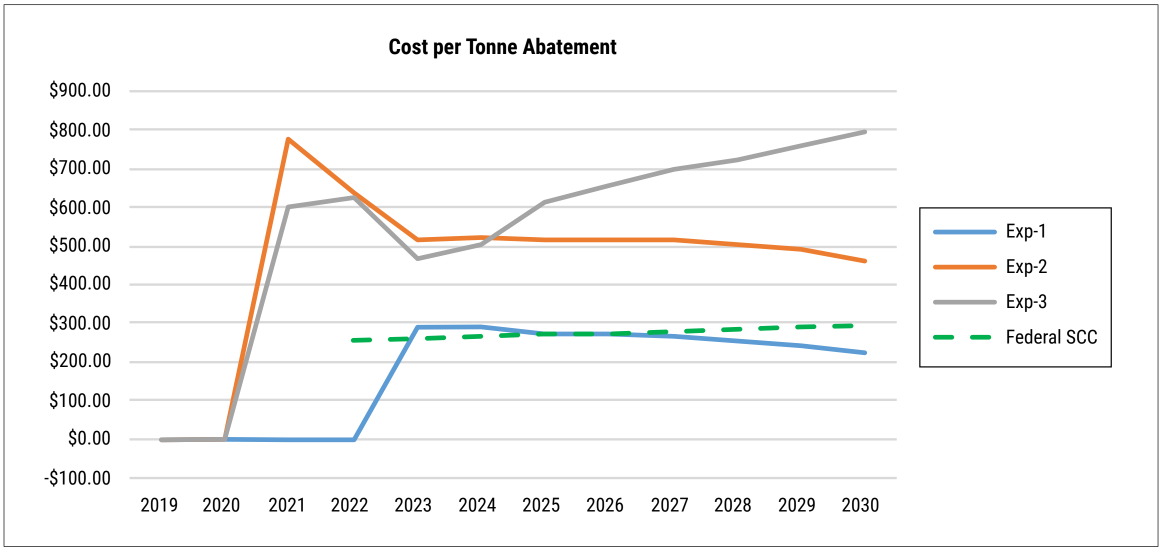


Source: Author's calculations.

Figure 4.9 shows the average costs per tonne of abatement (change in real GDP per tonne of GHG reduction). The carbon tax is the cheapest option, coming in initially at around $290 per tonne but declining over time to $227 per tonne. The cost per tonne declines because the gap between the base and the experiment case values grows more slowly for GDP than GHGs. The cost could be reduced further if the revenues were used to reduce income taxes rather than being partially refunded in a lump sum manner and partially used to fund increased government spending. Adding in the Clean Fuel Regulations (Experiment 2) raises the cost initially to $776 per tonne though it too declines through the decade, reaching $459 as of 2030. Hence adding the CFR to the policy mix more than doubles the cost per tonne of abatement. The jump-then-pullback occurs because the policy tends to have front-loaded costs, with only minimal initial emission reductions. Experiment 3 also involves an initial jump then a pull back, but quickly begins an upward trend and reaches $795 per tonne by 2030. Thus, the marginal costs of the regulatory instruments are so high that they more than triple the cost per tonne of abatement compared to the carbon tax alone.

It is instructive to compare these costs per tonne of abatement with the estimated Social Cost of Carbon (SCC). While the Government has published a set of estimates (Government of Canada, 2024), unfortunately they are not credible since they rely on an emissions scenario (RCP8.5) known to be scientifically invalid for the purpose, as well as other cherry-picked pieces of evidence that yield implausibly inflated numbers (see McKitrick, 2023c, for discussion). Even with these flaws, however, the federal SCC estimate,

Figure 4.9: Average Cost per Tonne of Abatement (Loss of GDP per Tonne Abated) of ERP Policy Groups and the Federal SCC Estimate



Source: Author's calculations.

shown as the green dashed line in figure 4.9, is lower than the cost of the combined ERP elements throughout the decade. It begins at $247 in 2020 and rises to $294 as of 2030 (in 2021 dollars), which is comparable to the cost of the carbon tax alone, but not to the combination of taxes and regulations. Hence the federal ERP clearly fails a cost-benefit test even when using the government's exaggerated SCC as a measure of the marginal benefits.

Economic detail at the provincial level is provided in tables 4.1 and 4.2. Table 4.1 summarizes changes in real GDP, employment, and real income. In general Ontario fares the worst of the provinces while PEI experiences the least costs. This differs from the results reported in McKitrick and Aliakbari (2021), which was based on an earlier version of the model that did not include any dynamics. In that model, Alberta and Saskatchewan experience larger economic impacts than Ontario, mirroring results seen in other static general equilibrium models. In the current dynamic version of the model, returns to capital decline across more sectors in Ontario, leading to relatively larger cumulative effects on capital income, consumption, and output. However, Alberta and Saskatchewan also experience large economic losses by 2030, especially under the combined tax and regulatory policies. No region is spared significant output and income losses as of 2030 under the full suite of policies.

Table 4.1: Output, Employment and Income Changes by Province under ERP Components

	GDP			Employment			GDP/worker		
	Exp 1	Exp 2	Exp 3	Exp 1	Exp 2	Exp 3	Exp 1	Exp 2	Exp 3
Canada	-1.2	-3.3	-6.2	-0.2	-0.4	-0.7	-1.0	-2.9	-5.5
BC	-1.4	-3.1	-5.4	-0.2	-0.2	-0.2	-1.1	-2.9	-5.3
Alberta	-1.4	-4.1	-6.0	-0.3	-0.8	-0.9	-1.1	-3.3	-5.2
Saskatchewan	0.0	-2.0	-6.8	0.6	0.4	-1.1	-0.6	-2.4	-5.7
Manitoba	-0.3	-0.9	-3.6	0.3	0.5	0.4	-0.7	-1.4	-4.0
Ontario	-2.1	-4.9	-8.9	-0.6	-1.0	-1.5	-1.5	-3.9	-7.4
Quebec	-0.4	-1.9	-3.9	0.2	0.2	0.2	-0.6	-2.0	-4.0
New Brunswick	0.2	-3.1	-6.6	0.4	-0.3	-1.2	-0.2	-2.8	-5.4
Nova Scotia	-0.3	-0.9	-5.4	0.4	0.7	0.1	-0.8	-1.5	-5.5
PEI	1.3	0.7	-0.5	1.1	1.3	1.4	0.2	-0.6	-1.9
Newfoundland	-1.0	-5.6	-7.4	0.0	-1.0	-1.0	-1.0	-4.6	-6.5
Far North	-0.8	-2.2	-3.4	0.2	0.1	0.5	-1.0	-2.3	-3.9

Table 4.2: Percent GHG Emission Changes by Province under ERP Components

	GHG Emissions		
	Exp 1	Exp 2	Exp 3
Canada	-18.1	-24.2	-26.5
BC	-14.4	-20.0	-21.4
Alberta	-15.1	-19.9	-21.5
Saskatchewan	-15.2	-20.5	-24.0
Manitoba	-16.2	-23.0	-25.4
Ontario	-23.1	-29.8	-32.2
Quebec	-16.1	-22.3	-23.7
New Brunswick	-20.3	-28.0	-33.1
Nova Scotia	-17.5	-26.1	-30.1
PEI	-14.1	-25.5	-27.8
Newfoundland	-13.3	-20.9	-22.1
Far North	-22.7	-32.6	-33.9

Conclusions

The policy simulations herein show that the rising federal carbon tax will stop emissions growth between now and 2030 and will have modest negative effects on national GDP. The costs per worker will exceed a thousand dollars per year by 2030. The pricing mechanism reduces emissions at the lowest cost per tonne of all the policies in the ERP. The Clean Fuel Regulations moves emissions down further so that by 2030, compared to the Base Case, emissions will be about halfway to the federal target. But these reductions are much costlier than those achieved through carbon pricing so the cost per tonne of abatement doubles and the cost per worker as of 2030 more than doubles. Adding in the regulatory measures further increases the costs per tonne of abatement of the policy package without gaining much in further emission reductions, and causes the cost per worker to be over five times higher than the carbon tax alone.

Canadian income and economic growth are currently matters of serious policy concern (Cross, 2023). While the government has signaled it wants to promote investment and growth, it has also announced a climate policy package that will thwart those objectives. The ERP is noticeably thin on cost estimates. The analysis herein supports several conclusions. First, the ERP will reduce Canadian GHG emissions but not by enough to reach the 2030 target level. Second, the ERP will seriously dampen GDP growth and eliminate net growth in real income per worker between 2022 and 2030. Third, the components of the ERP have very different marginal costs. The pricing mechanism costs the least per tonne, but the regulatory measures are extremely inefficient and raise the per-tonne cost of package as a whole to about 3.5 times that of the carbon tax alone.

References

Bercos-Hickey, Emily, Travis A. O'Brien, Michael F. Wehner, Likun Zhang, Christina M. Patricola, Huanping Huang, and Mark D. Risser (2022). Anthropogenic Contributions to the 2021 Pacific Northwest Heatwave. *Geophysical Research Letters* 49, 23 (December). <https://doi.org/10.1029/2022GL099396>, as of May 3, 2024.

Canada (2024). Social Cost of Greenhouse Gas Estimates—Interim Updated Guidance for the Government of Canada. <https://www.canada.ca/en/environment-climate-change/services/climate-change/science-research-data/social-cost-ghg.html>, as of April 15, 2024

Canadian Energy Centre (2023a). *Assessing the Impact of the Carbon Tax on Business Costs in Various Industries in British Columbia.* CEC Fact Sheet 93, 2 (August). <https://www.canadianenergycentre.ca/wp-content/uploads/2023/08/CEC-Fact-Sheet-93-V2-Aug-17-2023.pdf> as of April 15, 2023.

Canadian Energy Centre (2023b). *Assessing the Impact of the Carbon Tax on Business Costs in Various Industries in Ontario*. CEC Research Brief 30, 2 (July). <https://www.canadianenergycentre.ca/wp-content/uploads/2023/07/CEC-RB-30-Ontario-Carbon-Tax-V2-July-18-2023.pdf> as of April 15, 2023.

Canadian Energy Centre (2023c). How Will Atlantic Canada Fare under the Carbon Tax? Assessing the Impact of the Carbon Tax on the Business Costs of Various Industries in Atlantic Canada. CEC Research Brief 29, 3 (June). <https://www.canadianenergycentre.ca/wp-content/uploads/2023/06/CEC-Research-Brief-29-V3-June-27-2023.pdf> as of April 15, 2023.

Conference Board of Canada (2024). *Economic Impacts of a Greenhouse Gas Emissions Cap on the Oil and Gas Sector*. <https://open.alberta.ca/dataset/e034875d-f1cd-449f-acbc-e13b1631b5f0/resource/5c8471ca-c9fb-45b3-84ab-e0601f8eef83/download/epa-cboc-impact-ghg-emissions-cap-on-oil-and-gas-sector-2024-01.pdf> as of April 11, 2024.

Cross, Philip (2023). *What Is Behind Canada's Growth Crisis?* Fraser Institute. <https://www.fraserinstitute.org/studies/what-is-behind-canadas-growth-crisis>, as of May 3, 2024.

Energy Institute (2023). *Statistical Review of World Energy*. <https://www.energyinst.org/statistical-review>, as of May 3, 2024.

Environment and Climate Change Canada [ECCC] (2019). *Canada's Changing Climate Report*. Government of Canada. <https://natural-resources.canada.ca/sites/www.nrcan.gc.ca/files/energy/Climate-change/pdf/CCCR_FULLREPORT-EN-FINAL.pdf>, as of May 3, 2024.

Environment and Climate Change Canada [ECCC] (2022). *2030 Emissions Reduction Plan: Clean Air, Strong Economy.* Government of Canada. <https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/emissions-reduction-2030.html>, as of March 7, 2024.

Environment and Climate Change Canada [ECCC] (2023a). *2023 Progress Report on the 2030 Emissions Reduction Plan*. Government of Canada. <https://www.canada.ca/en/services/

environment/weather/climatechange/climate-plan/climate-plan-overview/emissions-reduction-2030/2023-progress-report.html>, as of March 7, 2024.

Environment and Climate Change Canada [ECCC] (2023b). *National Inventory Report 1990–2021: Greenhouse Gas Sources and Sinks in Canada*. Government of Canada. <https://publications.gc.ca/collections/collection_2023/eccc/En81-4-2021-3-eng.pdf>, as of April 11, 2024.

Fleishman, Erica (ed.) (2023). Sixth Oregon Climate Assessment. Oregon Climate Change Research Institute, Oregon State University, Corvallis, Oregon. DOI: 10.5399/osu/1161. <https://blogs.oregonstate.edu/occri/oregon-climate-assessments/>, as of May 3, 2024.

Intergovernmental Panel on Climate Change (2021). *Climate Change 2021: The Physical Science Basis*. Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. <https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_FullReport_small.pdf>, as of May 3, 2024.

Independent Electricity System Operator [IESO] (2021). *Decarbonization and Ontario's Electricity System: Assessing the Impacts of Phasing Out Natural Gas Generation by 2030*. IESO. <https://ieso.ca/-/media/Files/IESO/Document-Library/gas-phase-out/Decarbonization-and-Ontarios-Electricity-System.ashx>, as of May 3, 2024.

Irlam, Lawrence (2017). *Global Costs of Carbon Capture and Storage*. Global CCS Institute.

Lomborg, Bjorn (2016). Impact of Current Climate Proposals. *Global Policy* 7, 1 (February): 109–118. <http://onlinelibrary.wiley.com/doi/10.1111/1758-5899.12295/full>, as of May 22, 2024.

Marks, Levi (2022). The Abatement Cost of Methane Emissions from Natural Gas Production. *Journal of the Association of Environmental and Resource Economists* 9, 2 (March). <https://doi.org/10.1086/716700>, as of May 3, 2024.

McKinnon, Karen A., and Isla R. Simpson (2022). How Unexpected Was the 2021 Pacific Northwest Heatwave? *Geophysical Research Letters* 49, 18 (September). <https://doi.org/10.1029/2022GL100380>, as of May 3, 2024.

McKitrick, Ross (2023a). *Wrong Move at the Wrong Time: Economic Impacts of the New Federal Building Energy Efficiency Mandates*. Fraser Institute. <https://www.fraserinstitute.org/studies/wrong-move-at-the-wrong-time-economic-impacts-of-the-new-federal-building-energy-efficiency-mandates>, as of May 3, 2024.

McKitrick, Ross (2023b). *Detailed Description of the LFX Canadian Model*. Toronto: LFX Associates <https://www.lfxassociates.ca/uploads/4/8/0/8/4808045/lfxcm5.1_guide.pdf>, as of May 3, 2024.

McKitrick, Ross (2023c, May 25). The Social Cost of Carbon Game. *Financial Post*. <https://financialpost.com/opinion/junk-science-week-social-cost-of-carbon-game>, as of April 15, 2024.

McKitrick, Ross (2024a). *An Evaluation of Canada's Progress Towards Meeting the 2025 and 2030 GHG Emission Reduction Targets*. Fraser Institute. <https://www.fraserinstitute.org/sites/default/files/canadas-progress-towards-meeting-2026-and-2030-ghg-targets.pdf>

McKitrick, Ross (2024b). Economic Implications of a Phased-in EV Mandate in Canada. *Canadian Journal of Economics*. <https://www.economics.ca/cpages/cje-journal-content>, as of July 2, 2024.

McKitrick, Ross, and Elmira Aliakbari (2021). *Estimated Impacts of a $170 Carbon Tax in Canada*. Fraser Institute. <https://www.rossmckitrick.com/uploads/4/8/0/8/4808045/impact-170_-carbon-tax-rev-post.pdf>, as of May 3, 2024.

McKitrick, Ross, Elmira Aliakbari and Ashley Stedman (2019). *The Impact of the Federal Carbon Tax on the Competitiveness of Canadian Industries*. Fraser Institute. <https://www.fraserinstitute.org/sites/default/files/impact-of-the-federal-carbon-tax-on-competitiveness.pdf>, as of May 3, 2024.

Navius Research Inc. (2023). *Simulating the Economic Impacts of the Proposed Clean Electricity Regulations*. Draft report prepared for the Legislative Assembly of Alberta. <https://www.naviusresearch.com/wp-content/uploads/2023/05/Navius-UPDATED-REPORT-for-UCP-2023-03-31.pdf>, as of April 11, 2024.

Parliamentary Budget Officer (2023a). *A Distributional Analysis of the Federal Fuel Charge under the 2030 Emissions Reduction Plan*. Office of the Parliamentary Budget Officer. <https://distribution-a617274656661637473.pbo-dpb.ca/7590f619bb5d3b769ce09bdbc7c1ccce75ccd8b1bcfb506fc601a2409640bfdd>, as of April 11, 2024.

Parliamentary Budget Officer (2023b). *A Distributional Analysis of the Clean Fuel Regulations*. Office of the Parliamentary Budget Officer. <https://distribution-a617274656661637473.pbo-dpb.ca/e884599e101a53a3388d8c69884637f349b215fa483ca0089301ecb897da02b1> as of April 15, 2024.

Scace, Matt (2024, March 14) Coal Power Will Soon Disappear from Alberta's Grid—Six Years Ahead of Schedule. *National Post*. <https://nationalpost.com/business/energy/coal-power-disappearing-alberta-grid/wcm/147effa9-ef6a-4922-9223-e85113f041e2>, as of May 3, 2024.

Toda, Masaki, Masahiro Watanabe, and Masakazu Yoshimori (2021). An Energy Budget Framework to Understand Mechanisms of Land–Ocean Warming Contrast Induced by Increasing Greenhouse Gases. Part I: Near-Equilibrium State. *Journal of Climate* 34, 23: 9279–9292. <https://doi.org/10.1175/JCLI-D-21-0302.1>, as of May 3, 2024.

Treasury Board of Canada Secretariat (2024). *Policy on Cost-Benefit Analysis*. Government of Canada. <https://www.canada.ca/en/government/system/laws/developing-improving-federal-regulations/requirements-developing-managing-reviewing-regulations/guidelines-tools/policy-cost-benefit-analysis.html>, as of April 15, 2024.

Tremblay, Guillaume, & Olivier Rancourt (2022). *The Economic Impact of Applying a Carbon Emissions Cap to the Oil and Gas Sector*. Montreal Economic Institute. <https://www.iedm.org/wp-content/uploads/2022/11/note152022_en.pdf>, as of April 15, 2024.

Zinchuk, Brian (2024, April 14) SaskPower Turns Sod on Natural Gas-Fired Aspen Power Station near Lanigan. *The Pipeline Online*. <https://pipelineonline.ca/saskpower-turns-sod-on-natural-gas-fired-aspen-power-station-near-lanigan/>, as of May 3, 2024.

Appendix: Major Studies That Have Examined the Impact of GHG-Related Policies

The Conference Board of Canada (2024) has examined the impact of the proposed GHG cap on the oil and gas sector. They suggest that between 82,000 to 151,000 jobs will be lost across Canada by 2030, with Alberta experiencing between 54,000 to 91,500 of the total. Between 2030 and 2040, Canada is expected to experience a significant decline in employee earnings, with a cumulative reduction of up to $460 billion. Nominal GDP is projected to be reduced by $600 billion to $1 trillion, with the federal government revenue decreasing by $84 billion to $151 billion, and Alberta government revenue dropping by $73 billion to $127 billion during the 2030 to 2040 period.

Tremblay (2022) suggests that implementing a cap-and-trade system for the oil and gas industry, as outlined in the proposed *2030 Emissions Reduction Plan*, would require a production cut of 42% if no new reduction in GHG intensity can be achieved by 2030. This could result in revenue losses of up to $79 billion by 2030.

The Parliamentary Budget Officer (2023a) provides estimates for the distributional impacts of the federal fuel charge in fiscal year 2030–31, covering the increase in the charge from $65 per tonne in 2023–24 to $170 per tonne in 2030–31. When the impacts on the loss in employment and investment are considered, net costs increase for all households reflecting the overall negative economic impact of the charge. Furthermore, the federal deficit is expected to increase by $2.3 billion in 2024–25 and by $7.1 billion in 2030–31, when the charge reaches $170 per tonne.

The Canadian Energy Centre (2023a–c) has estimated sector-specific costs of implementing a carbon tax of $170 per tonne in provinces across Canada. Some of the notable findings are as follows:

- In British Columbia production costs for Non-metallic Mineral Mining and Quarrying would increase by 5.5% while the Forestry and Logging industry's costs would jump by 6.1% and those of the Fishing, Hunting, and Trapping sector could see a 5.2% increase. The most significant rise, however, is predicted for Support Activities related to Oil and Gas extraction, whose costs would potentially increase by 9.5%.

- In Ontario a carbon tax of $170 per tonne would bring an average cost increase of more than 62% in the Iron and Steel Manufacturing industry, 10% in the Utilities industry and 6.3% in the Transportation and Warehousing sector.
- In Newfoundland and Labrador, the Utilities sector is expected to face a production cost increase of over 9% on average, and the Forestry industry would experience an increase of more than 5%.
- For Prince Edward Island, the agriculture sector primarily benefits from exemptions but its cost hike stems from the knock-on effect of increased expenses in other industries, which are then passed on to agriculture. As a result, the farming sector is expected to see a 4% increase in production costs. Food Manufacturing and Basic Chemicals would see increases of 2% and 9%, respectively.
- In Nova Scotia, $170 per tonne carbon tax would raise costs in the utilities sector by more than 90%.
- In New Brunswick the Utilities sector would see the highest production cost increase in the province at 42.1%. Costs in the Transportation and Warehousing sector would increase by about 7%, and by about 5% in Forestry and Logging and Manufacturing.

Navius Research Inc. (2023) has conducted simulations to assess the economic implications of the proposed Clean Electricity Regulations (CER). Their findings suggest that implementing the CER alongside existing provincial and federal climate policies would result in a 0.3% reduction in Alberta's GDP growth rate from 2020 to 2040. In practical terms, this would equate to a loss of $35 billion in Alberta's GDP over the same period.

The Parliamentary Budget Officer (2023b) has also offered an analysis on the costs of Clean Fuel Regulations (CFR). According to the PBO, upon full implementation in 2030, these regulations will result in a notable increase in gasoline prices, potentially rising by up to 17 cents per litre, and diesel fuel costs may escalate by as much as 16 cents per litre. The PBO's findings suggest that Ottawa's CFR could impose additional financial burdens on the average Canadian household, with potential expenses of up to $573. Notably, the analysis underscores a disproportionate impact on lower-income earners, who may bear a heavier burden due to a larger portion of their income being allocated to energy and other goods affected by price hikes. Specifically, the PBO estimates that the poorest households could face an extra $231 in expenses.

About the Author

ROSS MCKITRICK holds a Ph.D. in economics from the University of British Columbia (1996) and is a Professor of Economics at the University of Guelph in Guelph, Ontario and a Senior Fellow of the Fraser Institute in Vancouver. He is the author of Economic Analysis of Environmental Policy published by the University of Toronto Press in 2010. He has been actively studying climate change, climate policy, and environmental economics since the mid-1990s. He has served as an invited expert reviewer for both Working Groups I and II of the last three Assessment Reports of the UN Intergovernmental Panel on Climate Change. He built and published one of the first national-scale Computable General Equilibrium models for analyzing the effect of carbon taxes on the Canadian economy in the 1990s. His academic publications have appeared in many top journals including the Journal of the Royal Statistical Society, Proceedings of the National Academy of Sciences, Journal of Geophysical Research, Climate Dynamics, Journal of Environmental Economics and Management, Canadian Journal of Economics, Canadian Public Policy, Energy Economics, Journal of Forecasting, Climatic Change, Climate Change Economics, and Environmental Economics and Policy Studies. He has also written policy analyses for numerous Canadian and international think tanks. Professor McKitrick appears frequently in Canadian and international media and is a regular contributor to the Financial Post Comment page. In addition to his economics research his background in applied statistics has led him to collaborative work across a wide range of topics in the physical sciences including paleoclimate reconstruction, malaria transmission, surface temperature measurement and climate model evaluation.

Professor McKitrick has made many invited academic presentations around the world, and has testified before the US Congress and committees of the Canadian House of Commons and Senate. His articles and other writings are available at rossmckitrick.com.

Acknowledgments

The author is grateful to Elmira Aliakbari, Julio Mejia and two anonymous reviewers for their helpful input. Any remaining errors or omissions are the sole responsibility of the author. As the researcher has worked independently, the views and conclusions expressed in this paper do not necessarily reflect those of the Board of Directors of the Fraser Institute, the staff, or supporters.

Publishing Information

Distribution

Our publications are available from <http://www.fraserinstitute.org> in Portable Document Format (PDF) and can be read with Adobe Acrobat® or Adobe Reader®, versions 8 or later. Adobe Reader® DC, the most recent version, is available free of charge from Adobe Systems Inc. at <http://get.adobe.com/reader/>. Readers having trouble viewing or printing our PDF files using applications from other manufacturers (e.g., Apple's Preview) should use Reader® or Acrobat®.

Ordering publications

To order printed publications from the Fraser Institute, please contact:
- e-mail: sales@fraserinstitute.org
- telephone: 604.688.0221 ext. 580 or, toll free, 1.800.665.3558 ext. 580
- fax: 604.688.8539.

Media

For media enquiries, please contact our Communications Department:
- 604.714.4582
- e-mail: communications@fraserinstitute.org.

Copyright

Date of issue

July 2024

ISBN

978-0-88975-788-2

Citation

Ross McKitrick (2024).
The Economic Impact and GHG Effect of the Federal Government's Emission Reduction Plan through 2030
<http://www.fraserinstitute.org>

About the Fraser Institute

Our mission is to improve the quality of life for Canadians, their families, and future generations by studying, measuring, and broadly communicating the effects of government policies, entrepreneurship, and choice on their well-being.

Notre mission consiste à améliorer la qualité de vie des Canadiens et des générations à venir en étudiant, en mesurant et en diffusant les effets des politiques gouvernementales, de l'entrepreneuriat et des choix sur leur bien-être.

Peer review—validating the accuracy of our research

The Fraser Institute maintains a rigorous peer review process for its research. New research, major research projects, and substantively modified research conducted by the Fraser Institute are reviewed by experts with a recognized expertise in the topic area being addressed. Whenever possible, external review is a blind process. Updates to previously reviewed research or new editions of previously reviewed research are not reviewed unless the update includes substantive or material changes in the methodology.

The review process is overseen by the directors of the Institute's research departments who are responsible for ensuring all research published by the Institute passes through the appropriate peer review. If a dispute about the recommendations of the reviewers should arise during the Institute's peer review process, the Institute has an Editorial Advisory Board, a panel of scholars from Canada, the United States, and Europe to whom it can turn for help in resolving the dispute.