Fairness and Effectiveness of Canada's Commodity-Based Carbon Tax System

Synopsis of results from investigations undertaken for MBA course IDM 7090 G05 (Sustainability Economics - Winter 2024)

August 2024 (Report Version 2.0)

Robert V. Parsons *, Jonathan Alegria, Ramy Penner and Ryan Tan, I.H.
Asper School of Business, University of Manitoba

This report provides a synoptic assessment of Canada's commodity-based carbon tax, focusing on fairness and effectiveness

Table of Contents

Page

Summary

[The summary for this report is presented in an op-ed style format for possible publication]

Canada is at an important juncture, with the Liberal government facing an imminent decision, important in terms of policy and politics. What should be done with the commodity-based carbon tax? This marquee policy, especially for the Prime Minister, was promised would address climate change by dramatically reducing greenhouse gas (GHG) emissions at low cost. Undeniably, the policy has become controversial and divisive. General shifts in public opinion have turned solidly against the carbon tax, despite tweaks. No one appears listening any longer to government rhetoric.

Political acceptability is key for any emission reduction policy, fail-score here, but this is not the only evaluation criterion. More important are two others. First is effectiveness, the ability to demonstrate overall reductions. Second is fairness, ensuring equity, especially not imposing excessive impacts on lower-income households. For more than a year, the Liberal government has promoted their carbon tax as a quasi-social program, exhorting that “eight of ten households are better off.” But is it really true?

There are many opinions of the carbon tax, including “dueling computer models,” yet surprisingly absent are updated evaluations using actual data. As part of graduate-level studies in sustainability economics, MBA students at the Asper School of Business over successive years have evaluated ongoing effectiveness of the carbon tax, with also most recently a team specifically investigating fairness. And, as a spoiler alert, the results are not pretty.

Effectiveness was considered in two ways using updated data. The genesis of the policy was in British Columbia, introducing North America’s first carbon tax in 2008. It was lauded, including initial investigations suggesting big reductions. But what happened? Time-series analyses, involving total transport-related emissions over 18 years from 2005 through 2022, compared British Columbia to Sweden, both with comparable scale

emissions, both incorporating carbon taxes. Yet results are starkly different. Since 2005 Swedish has shown a steady decline, down 0.4 million tonnes annually, while British Columbia has shown a relatively steady increase, up 0.3 million tonnes annually. Results are statistically significant. Sweden's carbon tax is strongly linked with declining emissions, demonstrating success, while British Columbia at best is a question mark. Extolled as an environmental leader, British Columbia has never actually led on emission reductions. Indeed, using 2022 data it ranks third worst. Enthusiasm to adopt their system appears upon closer re-examination to have been unjustified.

The second evaluation involved the federal back-stop carbon pricing system applied to two designated liquid fuels, on-road gasoline and on-road diesel, across four applicable provinces: Alberta; Saskatchewan; Manitoba; and Ontario. To avoid awkward positive relationships, analysis considered three-years, 2020 through 2022, using 2019 as the baseline. Emission reductions by 2022 totaled only about 3.8 million tonnes, negligible compared to 2019 emissions of 752 million tonnes. The small reduction is further complicated in assuming all reductions could be ascribed to the carbon tax, whereas in reality, other factors, notably COVID, were more important.

The cost of cumulative carbon tax payments over the three years, to achieve reductions, totaled more than $9.1 billion. The resulting raw cost of reductions translated to $2,400 per tonne. Given that a significant portion of these costs are returned to households, it is legitimate to reduce the cost based on the returned proportion, but with less actually being returned than promised. Including rebates, the revised cost of reduction translates to about $290 per tonne. In 2023, the value of the social cost of carbon was increased by the Minister from $50 to about $260 per tonne, effectively representing the "cost of doing nothing." Based on calculations, even optimistically, the cost per tonne reduction for the carbon tax turns out to be worse than the cost of doing nothing; hardly positive.

Regarding fairness, the team of Jonathan Alegria, Ramy Penner and Ryan Tan, focused evaluation on a single province, Manitoba, during one year, Fiscal 2021-22. Data were reported by government for that year, with a variety of other sources to allow data

triangulation. Total proceeds were indicated as $369 million, with this value corroborated through other sources, also allowing a breakdown in terms of fuel types and applications, both direct and indirect. For example, direct costs associated with household vehicles using gasoline, translated to about $117 million, representing the largest single cost. Two other important figures presented, however, were problematic and appeared to come out of thin air, without justification.

The average rebate was suggested to be $705 per household. This value was unrealistically high, indeed mathematically impossible, given both the clearly outlined rebate formula, and the nature of Manitoba's population and household makeup. Based on data from Census 2021, a more realistic average rebate could be estimated as no more than $614 per household.

The average cost of the carbon tax system was suggested to be only $462 per household. This value was unrealistically low, representing only 60% to 65% of total proceeds, similar to the proportions show in earlier Parliamentary Budget Officer reports, suggesting similar computer models rather than data. The nature of pass-through down supply chains was fully acknowledged in design of the carbon tax, but appeared down-played or ignored in reporting of results. Diesel is a good example, entirely indirect, being used to transport goods and freight, which based on a reasonable pass-through translate to more than $73 million, the second largest cost faced by households. Combining calculated direct-costs and indirect-costs, the latter using reasonable pass-through to reflect operational realities of supply chains, a more realistic average cost could be estimated as $652 per household.

Instead of a purported average net rebate of $243 per household in Manitoba, analysis showed an average net cost of $38 per household. Such contradictory results suggest realistically the Liberal's claim that "eight of ten households are better off" is untrue. The government legitimately could have made much more modest claims, but then no catchy electioneering-style slogan.

Students identified a long list of additional problems: levies and rebates inherently biased against lower-income households, with a “fiction of progressivity”; no consideration whatsoever of equity in the rebate formula, e.g., income testing, and no guarantee lower-income people are better-off; lack of transparency in carbon tax pass-throughs, a hidden concern with cost implications; continuing lack of adequate support for public transit as an affordable alternative to private vehicles, with services now deteriorating; significant numbers of Canadians not filing taxes and ineligible for rebates, a high proportion lower-income; specific impacts on First Nations and Indigenous citizens; and inflationary effects, that appear may be more significant than acknowledged.

All in all, the commodity-based carbon tax appears to produce negative impacts, including for lower-income households. The results suggest fail-scores on effectiveness and fairness criteria. From both a policy and a political perspective, a prudent move for the federal government would involve cutting losses and suspending the commodity-based carbon tax system, moving instead to measures that can demonstrate better effectiveness and fairness. A bigger concern is whether the Liberals are listening. One last point is that comments and analyses do not involve the Output Based Pricing System, a completely separate matter to consider.

[Note word count = 1,162]

1. Introduction

Carbon taxation is a policy measure specifically intended to address greenhouse gas (GHG) emissions It is a policy measure that falls within the broad category of “economic instruments” as opposed to regulatory controls. Since 2019, the Government of Canada has required the levying of carbon taxes across the country at levels progressively increasing over time, rising from $20 per tonne CO_2e in 2019 to potentially as high as $170 per tonne CO_2e by 2030.

Before considering carbon taxation, it is important to first outline the major criteria employed for the evaluation of emissions reduction-related policies in general. As summarized by Parsons (2021), the United Nations Framework Convention on Climate Change (UNFCCC) identifies four major different evaluation criteria, summarized as follows:

- **Economic efficiency**, involving the ability for the policy to be adopted within the economic system without causing excessive additional costs or competitiveness problems, with this often described the most important strength of carbon taxation;
- **Institutional feasibility**, in particular including political acceptance;
- **Distributional implications**, including fairness of impacts and ensuring equity across societal and income groups; and
- **Effectiveness**, expressly involving the ability to demonstrate adequate, desirably large, reductions in GHG emissions, with this often judged to be most important.

Because of the economic orientation involved, carbon taxation has been promoted by a number of economics professionals, in particular compared to the option of imposing direct regulatory “command and control” limitations (Open Letter… 2024). Various declaration and assertions have been made about carbon taxation, but there are also important concerns.

Carbon taxation as imposed in Canada, has turned out to be a contentious and politically divisive policy, which is problematic under the second criterion identified. That the tax is controversial is undeniable, with ample reporting in Canadian media, in particular over the past roughly one-year. A variety of identified concerns include:

- Selected carve-outs by the federal government that were well established to have been politically motivated (Bishop 2023, Cash 2023);
- Plummeting public support for carbon taxation, well below 50% by late 2023 (AngusReid Institute 2023);
- Significant and nation-wide protests ongoing over the carbon tax, especially around the April 1st 2024 increase in levy (Boyton 2024);
- One provincial government literally refusing to pay selected levies (Canadian Press 2024); and
- Canada’s ongoing poor performance in terms of emission reductions (Parsons 2024a).

Given this background, carbon taxation is already destined to be a focal issue in the next Canadian federal election campaign, occurring no later than the Fall of 2025, or possibly sooner. There are two main areas of controversy, both of which are addressed in this paper.

The first issue is **fairness of the carbon tax** in ensuring social and economic equity, in particular across income groupings. This relates to the third identified criterion. The carbon tax, as implemented within Canada, was not originally touted as a social program. However, as the situation and controversy associated with the carbon tax have developed, it appears to have become increasing presented as a social program. Importantly, assertions of social fairness have rested so far primarily on very selected future-oriented commuter model evaluations, rather than on available actual data. Hence on this aspect, updated assessment is a necessity.

As part of recent graduate-level studies in sustainability economics, a group of MBA students directly examined the fairness issue, in order to identify both deficiencies and opportunities for improvement. Their work is combined in this report with additional analysis to try clarify a more precise breakdown of carbon tax sources and rebate distribution. The objective of the latter is to more-objectively review whether or not the claim of the Government of Canada that eight of ten Canadian households gain more back in rebates than pay in carbon taxes is true.

The second issue is **effectiveness of the carbon tax** in achieving actual reductions in emissions toward Canada's ambitious, likely overly ambitious, reduction goal for 2030. This part of the report follows up on earlier work by Parsons (2021), and includes newly available data.

Carbon taxation certainly involves elegant economic theory, but its effectiveness in practice continues to be dogged by questionable results. On this, much of the justification for implementation and rationale for apparent success rests on preliminary analyses of limited data from some time ago involving application in British Columbia (BC). Unfortunately, however, on this there has been little further follow-up. There is thus an obvious need for re-evaluation, in particular of BC's performance, based on more recent and extensive ongoing data, this in order either to more validly confirm or refute the efficacy of the carbon tax over time.

In order to address current issues of concern, this report is broken down into three major components:

- Brief explanation of carbon taxation mechanisms in general and two main effects involved, Canada's current trajectory on overall GHG emissions, including most recently available data, and a range of concerns that have come to light (Section 2);
- Updated evaluation of effectiveness of the carbon tax, based on more recent data (Section 3); and
- Updated evaluation of fairness of the carbon tax, piecing together existing data using reasoned-allocation, triangulation and reconciliation of data from multiple sources, such as fuel consumption, in order to establish likely flows of tax proceeds and rebate payments, instead of computer modeling (Section 5).

2. Carbon Tax Mechanisms, Operations, and Limitations

Carbon taxation, of course, involves an economic instrument, specifically a form of emission-fee system, with the express intent to control, and hopefully reduce GHG emissions. A highly related approach with some operational distinctions involves cap-and-trade, a form of tradeable-permit system, but also inherently based on use of an economic instrument.

A first important situation to clarify is that Canada currently has two major and distinct forms of carbon taxation systems operating simultaneously, with the distinctions also paralleled in provinces adopting cap-and-trade systems. As outlined by the Office of the Parliamentary Budget Officer (PBO 2019), these involve:

- Commodity-fuel based carbon taxation in the form of per-unit regulatory charges applied to designated fossil fuels, with these consisting primarily of gasoline, diesel, natural gas, plus a number of minor contributing fuels like propane, heating oil and aircraft fuel; and
- Output Based Pricing System or OBPS applied for large industries, these consisting of designated Large Final Emitters (LFE) as well as industries deciding to voluntarily opt in.

The report deals solely with the commodity-fuel based carbon tax, and includes no direct discussion of the OBPS. There is vast literature regarding the general subject of carbon taxation, in particular commodity-fuel based carbon taxes. Given many background reviews that outline working principles, no exhaustive in-depth explanation or review is needed. There are many variations in how the policy can be implemented, however, with various subtleties.

Given subtleties, several aspects are important to first describe. For this purpose, two brief and readily available references are useful. First, is by the Center for Climate and Energy Solutions (C2ES) (2013) in the United States. Second, is by McKitrick (2016) in Canada.

Carbon taxation as applied to commodity-fuels can involve two different effects, although sometimes combined, with these separately explained:

- First involves direct pricing effects, impacting the price as available to consumers, and thus hopefully reducing the consumption of fossil fuels; and
- Second involves revenue generation effects, in particular in how collected funds may be employed.

2.1 Pricing Effects of Carbon Tax

The first, “pricing”, effect and its implications can be explained in three ways using microeconomic principles. The first approach is illustrated in Figure 1, involving a simple supply-demand plot for a consumer product with embedded carbon, like fuel. Scale is not intended to be representative, but for illustration. This is consistent with presentation by Gerbeti (2021).

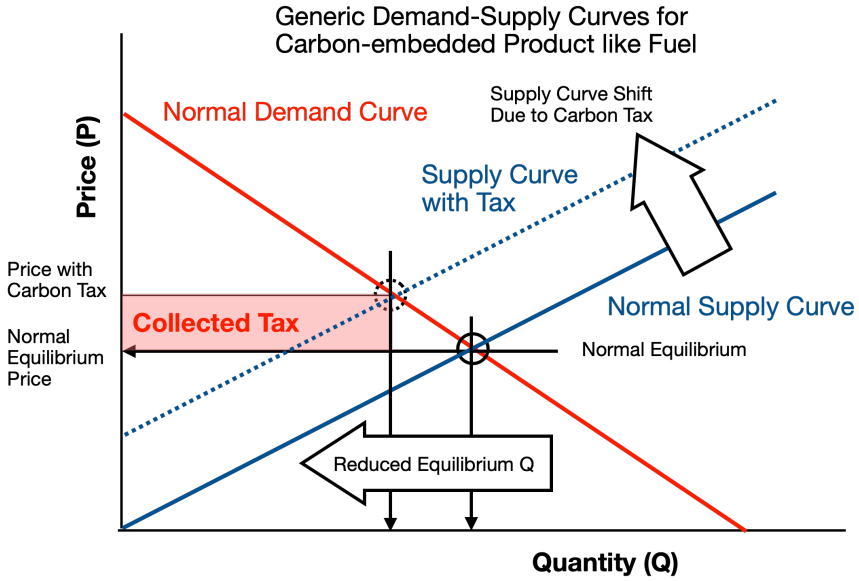

Figure 1. Illustration of Desired Price Effect of Carbon Tax to Reduce Consumption

Under normal circumstances, market price is set by the intersection of supply and demand curves, i.e., where the marginal benefit = marginal cost. However, this situation does not recognize nor include environmental externalities, such as GHG. Inclusion of the carbon tax effectively pushes the supply curve up, reflecting higher overall costs due to externalities. Without changes in demand curve, the equilibrium is pushed to a higher market price, with lower consumption. In essence, addition of the tax pushes up product costs, making it less attractive, reducing consumption, and hence reducing emissions. Carbon tax collected is also illustrated.

The second approach to considering the carbon tax comes from analyses of companies discharging specific pollutants, the associated marginal damage cost (MDC) caused by pollutant releases and the marginal abatement cost (MAC) to reduce pollutant releases. The MAC and the MDC represent respectively the cost for control/removal of, and the damage from the next incremental unit of the specific pollutant. From an overall perspective, when multiple companies are involved, the economically optimum control point occurs, obviously, when MDC = MAC, i.e., where aggregate combined costs of damages from uncontrolled releases and costs for controls by companies are at overall minimum. Yet, when multiple companies are involved, how can the costs of control be distributed on an economically efficient basis?

A simple two-company model is frequently used to illustrate this situation, as in Figure 2 and Figure 3. In Figure 2 only MAC are considered for the two companies, with the government authority separately determining what may be acceptable emission releases. Increasing control for the first company is shown moving to the right, and increasing control for the second company is shown moving to the left.

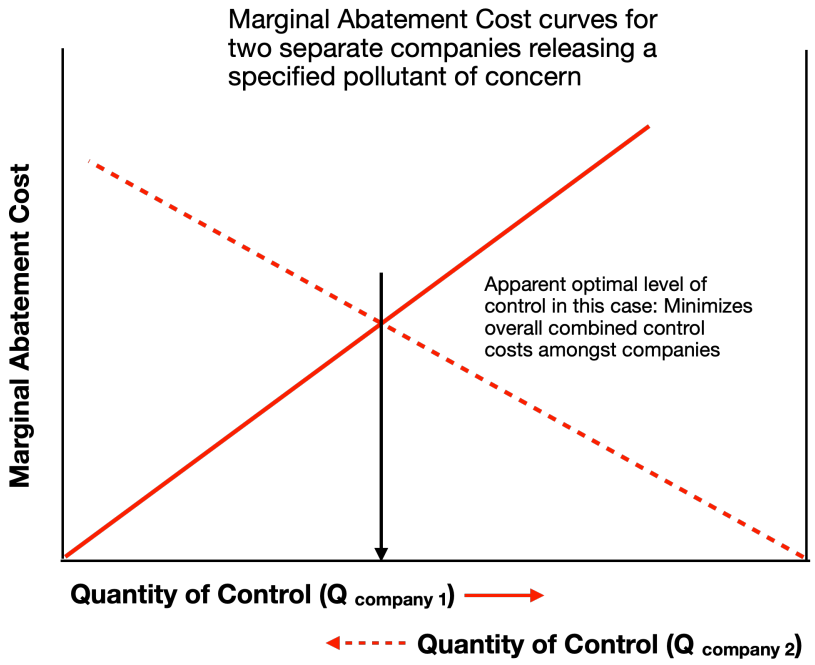

Figure 2. Model of Two Companies and Associated Marginal Abatement Costs

Again, to emphasize specific points, these plots are not on a representative scale and are shown merely as straight lines (though in such cases are likely upward curves). Importantly, in Figure 2, while marginal abatement costs for the two separate companies are the same, the costs borne by each individual company may indeed be different. The resulting economic-based allocation deals solely with economic-efficiency and not "fairness".

At the point where $MAC_{company\ 1} = MAC_{company\ 2}$ corresponds to the overall minimum abatement cost. The level of control achieved will correspond to the aggregate sum of the emissions controlled by individual companies (i.e., area under curve). This situation certainly introduces incentives for companies to "game" the system for their own advantage, e.g., claiming over-performance of abatement, while actually releasing more than indicated or anticipated, which need policing. To provide a more systematic approach, an emission-fee can be employed, i.e., carbon tax in the case of GHG emissions, with effects as illustrated in Figure 3.

The imposition of a stipulated fee encourages firms to control emissions up to the level where their MAC equals the emission-fee. This is given that control is less costly for the company up to that point. All companies are similarly motivated, so all will tend to control up to the level of the fee, just paying the fee above that level of control.

An inherent problem with this arrangement is that the level of the emission-fee may, or may not, correspond to the optimum abatement point, whereby total costs of control are minimized, nor correspond necessarily to the desired pollutant reduction level. Achieving both becomes effectively trial and error.

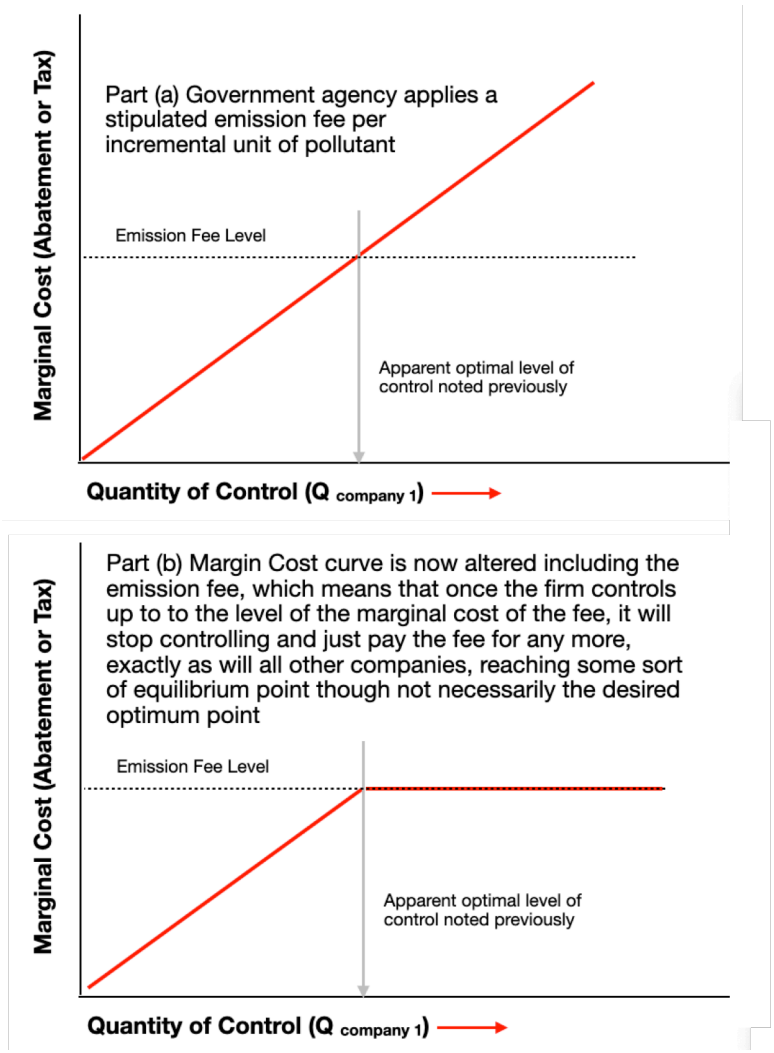

Figure 3. Impacts of Employing Emission Fee on MAC for Individual Company

It is this express situation that led to consideration of a variation of the emission-fee policy, namely the tradable-permit approach, so-called “cap-and-trade” systems for GHG emissions. While cap-and-trade systems have been frequently lauded, they are not necessarily best for any given set of circumstances. Emission-fee systems provide more certainty for companies in understanding the cost of control faced into the future, and inherently lead to better industry response to improvements in emission control technologies, i.e., more-innovative technology is implemented given it results in lower costs, with resulting lower emissions too. Tradable-permit systems, on the other hand, ensure more certainty in the overall level of control achieved, and respond inherently better to both inflation and to new additional emission sources (C2ES 2015).

Several complications are immediately apparent considering GHG emissions:

- Basis for and earlier experience with emission-fee systems and tradable-permit systems alike has involved control by companies of specifically identified air-pollutants of concern, including sulphur oxides (SOx), nitrogen oxides (NOx), and particulate matter (PM).
- Concentrations for such pollutants are reasonably low in all cases to start, with control technologies also available at reasonable costs, such as catalytic converters in automobiles for NOx, or scrubbers at power plants for SOx.
- GHG emissions on the other hand, especially carbon dioxide, are more ubiquitous and are not generally toxic, with elevated concentration levels generated, especially in exhausts from combustion processes, both stationary and mobile.
- Carbon dioxide removal (or recovery) is an expensive process, and can involve significant input energy as well as large quantities of toxic solvents or caustic solutions, the latter themselves generated using relatively high energy- and emission-intensive processes.
- Practical tactics involve reduction or displacement of fossil fuels consumption in the first place. Hence a focus on efficiency improvement, or new alternative technologies not employing fossil fuels, e.g., electric vehicles or ground source heat pumps.
- The latter alternative technologies, however, tend to be very expensive, and can involve other serious sustainability consequences that need to be addressed, e.g., cobalt mining for car batteries and serious associated social abuses, or refrigerants necessary to operate all heat pumps, having very high Global Warming Potential (GWP) values if released.
- Unlike the two-company example analysis presented, there is little ability to incrementally reduce GHG; instead, the situation becomes one of all-or-nothing. As such, companies and consumers are forced make significant bets on technology, with little to no certainty they will be economically practical over the longer-term, entailing significant associated risks.

Analysis by McKitrick (2016) further extends consideration of the carbon tax to a broader societal perspective beyond individual discrete source-companies or consumers in order to address the above. This is illustrated in Figure 4, with key points following:

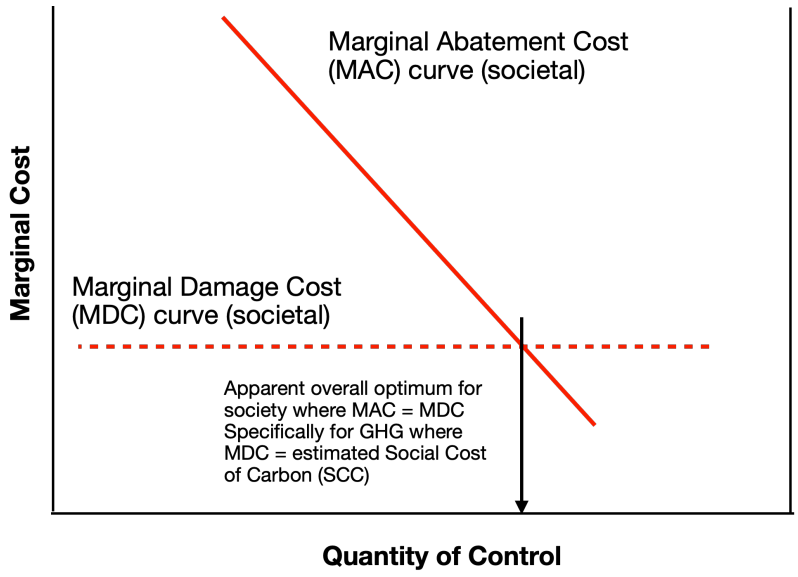

Figure 4. Representation of Overall Societal Optimum where MDC = MAC

- Given GHG generation overall by Canada is relatively small from an international perspective, any reductions or increases in GHG within the country will not cause any appreciable change world-wide. As such the MDC thus remains effectively constant.
- At the same time, costs for abatement are still at play, and are variable, hence a downward sloping curve for MAC, similar to that illustrated for Company 1 in Figure 2.
- Combined curves still define an optimum equilibrium where MDC = MAC, as illustrated. This represents where the overall combined costs of damages and for controls are minimized, however, given the flat MDC curve, this point is effectively determined by the MDC value.

This sort of analysis puts increased emphasis on understanding the overall country-based MDC. A useful policy tool in this regard, as employed in particular within the United States and Canada, has been the social cost of carbon (SCC). The SCC represents an estimate of the present value of future damages associated with the release of a unit of GHG today, typically per tonne (Rennert and Kingdon 2019; Asdourian and Wessel 2023).

The nature of what the SCC value should be, of course, is subject to interpretation. A major variable impacting the SCC is the discount rate employed. For some time, in both Canada and the U.S., the SCC value was approximately $50 per tonne, with this based on a 3% discount rate. In the U.S. during the Trump Administration, the SCC value was dramatically lowered, due specifically to a much higher discount rate employed. When the Biden Administration began, the SCC value was quickly revamped back to around $50 per tonne based on a 3% discount rate, with further review and update following.

In 2023, the Government of Canada elevated the SCC to approximately $260 per tonne (ECCC 2023a). While the Minister of Environment emphasized severity of damages and threats (Rabson 2023a), it was not directly stated, but apparent from reviewing report details, that this increase resulted primarily via a reduction of the discount rate to 2%. The $260 per tonne value is further indicted to be equivalent on a currency-converted basis with recent U.S. estimates.

Based on McKitrick's analysis approach, a suitable country-wide level for the carbon tax could be construed as the SCC, representing a national estimate of MDC. This line of thinking would further lead to an earlier suggested carbon tax of around $50 per tonne, more recently upwards of $260 per tonne. The latter, however, is extremely high. The precise suitable value is still subject to debate. An unexpected beneficial use of the SCC is that by definition it provides an estimate of the "cost of doing nothing." While this could be viewed as a bit backhanded and cheeky, it is an entirely reasonable interpretation and is employed later in this report.

2.2 Revenue Generation Effects of Carbon Taxes

If and when a carbon tax is stipulated as policy, the obvious question arises regarding, "What should be done with the revenues?" On this, there are divergent opinions regarding how best to employ funds, with the Eco-Fiscal Commission (EFC) group identifying a reasonably comprehensive list of options (Ragan et al. 2016). This used as a basis, with further augmented list as follows:

- Retain as part of government general revenues to support other government services;
- Transfer revenue to households;
- Reduce income (or other) taxes;
- Invest in emissions-reducing innovation and technology;
- Invest in critical public infrastructure;
- Reduce government debt; or
- Provide transitional support to industry, in particular so-called emissions-Intensive, trade-exposed (EITE) industries (Dobson and Winter 2018).

Of these options, investment in emissions-reduction technologies obviously serves to amplify reduction performance. This is for example seen with so-called “feebate” systems, whereby higher levies applied to vehicles with high fuel-consumption (price effect) are used to provide rebates for efficient vehicles (revenue generation effect), thus enhancing a shift in consumer purchasing behaviours (C2ES 2015).

Under the backstop carbon tax system as implemented in Canada starting in 2019, it was originally intended for 10% of funds to go to small and medium businesses, MUSH sector (municipalities, universities, schools and healthcare), or First-Nations to support efficiency improvements. However, so far this approach this largely failed (Solberg 2024), significantly due to poor uptake, and appears to be now abandoned. The alternative ideas of using funds for investments in infrastructure, debt reduction, or support of vulnerable industries all have valid rationales, however, the emphasis in Canada has been direct payments to households, sometimes termed “revenue recycling.”

Although much of the rationale presented for revenue recycling by the Government of Canada relates to apparently ensuring equity, especially for lower-income Canadians, discussed later, the overriding focus appears to have been on building political-acceptance. The nature of and equity issues associated with federal rebates to households are discussed in more detail later.

In the lead-up to implementation of the national carbon tax structure in April 2019, the Pan-Canadian consensus enjoyed by the federal Liberals, going back to 2016, had dramatically fractured, with control of a significant proportion of provincial governments shifting to parties holding anti-carbon tax positions during the 2018-2019 timeframe. A stop-gap political solution began to emerge that, “taxpayers will back a carbon tax if they get a cheque in the mail.” This was exemplified by an apparently influential article by Antweiler and Gulati (2018), with suggestions appearing to have been adopted, but at the same time confirming a clear motivation more toward political-acceptance, not social-equity. In a further unexpected irony, more recent work by Mildenberger et al. (2022) found in particular for Canada that rebates have proved ineffective for enhancing political-acceptance of carbon taxes. As such, carbon taxation remains politically divisive in Canada.

2.3 Canada's Promised Reductions and Current Emissions Trajectory

In order to fulfill requirements under the UNFCCC, Canada, like other nations annually issues a National Inventory Report (NIR). This provides a compilation of GHG sources and sinks: for country as a whole; for major defined sectors; and for individual provinces and territories. Data in all cases are summarized back to 1990. Due to the quantities of information required, all submitted reports involve a two-year delay. As such, the most recent report provides data for performance in 2022 (ECCC 2024a). A further aspect of reports is that because of alterations and updates as time progresses, values for the past can be, and indeed have been, adjusted.

As part of the 2015 Paris Agreement negotiated at the COP11 (Conference of Parties) meeting held in France, and ratified by Canada in 2016, all parties to the agreement were required to establish Nationally Determined Contributions (NDC) representing their proposed target for reductions of GHG. Initially, a NDC target for Canada was set by the Federal Government as achieving a 30% reduction in overall GHG levels by 2030 compared to 2005 as the baseline year. Canada also committed to looking at more-stringent reduction targets, and in 2021 committed to an even more ambitious reduction of 40% to 45% in overall GHG levels by 2030 compared to 2005 as the baseline year (Office of the Prime Minister 2021, with background provided in ECCC 2021a).

Using Canada's most recent data (ECCC 2024a), a time-series track of overall national GHG emissions per year is presented in Figure 5, starting in 2005, the selected baseline year for Canada. To this plot is also added a regression of time-series data starting from 2005.

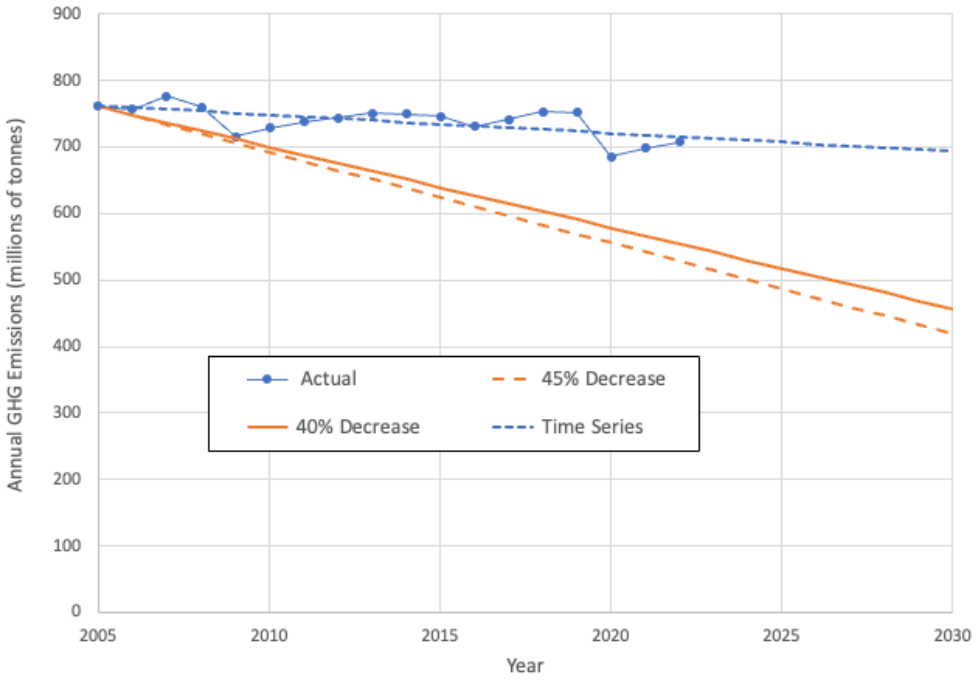

Figure 5. Canada's Overall National GHG Emissions from 2005 Forward

A number of observations can be made about Canada's performance since 2005, based on this data, and also considering Canada's committed reductions:

- Results for 2022 show Canada only reduced emissions since 2005 by about 53 million tonnes, or about 7%.
- In order to reach the Liberal government target, Canada must reduce emissions by a minimum of 31 to 37 million tonnes annually year-on-year until 2030 (or 4% to 5% annual reduction year-on-year), which is unrealistic.
- Regression of time-series data for annual emissions shows a slight downward slope since 2005, with the projected level of emissions by 2030 corresponding to a reduction of no more than 9% compared to 2005. This result, based on historical data so far, is nowhere near the 40% to 45% reduction committed to by the Liberal government.
- The resulting slope from the regression suggests an annual change (reduction) of only about 2.75 million tonnes per year, with analysis showing this regression to be statistically significant, i.e., $p = 0.01$. This reduction trend represents less than a tenth of the reduction needed to meet the target.
- Since 2005, annual emission levels have only declined significantly during two years, namely in 2009 and in 2020, also noted by Canada's Environmental Commissioner (Zimonjic 2023).
- The reasons for reductions in these years are also clear, and in both cases have little to do with government climate-policies, and more to do with external factors.
- The reduction seen in 2009 corresponded to the global recession that began in 2008, and acknowledged as such (EC 2011), while the reduction seen in 2020 corresponded to the COVID pandemic, with associated lock-downs and much reduced activity and travel, again acknowledged as such (ECCC 2022a).

Potentially worrisome is that emission projections from the Government of Canada (ECCC 2023b), suggest that the country's emissions by 2023 are not anticipated to be significantly lower, likely to be roughly similar with 2021, noting values for 2023 will not be officially confirmed until April 2025. This continues to translate to reductions that are not in line with the aggressive 31 to 37 million tonnes year-on-year reductions needed to reach the pending target.

Regarding the reduction targets themselves, Canada has touted itself as having aggressive ambitions, in particular the updated 40% to 45% reduction by 2030. Yet more-objective third-party evaluation of G20 countries by Bloomberg NEF (Cuming 2021) suggests otherwise. Canada was ranked somewhat in the middle (i.e., scoring 4 of 20), comparable with Japan and India, but behind others. These included the U.K. (score 16), the E.U. (score 14), Brazil (score 7), the U.S. (score 7) and Australia (score 5).

While there has been significant international focus on the levels of reduction targets, there has been much less consideration of tracking and comparison of actual year-on-year reduction performance against committed targets. The lack of any systematic tracking internationally on this basis thus represents an important gap. The results from the above diagram raise serious doubts about Canada's performance and ability to actually achieve the stipulated targets.

2.4 Further Concerns with Carbon Taxes

There are further concerns regarding carbon taxes as implemented within Canada, including inconsistencies and limitations that have come to light. These range from general to very specific, and include the following:

- Inconsistencies and alterations in the apparent purpose of the carbon tax;
- Inconsistencies in application of what is considered adequate, in particular carve-outs, as well as taxation of some renewable fuels;
- Concerns regarding consumer responsiveness to carbon taxes being largely ignored;
- Reliance of overly sophisticated macroeconomic input-output models, without adequate attention nor explanation of price elasticity of demand assumptions;
- Lack of adequate proof of effectiveness, in particular over-reliance on selected older work that is now largely long out of date, and not reflecting current data;
- Nature of pass-on of carbon taxes down supply chains.

These points are discussed in the following subsections:

2.4.1 Inconsistencies and Changes in Apparent Purpose

In order to be successful, an emission reduction policy needs to accomplish overall emission reductions, year-on-year, in particular based on actual emissions for a jurisdiction, not just compared to a business-as-usual model. Perhaps unusual to consider at this point, it is still relevant to ask the basic question regarding, “what is the intended primary purpose of a carbon tax?” given that sometimes contradictory and changing reasons have been expressed. Strong proponents like the EFC group, have long asserted that not only is the main purpose of a carbon tax to “reduce GHG emissions,” but that it represents the least-cost way to do so (Ragan et al. 2015; Beugin et al. 2018; Open Letter … 2024).

Yet at the same time, McKitrick (2016) has strongly countered, suggesting that this perspective is incorrect and that the purpose is instead to “impose a cost on an undesired pollutant.” Based on the cost as imposed, consumers will then react as they see fit. They might, hopefully, reduce consumption, but such action is not necessarily guaranteed with a carbon tax, depending on the elasticity of demand for the market involved, as discussed later.

Both McKitrick and economists associated with the EFC group appear to share the belief that carbon taxation is preferred over regulatory command-and-control. A concern arising from McKitrick’s perspective is that if carbon taxation cannot be relied upon to reduce GHG emissions, but GHG emissions indeed still need to be reduced, as per commitments currently in play, then why bother? Why not just stick with some sort of regulatory control?

A similar contradiction is seen internationally regarding the Carbon Pricing Leadership Coalition. This voluntary group, coordinated through the World Bank, has promoted expansion of

international applications. It involves representatives from various governments, including prominently Canada, private sector companies, and non-governmental organizations (NGO). While its most recent report includes various exhortations regarding carbon taxation, including from the Prime Minister of Canada, progress is monitored and reported solely on the basis of implementations (World Bank 2022). No considerations regarding how much in the way of emission reduction results may be achieved are included, emphasizing the contrast, i.e., is it about showing actual reductions, or is it just about implementation, based on an inherent acceptance of the presumption that carbon taxation is "the best solution"?

The most stark but subtle contradictions regarding the primary purpose of carbon taxation are indeed seen in with the Government of Canada, and changing statements over time. Initially the Liberal government strongly promoted carbon taxation as a means to achieve decisive emission reductions; both rapid and quantitatively significant. This is most clearly seen in a key document released by ECCC in the lead up to implementation of the national carbon tax structure (ECCC 2018). The document opens with a strong endorsement:

> Pricing carbon reduces pollution at the lowest cost to businesses and consumers.

It then follows, making a strong assertion regarding performance, both in terms of timing and significance:

> Carbon pricing will make a significant contribution towards meeting Canada's greenhouse gas reduction target. A price on carbon could cut carbon pollution across Canada by 80 to 90 million tonnes in 2022, once all provinces and territories have systems that meet the federal standard. … Without this contribution, more costly regulatory interventions would be needed to meet our target.

This report also specifically cites both Murray and Rivers (2015) and Antweiler and Gulati (2016) as providing evidence on the effectiveness of carbon taxation, with further discussion of these papers later on. Both of these papers are predicated solely on results for "fuel charges" levied on consumers, specifically gasoline, and do not include implications regarding industries.

The initial priority messaging regarding the carbon tax appeared to be as a means to reduce emissions. The use of direct payments of rebates to households was selected as the approach to dispense funds collected, with this appearing predicated primarily on increasing political acceptability.

Beginning in the Fall of 2023, however, emphasis by the Liberal government appeared shift significantly toward "affordability" concerns. At that time, the Prime Minister announced a three-year pause in application of the carbon tax on heating oil for home heating, which also sparked national controversy. The event, as reported by Rabson (2023b), noted the logic in this case that a carbon price not actually encouraging or accomplishing fuel switching amounted ultimately to just a tax with no climate benefit. This logic actually relates to the discussion of price elasticity of demand for fuels.

The announcement in question prominently highlighted the theme “Making Life More Affordable” and included quotable statements such as “We are putting more money back in your pocket …” (Office of the Prime Minister 2023). The event included particularly strident statements by the Prime Minister, for example that Canada is “bending the curve, leading the G7 countries.” This is notable given that objective data shows Canada to have been consistently the worst performer of the G7, definitely not leading.

Moving into 2024, with popularity of both the Liberal government and the carbon tax continuing to fall, some prominent Liberals began to question its efficacy and utility. These included Andrew Furey, Liberal Premier of Newfoundland and Labrador, and Mark Carney, one-time Governor of the Bank of Canada, former Governor of the Bank of England, and prospective Liberal leadership hopeful to replace Justin Trudeau (Leveque 2024). Yet messaging from the government has become more assertive, even combative, “doubling down” rhetoric, in particular given the April 1, 2024 increase of the carbon tax from $65 per tonne to $80 per tonne.

An example of aggressive rhetoric are comments in an interview given by the Minister of Natural Resources, who suggested the Leader of the Opposition should “stop lying to Canadians, because he is telling lies on an ongoing basis and that is just not something a responsible leader should be doing” (Paas-Lang 2024; Common 2024). The Minister went on at length regarding affordability suggesting that:

> At the end of the day eight of ten Canadian families get more money back from the rebate than they pay in the price. It works directly inverse to income so it’s those who are most vulnerable that actually get more money back. And the folks who actually pay more than they get back in rebates are people who live in six thousand square feet homes, own a Hummer and have a boat in their back yard. And you know what, they should pay more because they pollute more.

Messaging by individual government Members of Parliament contain now common statements, with one example being Carr (2024):

> Most families receive more money in rebates than they pay in carbon pricing, particularly those with low or medium incomes.

Such messaging has clearly emphasized a shift in the apparent purpose of the carbon tax, more toward affordability, in particular suggesting that the tax and associated rebate are most beneficial to lower-income families. The accuracy and credibility of such statements remain questionable; hence a significant part of this work to provide better clarification.

2.4.2 Inconsistencies in Application

The most obvious and significant inconsistency in application of the carbon tax was the announcement in 2023 of a three-year pause regarding home heating oil (Wherry 2023). This was controversial, and appeared to contradict the earlier stance of the government.

Earlier in 2021, the federal government successfully defended its *Greenhouse Gas Pollution Pricing Act* (GGPPA, Government of Canada 2018) before the Supreme Court of Canada (ECCC 2021b). An important concern with the heating oil carve-out was that it undermined the primary legal principle employed by the Liberal federal government. At the time they argued that emissions are inherently a matter of "national concern" under the Constitution, with indivisibility a necessary component.

The carbon taxation system was characterized in the court case by urgency and the need for comprehensive completeness. This meant deviations by any individual provincial government making local decisions to suit their own situation could fatally undermine the overall system. Hence consistent carbon taxation, determined federally, was necessary (Cash 2023).

Even from the very start of implementation on April 1, 2019, a variety of inconsistencies were identified (Forrest 2019), with costs on gasoline used for comparison:

- Four provinces under the Federal Carbon Backstop saw an increase of 4.4¢ per Litre;
- Newfoundland Labrador and Prince Edward Island were allowed to offset carbon taxes by cutting existing provincial gas taxes.
- Result was that Newfoundlanders only paid net 0.42¢ per Litre from before, and Islanders only paid net about 1¢ per Litre from before.
- Nova Scotia's cap-and-trade system had residents paying less than 1¢ per Litre additional.
- Canadian Taxpayers Federation (CTF) specifically noted that the federal Liberal government appeared inclined to approve carbon pricing plans from friendlier governments having lower costs to consumers, regardless of inconsistencies.

A final, but significant additional inconsistency was identified by Parsons (2023a) dealing with the application of carbon tax to elevated levels of renewable ethanol in Manitoba and other provinces. Manitoba for some time has led the country in the inclusion of renewable ethanol in gasoline. As a renewable component, ethanol in gasoline should not be taxed. Yet, Parsons discovered the wording of the GGPPA (Government of Canada 2018), specifically Section 8, indicates that if ethanol content in gasoline in a province is at 10%, as in Manitoba, it is only counted as 5% for the purpose of the carbon tax. Unbelievably, this has meant that roughly half of renewable content have been taxed, a completely contradiction to any objective of reducing emissions. This situation suggests that the current government considers political expediency as more important than actual environmental performance.

2.4.3 Concerns with Price Elasticity of Demand (Consumer Responsiveness)

Emission fees, including carbon taxes, certainly are not bogus policies, but not magic either, being incapable of creating dramatic reductions by mere presence alone. They all rely, as outlined, on economic principles. Reiterating the mechanisms for the case of a carbon tax: (a) increasing the price on a fossil fuel makes the fuel more expensive; (b) prompting consumers to deter purchasing; and thus, (c) reducing consumption and associated emissions. However, the

extent of reductions depends on two factors: level of the tax itself, which appears well appreciated; and responsiveness of consumers, which appears often downplayed or ignored.

Consumer responsiveness is described technically using the price elasticity of demand. This is denoted by the Greek letter epsilon (ε) and quantitatively defines the percentage change in consumption (Q) occurring in response to a percentage change in price (P), as outlined in Equation (1):

Price elasticity of demand (ε) = $\frac{\Delta Q/Q}{\Delta P/P}$	Equation (1)

Price elasticity of demand calculation and interpretation can involve significant complexities, e.g., by time frame, by time duration (short-run versus long-run), by location, etc. Some basic points are obvious and useful to note. Given that increasing a fuel price typically reduces consumption, price elasticity of demand values for fuels is typically negative, and if not, this raises concerns for operation of a carbon tax. The equation can be further rearranged to show that achieving a desired reduction in quantity (i.e., $\Delta Q/Q$) can be achieved by proportionately increasing the level of the tax (i.e., increasing $\Delta P/P$), improving consumer responsiveness to the tax (i.e., increasing absolute value of ε), or a combination of both, as outlined in Equation 2:

Level of Reduction in Consumption ($\Delta Q/Q$) = $\varepsilon \times \Delta P/P$	Equation (2)

Responsiveness, however, remains critical, in particular if consumers turn out to be not very sensitive to price changes. This it indicated in situations where the absolute value of ε is less than 1.0, denoted as being “inelastic.” Especially concerning for implementation of a carbon tax is if consumers are highly unresponsive, i.e., with absolute values of ε much lower than 1.0. In such cases even a significant proportionate increase in carbon tax (price) may yield little reduction.

A characteristic of commodity fossil fuel markets commonly observed across economics literature is inelasticity, with inelasticity of gasoline indeed used as a classic case in point (Eitches and Crain 2016). During the 2000s and early 2010s, it was observed in the United States that consumers appeared to have become inured to fuel prices, and less responsive to changes, especially compared to earlier time periods (Hughes et al. 2008, with short run ε values ranging from -0.03 to -0.08, and EIA 2014, with short run ε values ranging from -0.02 to -0.04), and this further exacerbated by high price-volatility of gasoline (Lin and Prince 2013).

The perspective that consumers are insensitive to gasoline prices, and that price elasticity of demand has reduced in absolute terms are not universal, and subject to ongoing debate. As noted by The Economist (2022), a cluster of newer academic works has begun to examine, in particular, micro-level behaviour of individual consumers, including driving patterns, with findings that consumers indeed respond. Earlier findings of price insensitivity were further ascribed largely to use of aggregated data, masking individual behaviours. Yet, in terms of overall emissions reductions, it is indeed aggregate fuel consumption quantities that count.

Thus, while consumer behaviour at a micro-level is highly nuanced, in terms of emission reduction, it is aggregated consumption that ultimately matters. For example, one paper (Kilian and Zhou 2020) that examined variability more closely, but still confirmed that over the period from 2000 through 2008, average nominal and real U.S. retail gasoline prices increased dramatically, roughly doubling. The same time period saw consumption of gasoline increase in the range of 6% to 7% in the U.S. and Canada, providing fairly strong evidence at an aggregated level that consumers overall have not been so responsive to price increases.

A further important aspect of consumer responsiveness and price elasticity of demand for products in general, is the availability of substitutes or alternatives, or lack thereof (Gallo 2015). Without substitutes, consumers tend to be less sensitive to price changes, which is important in terms of emissions reduction for Canada. In this regard, important work has been undertaken in Sweden showing differences between rural and urban areas. Dahlkvist (2016), for example, found that while calculated price elasticity of demand values for fuel were consistent overall with past analyses, there were differences between urban and rural areas. As was noted, the overall pattern showed rural areas to be inelastic, while major urban areas, like Stockholm, Malmo and Gothenburg, very elastic. This makes absolute sense in particular in the context of Stockholm, with an extremely well-developed public transportation network, including low costs for consumers. Rural locations, on the other hand, lack alternatives.

The major commodity fuels most relevant to the carbon tax in Canada are natural gas, involved in home heating, gasoline, involved primarily with light-duty personal vehicles, and diesel, involved primarily with heavy-duty vehicles for goods movement. Over the recent past, Parsons has been directly involved in examining costs of a variety of alternatives, finding affordability concerns in all cases:

- Regarding home heating, Parsons (2023b) and Parsons (2024b) described the high up-front costs currently associated with heat-pump technologies, and the lack of ability to pay for such systems out of future savings, without yet any cost-effective solutions;
- Regarding gasoline, Parsons et al. (2023) outlined the lack of affordability of light-duty electric vehicles for most people in Canada, especially at lower-incomes; and
- Regarding diesel, Larson et al. (2024) outlined the excessively high costs associated with zero-emission heavy-duty vehicles, still relatively impractical, in particular for long-haul freight applications.

The rationale outlined by the Federal Government regarding its pause to the carbon tax on home heating oil turns out to be equally applicable in all these cases as well. Without affordable options, the cost of the carbon tax becomes just a hindrance to consumers being able to move to lower emissions alternatives. Consumers thus generally and are well observed to be relatively unresponsive, largely “inelastic” to the carbon tax in economic terms.

Such trends can help explain ineffectiveness for carbon taxation. Consumer responsiveness cannot be taken for granted. When considering these effects, the carbon tax level acts solely as a “price signal.” The carbon tax level thus cannot be construed as the outright cost of carbon.

When consumer responsiveness is low, the effective cost per tonne for reductions is increased, directly impacting both environmental effectiveness and economic efficiency. This impact is seen in later results presented for Canada (Section 3.2), and raises a further problem.

Merely citing the price signal makes the cost of reducing emissions via carbon taxation appear unrealistically low, skewing consideration away from other legitimate measures. An example is the legitimate policy of grid decarbonization, which Parsons (2021) showed to be a highly successful emissions reduction policy across provinces over the period from 2005 to 2019. While successful, it has been costly, in particular compared to an unrealistically low-cost level suggested by a carbon tax price signal.

2.4.4 Over-Reliance on Sophisticated Input-Output Models

A subtle problem with the current federal carbon tax is the Liberal government's over-reliant on computer models both for projecting anticipated reductions and in accessing effects. Such models have turned to perform poorly, with a number of illustrative examples:

- Initial projections of emission reductions by ECCC (2018) asserted that by 2022 the carbon tax was anticipated to be Canada's largest single measure, resulting in reductions by 2022 in the range of 80 to 90 million tonnes.
- While referenced to a business-as-usual scenario, these reductions were anticipated to be massive.
- Actual results by 2022, however, showed such massive-reductions attributable to government policy actions were nowhere to be seen.
- In more recent projections of reductions ascribed to the carbon tax, ECCC (2024b) estimated reductions for 2022 to be about 19 million tonnes, this occurring prior to the release of official figures in May 2024. The value is dramatically lower than the earlier figure of 80 to 90 million tonne (ECCC 2018), Further the suggested reduction makes little sense given that official emission for 2022 increased overall more than 9 million tonnes from 2021.
- Significant reductions seen in 2020 were directly attributed to the COVID pandemic by ECCC (2022), with no mention at all of carbon taxation as a contributing factor. ECCC (2024c) also mentions COVID as the causative factor.

The over-emphasis on computer models also extends to academic work that has been cited directly by ECCC (2023c), in particular to justify the claim that eight of ten families are made better off (Winter et al. 2021). This latter work done by competent researchers, however, suggests a perspective that sophisticated input-output macroeconomic-based computer model estimates are preferable over "simplistic approaches" such as dividing emission costs by the number of households. Yet the use of aggregate averages is both legitimate and relevant, with values such as mean income per household or overall emissions per capita commonly employed without concerns being expressed.

As recently outlined by Thompson (2022), a naive overreliance on computer models to provide answers is highly problematic. Without adequate ground-truthing or verification, computer

models, especially sophisticated models, can end up just reflecting the biases, including sometimes deeply buried assumptions, perspectives and expectations built into the model, rather than reflecting the realities that occur in the world itself.

2.4.5 Lack of Adequate Proof of Effectiveness with Reliance on Out-of-Date Data

The perspective of McKitrick (2016) suggests that the purpose of a carbon tax is merely to put a price on carbon, to which consumers will respond in some way, although not necessarily reducing consumption. Unlike McKitrick, the Government of Canada, along with a variety of supporters, continue to exhort the claim that carbon taxation, as implemented within Canada, is an effective measure to achieve significant and rapid emission reductions.

Increasingly serious concerns, however, have been emerging regarding the lack of concrete proof, beyond mere opinions that carbon taxation can be effective. A related concern is that much of the proof being put forward continues to rely on a number of selected, but now relatively old, studies. The researchers involved at the time used diligent procedures, however, more recent data show contrary results (Section 3), suggesting earlier researchers likely had been misled, finding merely correlation instead causation.

A useful starting point is the EFC group, a non-profit based at McGill University. For some time, they have stridently advocated for carbon taxation, for example Beugin et al. 2018, and indeed were the sponsored the Open Letter … (2024). As part of the Open Letter, they attempt to debunk what they term a series of five "Critic's Claims," yet their own analyses and reasoning contain flaws that ignore fundamental economic principles. As McKitrick (2024) has noted, their analysis is "conspicuously selective in its focus."

This first point raised in their letter is particularly important to review in more detail. The first "Critic's Claim" noted in the letter is that, "Carbon pricing won't reduce GHG emissions." They go on to suggest that evidence shows, "Not only does carbon pricing reduce emissions, but it does so at a lower cost than other approaches. Since federal carbon pricing took effect in 2019, Canada's GHG emissions have fallen by almost 8 percent, although other policies were also at work. …"

There are a series of important points to note regarding these statements, as follows:

- ECCC (2022) reported that from 2019 to 2020 Canada's emissions did indeed drop by 66 million tonnes CO2e, or 8.9% annually, but also rightfully acknowledged that the direct impacts of the COVID pandemic represented a significant cause of this reduction, including dramatically lower road and air travel, reduced power consumption, and industrial activity.
- ECCC (2022), in the second Key Point at the beginning of the Executive Summary specifically notes, "The year 2020 was marked by the COVID-19 pandemic, coinciding with a decrease in emissions of 66 Mt or 8.9% across numerous sectors. Notable examples include Transport (-27 Mt or -12%) largely due to fewer kilometers driven and a decrease in

air traffic; and Public Electricity and Heat Production (-7.4 Mt or -11%) due to decreased coal consumption partially offset by an increase in natural gas consumption."

- ECCC (2022) was quite clear, with carbon taxation not mentioned at all as a major contributing factor. It is disingenuous and misleading for EFC to suggest that emission reductions from COVID somehow provide evidence that carbon taxation is successful.
- The situation in 2020 further involved additional anomalous behaviour that runs counter to economic principles involved in carbon taxation.
- From an economics perspective, in particular regarding motor fuels like gasoline, the COVID pandemic precipitated previously unanticipated reductions in fuel consumption and also simultaneously lower prices. Normally, the price elasticity of demand for fuels, described earlier, is expected to involve a negative value, signifying that an increase in price results in a reduction in consumption, indeed a central premise of carbon taxation.
- In Winnipeg, for example, during 2019, gasoline prices ranged from above $1.00 to upwards of $1.20 per Litre, including all taxes, over the course of the year. Yet in 2020, with the onset of COVID, prices dropped dramatically to as low as $0.66 per Litre, hovering for the remainder of the year close to $1.00 per Litre. As such, calculated price elasticity of demand for fuel involved a positive value; highly abnormal.
- Further, for subsequent years of 2021 (ECCC 2023d) and 2022 (ECCC 2024a), overall emissions for Canada grew sequentially year-on-year. There were observed increases in fuel consumption from a quantity perspective (Statistics Canada 2023a) for Canada overall from 2020 through 2022, a period that also coincided with increased fuel prices, including significantly higher carbon taxation levies. As such, price elasticity of demand values again appeared generally positive; again highly abnormal.

These facts suggest that carbon taxation contributed little to reductions seen since 2019. None of these points were discussed by the EFC group (Open Letter … 2024), confirming "conspicuous selectivity" noted by McKitrick (2024).

Much of the justification for the carbon tax relies on a selected number of somewhat older papers, published earlier in the past decade. Three important and much referenced papers involve: Elgie and McClay (2013); Murray and Rivers (2015); and Antweiler and Gulati (2016). The latter two are specifically mentioned by ECCC (2018) as part of the justification of efficacy for the carbon tax. While all of these represent legitimate analyses undertaken by competent researchers, all of these papers share certain methodological characteristics that could easily lead to researchers being misled.

In all cases, the papers involve: (a) focus exclusively on British Columbia, given their early introduction of a carbon tax; (b) only relatively short timeframes considered, generally involving the five-years of 2008 through 2012, meaning that longer term perspectives and trends are missed; (c) consumption data primarily focused on transportation fuels, with a particular focus gasoline used for light-duty vehicles, and assumed to be representative of overall emission trends; (d) consumption data often considered on a per-capita basis, which is problematic in that the overall objective is to reduce total absolute emissions, rather than relative per-capita

intensity; and, and most problematically, (e) experience of British Columbia being compared to an entity that does not actually exist, namely the “Rest of Canada.”

Longer-term review of emission reduction performance by individual provinces over 15-years up to 2019 by Parsons (2021) showed British Columbia to be middling at best in terms of performance, and hardly a leader. More up-to-date analysis is presented later suggesting the conclusions of these papers were incorrect, and explaining why (Section 3). The over-focus on British Columbia is further problematic in that the most prominent feature habitually highlighted has been revenue neutrality. This characteristic, however, deals with distribution of funds, and not directly linked as a causative factor in emission reduction effectiveness.

2.4.6 Carbon Tax Indirect-Cost Pass-Though Assumptions

Concerns regarding likely pass-on of carbon tax costs are important to clarify, especially in in the context of assumptions as employed in reports by the Office of the Parliamentary Budget Officer (PBO). In order to accurately estimate the costs of the carbon tax to households, much hinges on precisely which costs are included. The PBO (2019, Appendix A) clarifies what costs they considered as part of fiscal-based analyses, which also appear similarly assumed by the federal government. Their fiscal-based analyses consider the “distribution of the gross carbon costs from energy and non-energy purchases,” and broken down into two components:

Household Direct-Costs of Carbon Tax

“ The direct effect includes the costs related to residential energy consumption as electricity, heating fuel and motor fuels used in private transport. ”

Indirect-Costs of Carbon Tax

“ The second part of the model sets out to estimate the indirect emissions from the production of the goods and services that households consume. … This component is divided among:

- Industrial use;
- Household consumption;
- Public service use; and
- Interprovincial and international exports. ”

For our report, the same components of direct-costs are considered as by the PBO, but in this case based on employing actual fuel consumption values, rather than computer model approximations. There is thus no divergence in the intent of approaches employed on that point. There is, however, significant divergence regarding the indirect-costs of the carbon tax and assumptions of the PBO that appear to be relatively consistently employed by ECCC, and are highly problematic, not suitably representative of Manitoba. These concerns are discussed in more detail.

A first concern is the analysis of the PBO involves clustering all indirect-costs together, including large industries under the OPBS, and then distributing them using broad economic trade values among the four identified categories. In the case of the current analysis, the OBPS is not included, and rightfully should not be included, given sole consideration here of the commodity-based carbon tax. Such an approach, of including the OBPS, may be relevant to other provinces, such as Alberta, Saskatchewan or Ontario with much larger exports of energy or energy intensive goods, however, it does not reflect Manitoba's situation.

A second concern following directly from the above is that Manitoba has only a small number of Large Final Emitters (LFE), and not all of these are even relevant, for example landfills, or oil and gas flaring operations. Indeed, the PBO (2019) directly notes that, "Manitoba's fuel charges will account for virtually all (99%) of the revenue collected in the province, the highest share, due to the small number of industrial facilities that emit large quantities of GHG."

Manitoba only has in the range of 40 to 50 facilities in total registered under the Greenhouse Gas Reporting Program (GHGRP). These include LFE, with annual emissions over 50,000 tonnes CO_2e, but also a variety of smaller facilities who participate voluntarily. As outlined by ECCC (2023e), Manitoba has the second lowest proportion in Canada of overall provincial emissions that are made up of facilities reporting under the GHGRP, in particular significantly lower than Ontario, Alberta or Saskatchewan. Further, unlike other provinces, it is relatively simple to gather data on all relevant facilities reporting under the GHGRP, which, expressly, are not included under the commodity-based carbon tax. Unfortunately, only aggregate data for 2021 are available, but discrete data for individual facilities are accessible for 2022, which is reasonably close in time and used for triangulation (data files: Government of Canada 2024).

The known six LFE that involve industrial plants and generate annual emissions greater than 50,000 tonnes CO_2e per year are most important, with each described individually as follows:

- Koch Fertilizer plant in Brandon, is the province's largest single emitter overall, listed as approximately 715,800 tonnes CO_2e in 2022. Emissions primarily come from natural gas used for their process, which based on a simple emission factor (i.e., 0.0019 tonnes per m^3) translate to approximately 376,736,000 m^3 of natural gas. Koch on its own represents approximately 18% of natural gas delivered by Manitoba Hydro. Their quantities are worthwhile tabulating, and are not included in the commodity-based carbon tax steam.
- TransCanada Pipeline, which operates across the province, is the second largest (industrial) emitter, listed as approximately 323,000 tonnes CO_2e in 2022. They consume natural gas to power repressuring operations, however, although combustion occurs in Manitoba, all such gas employed is internal, not delivered or including under Manitoba Hydro deliveries, and none is part of the commodity-based carbon tax stream.
- Graymont's lime production facility in Faulkner is known to still exist and had been listed in the past as a significant LFE, i.e., roughly third largest (industrial) source with emissions of more than 100,000 tonnes CO_2e (Manitoba Sustainable Development 2018), but it could not be readily located in GHGRP data for Manitoba in 2022. This facility has been a user of coal

and petroleum coke, sourced from outside of Manitoba given coal-related resale is no longer permitted in the province, and is not part of the commodity-based carbon tax stream.

- Canadian Kraft Papers' pulp and paper facility in The Pas is the fourth largest (industrial) emitter, listed as approximately 84,300 tonnes CO_2e in 2022. The largest part of emissions come from thermal combustion, but noting the facility is not on the natural gas network. A diverse range of fuels are consumed, but these outside the commodity-based carbon tax system. A portion of emissions are also for transportation, which based as a simple diesel emission factor (i.e., 0.0027 tonnes per Litre) translate to approximately 860,700 Litres. These, however, mostly likely involve off-road use, and thus excluded from the commodity-based carbon tax stream, but worthwhile tabulating.
- Minnedosa ethanol plant, now under control by Cenovus, is the fifth largest (industrial) emitter, listed as 78,200 tonnes CO_2e in 2022. They are connected to the natural gas network and their emissions come mostly from natural gas combustion used for operations, which based on a simple emission factor (i.e., 0.0019 tonnes per m3) translate to approximately 42,103,000 m^3, or about 2% of natural gas delivered by Manitoba Hydro. This is an interesting case given even if they are not excluded from the commodity-based carbon tax stream, any and all of such costs would be past to consumers given their ethanol fuel additive production is used entirely within Manitoba.
- Simplot potato processing facility in Portage la Prairie is the sixth largest (industrial) emitter, listed as 63,900 tonnes CO_2e in 2022. They are connected to the natural gas network and their emissions come mostly from natural gas combustion used for operations, which based on a simple emission factor (i.e., 0.0019 tonnes per m3) translate to approximately 33,242,000 m^3, or about 1.6% of natural gas delivered by Manitoba Hydro. This is certainly an export-oriented facility but given it is included as a large emitter it is not part of the commodity-based carbon tax stream, but worthwhile tabulating.

Beyond these LFE, which are required to be part of the GHGRP, there are a further 19 industrial or other facilities with significant emissions, but in all cases less than 50,000 tonnes CO_2e per year. All of these participate voluntarily. Note these are excluded in the commodity-based carbon tax stream too, but are useful for tabulation.

Three are mining operations in the northern part of the province that are not connected to the natural gas network and are primarily relevant in terms of tabulating liquid fuel consumption, treated as off-road diesel. These are:

- Hudbay Minerals metallurgical complex in Flin Flon, listed as 29,700 tonnes CO_2e in 2022, including estimated 1,004,000 Litres of off-road diesel for operations.
- Hudbay Minerals copper-zinc mine in Flin Flon, listed as 27,200 tonnes CO2e in 2022, including estimated 4,300,000 Litres of off-road diesel for operations.
- Vale Canada nickel operations in Thompson, listed as 20,200 tonnes CO_2e in 2022, including estimated 3,845,000 Litres of off-road diesel for operations. Emissions from Vale operations have continued to drop significantly over time, having in the past been an LFE, with for example approximate emissions noted as about 57,000 tonnes CO_2e in 2018.

The remaining 16 other sites are linked to the natural gas network and important primarily for tabulating natural gas deliveries, and in a few cases off-road diesel consumption. These are as follows, in order of emissions generation:

- Gerdau recycle steel mini-mill in Selkirk, listed as 48,100 tonnes CO_2e in 2022, including estimated 19,774,000 m^3 of natural gas and estimated 1,466,000 Litres of off-road diesel.
- Bunge oilseed facility in Altona, listed as 37,900 tonnes CO_2e in 2022, including estimated 19,899,000 m^3 of natural gas.
- Diageo distillery in Gimli, listed as 34,000 tonnes CO_2e in 2022, including estimated 17,833,000 m^3 of natural gas.
- McCain potato processing facility in Portage la Prairie, listed as 31,900 tonnes CO_2e in 2022, including estimated 16,785,000 m^3 of natural gas.
- Bunge oilseed facility in Russell, listed as 31,600 tonnes CO_2e in 2022, including estimated 16,181,000 m^3 of natural gas.
- University of Manitoba central heating plant in Winnipeg, listed as 31,300 tonnes CO_2e in 2022, including estimated 16,404,000 m^3 of natural gas.
- McCain potato processing facility in Carberry, listed as 26,900 tonnes CO_2e in 2022, including estimated 14,181,000 m^3 of natural gas.
- Maple Leaf Foods pork processing facility in Brandon, listed as 24,300 tonnes CO_2e in 2022, including estimated 11,338,000 m^3 of natural gas, with this plant a notable consumer of biogas as heating fuel, which is obviously not included for the commodity-based tax.
- Roquette pea protein processing facility in Portage la Prairie, listed as 21,300 tonnes CO_2e in 2022, including estimated 9,931,000 m^3 of natural gas.
- CertainTeed wallboard plant in Winnipeg, listed as 17,900 tonnes CO_2e in 2022, including estimated 9,319,000 m^3 of natural gas.
- Darling rendering plant in Winnipeg, listed as 15,300 tonnes CO_2e in 2022, including estimated 7,996,000 m^3 of natural gas.
- HyLife Foods pork processing facility in Neepawa. Listed as 14,200 tonnes CO_2e in 2022, including estimated 5,679,000 m^3 of natural gas, and estimated 744,000 Litres of off-road diesel.
- Consumer Foods rendering plant in Winnipeg, listed as 13,600 tonnes CO_2e in 2022, including estimated 7,139,000 m^3 of natural gas.
- Department of National Defense 17 Wing heating plant in Winnipeg, listed as 12,000 tonnes CO_2e in 2022, including estimated 6,272,000 m^3 of natural gas.
- Viterra oilseed facility in Ste. Agathe, listed as 11,300 tonnes CO_2e in 2022, including estimated 5,882,000 m^3 of natural gas.

These 25 facilities together account for approximately 1.8 million tonnes CO_2e or roughly 9% of overall provincial emissions in 2021. Most of these facilities are export oriented. The PBO (2019) assumed that a portion of emission costs from large industrial operations are considered to flow back to consumers as part of indirect costs. Given it is acknowledged that the scale of emissions and revenues under the OBPS in Manitoba are comparatively small, all of these OPBS costs can be presumed to be essentially discounted in passing-on to households.

Further, as outlined by Chung (2023), ECCC recognized that uniquely in 2021 across provinces, Manitoba's largest single emissions source was indeed agriculture, which is also primarily export-oriented. Yet, at the same time, under the GGPPA, a variety of fuels, including gasoline and diesel that are related to farming, fishing or a few other selected cases are exempted from carbon tax (Government of Canada 2018, referring to Subdivision A, Section 17(2) of the GGPPA). As such, the finding together on the OBPS and agricultural contributions suggest exporting industries and sectors for Manitoba are overall substantially exempted from the commodity-based carbon tax. However, this also leads logically to the situation whereby fuels covered under the commodity-based carbon tax within Manitoba are oriented much more strongly to domestic applications, with a relatively high proportion of indirectly collected proceeds being passed-on to consumers (or to restate consistent with analyses below, a low proportion of indirect carbon tax costs not being passed-on).

Yet, the PBO (2019 and 2020) in projected computer modeling for 2021, as well as ECCC (2023c) in reporting results for Fiscal 2021-22, both suggest that a significant portion of commodity-based carbon taxes are not passed-on to consumers, although importantly without any data or background information directly presented to support the assumed proportions. It can be calculated from available data that unrealistically high proportions of overall collected carbon-tax proceeds are presumed to be not passed-on to households in Manitoba. In assessing fairness of the carbon tax, this is a concerning, making it appear Manitobans are made better off when, more realistically, they are not.

The PBO assumes allocation of indirect proceeds into four categories, but only one that involves pass-on (i.e., household consumption). The other three involve no pass-on internally within a province (i.e., industrial use; public service use; and interprovincial and international exports). Beyond an overall explanation of methods, PBO (2019) provides no information on what proportions are employed for each of these categories in each of the provinces. ECCC is the same, and it is only possible to estimate from data the overall proportion total carbon tax proceeds that are presumed to be passed-on (or in reverse the proportion assumed to be not passed-on).

The easiest comparison to illustrate concerns comes by comparing the four main provinces levied carbon-taxes under the federal Backstop in 2021, namely: Alberta; Saskatchewan; Manitoba; and Ontario. As part of their analysis, PBO included estimates for Fiscal 2021-22 both of the total proceeds collected in the different provinces, and the presumed average household cost for the carbon tax in the different provinces. From these data, it is possible to estimate the proportion of commodity-based carbon taxes that are not passed-on to households, with procedures outlined as follows:

- Calculation starts with total carbon tax proceeds collected from each province for Fiscal 2021-22, with inputs from data source;

- Value then divided by the number of total households in each province, specifically the number of households in occupied dwellings using Census 2021 data, as outlined for respective provinces in Statistics Canada data tables for each province;
- Resulting value represents the total carbon tax proceeds per household in 2021 for the respective province;
- Next from input data sources are included the presumed average cost impact per household of the federal system; and finally
- Proportion of carbon tax not passed-on to households in each province, which can them be directly calculated as in Equation (3).

$\text{Proceeds Not Passed-on} = 1 - \frac{\text{Average carbon tax per household}}{\text{Total carbon tax proceeds per household}}$	Equation (3)

Results using data from PBO (2019) are presented in Table 1, and using slightly updated data from PBO (2020) are presented in Table 2.

Table 1. Proceeds Not Passed-On (per Household Basis) for Fiscal 2021-22 from PBO (2019)

Province	Total Proceeds	Households *	Proceeds Per Household	Cost per Household	Proceeds Not Passed-On
Alberta	n/a	n/a	n/a	n/a	n/a
Saskatchewan	$436 million	449,580	$970	$773	20.3%
Manitoba	$392 million	518,054	$757	$496	34.5%
Ontario	$3,753 million	5,491,200	$683	$490	28.3%
*From Statistics Canada (2023)					

Table 2. Proceeds Not Passed-On (per Household Basis) for Fiscal 2021-22 from PBO (2020)

Province	Total Proceeds	Households *	Proceeds Per Household	Cost per Household	Proceeds Not Passed-On
Alberta	$1,942 million	1,633,220	$1,189	$815	31.5%
Saskatchewan	$491 million	449,580	$1,092	$891	18.4%
Manitoba	$378 million	518,054	$730	$531	27.3%
Ontario	$3,578 million	5,491,200	$652	$538	17.5%
*From Statistics Canada (2023)					

Prior to Alberta being included, Manitoba was presumed by the PBO (2019) to have the highest proportion of carbon taxes not passed-on, also meaning then that passed-on costs assumed in the net evaluation of carbon tax cost impacts were proportionately the lowest. After the inclusion of Alberta, Manitoba was presumed by the PBO (2020) to have the second highest proportion of carbon taxes not passed-on, only exceeded by Alberta. Results using data from the GGPPA reporting for 2021 (ECCC 2023c) are presented in Table 3, using the same procedure.

Table 3. Proceeds Not Passed-On (per Household Basis) for Fiscal 2021-22 from ECCC (2023d)					
Province	**Total Proceeds**	**Households ***	**Proceeds Per Household**	**Cost per Household**	**Proceeds Not Passed-On**
Alberta	$1,688 million	1,633,220	$1,034	$598	42.2%
Saskatchewan	$462 million	449,580	$1,028	$720	30.0%
Manitoba	$369 million	518,054	$712	$462	35.1%
Ontario	$3,487 million	5,491,200	$635	$439	30.9%
*From Statistics Canada (2023)					

The data from ECCC (2023c), consistent with earlier projections by the PBO, show Manitoba to have the second highest proportion of overall commodity-based carbon tax proceeds not passed-on to households, only exceeded by Alberta. Manitoba is also presumed to have a much higher proportion than either Saskatchewan or Ontario. In this case, suggesting a higher proportion of proceeds not passed-on to households means that the cost per household used in assessing overall net benefits (or costs of the carbon tax) is presumed proportionately much lower in Manitoba. However, no rational explanation is provided as to why Manitoba is so high.

There appears to be consistency across the analyses as well in terms of the proportion of carbon taxes presumed to be not passed-on for Manitoba, presented in Table 4. Such a result is not positive, in that it can reflect that the use biased or inappropriate presumptions of behaviour for Manitoba is merely being propagated.

Table 4. Results Across Assessments of Carbon Tax Proceeds Not Passed-On			
Province	**Portion Not Passed-On**	**Standard Deviation**	**Comments**
Alberta	36.9%	7.6%	Only two data points
Saskatchewan	22.9%	6.2%	
Manitoba	32.3%	4.3%	Lowest variability
Ontario	25.6%	7.1%	

At the same time Alberta shows the highest proportion of proceeds not passed on (or lowest proportion of overall proceeds assumed passed on to households). Yet in this case the results can readily make sense. Such a situation reflects the context of Alberta's significant fossil fuel resource exports, and the myriads of goods and services directly or indirectly supporting the fossil fuel industry that might not be directly under the OBPS. The relative proportions of exports for the provinces, and associated impacts, are thus relevant to further consider. This is, in particular, given that PBO (2019) specifically identifies extra-provincial exports as a major category of carbon tax costs not passed-on.

Consideration of relative export data are presented in Table 5, with procedures as follows:

- Calculation starts with the proportion of proceeds not passed-on (per household basis), for each province in Fiscal 2021-22, as calculated earlier in Table 3;
- Next for each province, the export GDP proportion of total GDP for each as represented for 2021 is outlined, these data from Statistics Canada; and lastly
- Ratio of the proportion of proceeds not passed-on is then divided by the proportion of GDP represented by exports.

Table 5. Not Passed-On Carbon Taxes Considering Exports			
Province	**Proceeds Not Passed-On***	**Exports as Proportion of Provincial GDP****	**Ratio (Relative Carbon-Tax Intensity for Exports)**
Alberta	42.2%	37.1%	1.14
Saskatchewan	30.0%	20.7%	1.45
Manitoba	35.1%	19.2%	1.83
Ontario	30.9%	23.8%	1.30
*From Table 3 **Lagace-Roy (2023 a, b, c, d in sequential order by province)			

The final ratio as calculated provides effectively a surrogate measure of relative intensity of emissions under the commodity-based carbon tax for exports from each province. As noted, this has validity given that some significant portion of carbon taxes not passed-on are assumed by the PBO to be associated with extra-provincial exports.

The final results demonstrate anomalous and unrealistic behaviour to be presumed for Manitoba by ECCC. Manitoba has the second highest proportion of total proceeds calculated to be not passed-on to consumers (second lowest proportion of total proceeds assumed to be passed on to households), but also of the four provinces has the lowest export GDP proportion of total GDP. The resulting relative carbon-tax intensity associated with exports is dramatically higher than any other province, i.e., 26% to 60% higher. This cannot be adequately explained.

In order to be in-line with other provinces, the proportion of proceeds not passed-on needs be much lower (proportion of proceeds assumed to be passed on to households much higher). ECCC appears to arbitrarily assume for Manitoba that relatively high proportions are not being passed-on to households, which in turn makes the carbon tax appear arbitrarily but unrealistically beneficial. ECCC appears to be merely using a computer model that includes inherent underestimation of costs, most impactful and misleading for lower-income households. This would not necessarily be problematic if there were proper independent verification or rationales provided, e.g., explaining assumptions, however there is nothing.

An intrinsic aspect of carbon taxation in Canada, one never strongly emphasized, is the expectation, even in the original design, that carbon taxes imposed on companies would be passed down supply chains to their own customers, whether other companies or consumers. Indeed, ECCC (2021c, page 93) outlines this directly, as part of discussion on energy-intensive, trade-exposed (EITE) industries for whom the ability to pass-on is constrained. As stated, “Indirect costs are those passed on through the supply chain due to emissions from other firms. For example, a manufacturing facility would pay for its own emissions from its production process (direct carbon cost), as well as the emissions from shipping its raw materials, which would be passed on to the facility by the shipping company (indirect carbon cost).”

While this aspect is mentioned, ECCC appears to largely ignore the reality of cost pass-on in supply chains. All firms will the greatest extent possible pass on costs to their own customers. This is a matter of economic survival. In the context of supply chains, the nature of pass-on will

be based on business fundamentals of the business sectors involved, rather than for example being explicitly associated with any emissions content. In the case of logistics and transportation, the costs passed on will reflect total costs associated with storage, handling and movement, with carbon taxes merely one component of costs passed on, nothing special.

The notion of pass-through of carbon taxes is also fairly universal whether private or public sector, in particular exacerbated given rebates are directed to overwhelmingly to individual households, not to businesses or other entities. Public entities tend to operate based on strictly allocated budgets to achieve specific services, and if costs are increased as a result of carbon taxation, such budgets need to be increased accordingly to maintain service levels. This means ultimately greater funding needs that require either corresponding increases in service fees or increased taxation. Public utility organizations similarly operate on costs-of-service models, meaning carbon tax costs become a component of overall costs-of-service and end up translating to correspondingly higher fee rates. Based on fundamentals, the passing-on of carbon tax costs is normative for all, with the inability to pass-on such costs being more the exception. A presumption that only roughly 65% of incurred carbon-tax costs are passed on to households is unrealistically low.

Given economic fundamentals involved, along with Manitoba's environmental situation, the assumed level of commodity-based carbon tax passed-on to households reasonably needs to be much higher than the implied assumptions of ECCC. At the same time, however, complete pass-through of all commodity-based carbon tax costs is highly unlikely. From an environmental perspective, Manitoba's electrical system has the lowest grid-intensity in North America (Larson et al. 2024) and, further, Manitoba for some time has maintained the highest renewable content in liquid fuels across Canada.

In further analysis, the extent of pass-on is treated to some degree as a variable, but with a more reasonable target assumptions for analysis that of indirect commodity-based carbon tax processes no directly ascribed to households:

- 80% of natural gas and gasoline costs are likely passed-on, meaning 20% are not passed-on; and
- 90% of diesel costs are likely passed-on, meaning 10% are not passed-on.

These assumptions alter the calculated ratio in Table 5, meaning overall that the relative commodity carbon-tax intensity for exports is reduced to a value of approximately 0.52, more reasonable compared to other prairie provinces, particularly Alberta with a value calculated to be about 1.14. For the three main fossil fuels under carbon tax system, for which costs are not passed-on, total fuel quantities are presented in Table 6. As can be seen, these are significant.

Table 6. Taxable Commodity Fuel Volumes with Costs Not Passed-On to Consumers

Commodity Fuel Type	**Carbon Taxable Volume Not Passed-On to Consumers**
Natural Gas	172,000,000 m3
Gasoline	68,711,000 Litres
Diesel	75,946,000 Litres

3. Updated Evaluations of Carbon Tax Performance

The point of evaluating performance of the carbon tax is not to suggest that this policy is illegitimate, but rather to emphasize that carbon taxes have not lived up to highly touted expectations for Canada, as expressly outlined in ECCC (2018). The latter suggested that they literally represented a silver bullet, i.e., simple way to achieve decisively large, rapid and low-cost GHG emission reductions. Legitimately, the Government of Canada could have implemented a modest carbon tax based on the perspectives of McKitrick (2016) whereby the objective of the policy would be to put a price on carbon and then allow consumers to respond as they see fit. Yet in this case the key limitation that carbon taxation cannot guarantee any reductions would need to have been acknowledged, which within Canada has never occur.

The Liberal government has been attempting to "have its cake and eat it too." As outlined in ECCC (2018), carbon taxation was expressly identified as the most significant potential emission reduction measure for Canada. Large anticipated reductions, i.e., 80 to 90 million tonnes per year, were expected by 2022 alone, based on this policy by itself, however, this assertion turned out to be pure fantasy.

Paradoxically, the carbon tax has ended up effectively impeding emission reduction efforts. Parsons (2021) employed a comparison of eight different provincial policies over a 15-year period in relation to longer-term emission trends in individual provinces. It was concluded that neither carbon taxation nor related cap-and-trade was associated with any long-term reduction trends. At the same time another policy was identified that did indeed appear to be associated with significant ongoing overall reductions, namely grid-decarbonization.

Parsons (2021) is not the only one to raise doubts about carbon taxation, with examples as follows, noting all lead authors are based in Canada:

- Jaccard (2016), while in general terms positive toward carbon taxation, estimated that in order to achieve significant reductions, tax levels in the range of $160 to $180 per tonne would be required, which were identified as likely to be a politically problematic, hence recommending a regulatory approach to achieve reductions instead.
- Rosenbloom et al (2020), while not adverse to carbon taxes, noted the tendency in carbon tax systems to overemphasize efficiency aspects, i.e., not imposing excessive economic costs, while being deficient in terms of effectiveness, i.e., not actually reducing emissions to any adequate extent, with prices around the world far still too low to be meaningful, instead recommending more encompassing sustainability transition policies.
- Pretis (2022), while also positive toward carbon taxation, identified that neither carbon taxation nor cap-and-trade could be "detected as large and statistically significant interventions" within Canada. Pretis further identified that "closures and efficiency-improvements in emission-intense industries" instead have been associated with appreciable emission reductions.

The emerging perspective appears to be that while carbon taxation as a policy measure may have some positive attributes, it is unlikely, in particular within Canada, to be a dependable means to achieve significant reductions. This is especially true given the extent of reductions necessitated by the commitments agreed to by the current Liberal government.

To illustrate and confirm the inadequacy of carbon taxes within Canada to achieve appreciable reductions, two new analyses are presented:

- First involves comparing time-series emission trends over an extended timeframe for BC (within Canada) versus Sweden, two jurisdictions both implementing carbon tax systems; and
- Second involves estimating emissions reductions, total costs and costs per tonne of reduction associated with carbon taxes on liquid transportation fuels in four provinces (Alberta, Saskatchewan, Manitoba and Ontario) under the federal Backstop pricing system over the three-year period from calendar 2019 through to calendar 2022.

These are presented in the following sections.

3.1 Contrasting Performance of British Columbia versus Sweden

British Columbia implemented the first carbon tax system in North America starting in 2008, and based on this received significant accolades. Review by Murray and Rivers (2015), which was mentioned earlier as being used in part for the rationale to implement the carbon tax federally, suggested this policy could potentially reduce GHG emissions in the range of 5% to 15%, an assertion reiterated by ECCC (2018). Yet a key question mark has been the ability of the BC system to achieve longer-term overall emission reductions, this given the lack of reevaluation to either confirm or refute success. A useful and positive example to evaluate and compare carbon tax performance is Sweden. Sweden indeed has been identified as achieving appreciable GHG reductions over time (Andersson 2019).

The comparative analysis in this case is similar to that undertaken by Parsons (2021), tracking the time-series of annual GHG emissions for both BC and Sweden to determine relevant trends. In this case, it is most appropriate to compare the UNFCCC category of total transport emissions, given both that the commodity carbon tax in Canada is applied significantly to transportation fuels, including gasoline and diesel, and that the evaluations used to justify the carbon tax by ECCC were based significantly on transportation fuels.

Time-series data on total transport emissions for Sweden (Statistics Sweden 2024) and BC (ECCC 2024c) are presented in Figure 6. These data cover the eighteen-year period from 2005 through 2022, and fortuitously are of similar scale such that raw data can be directly presented, without modification. The year 2005 is used as the starting point given this is Canada's baseline year for evaluation of reduction targets under the Paris Agreement.

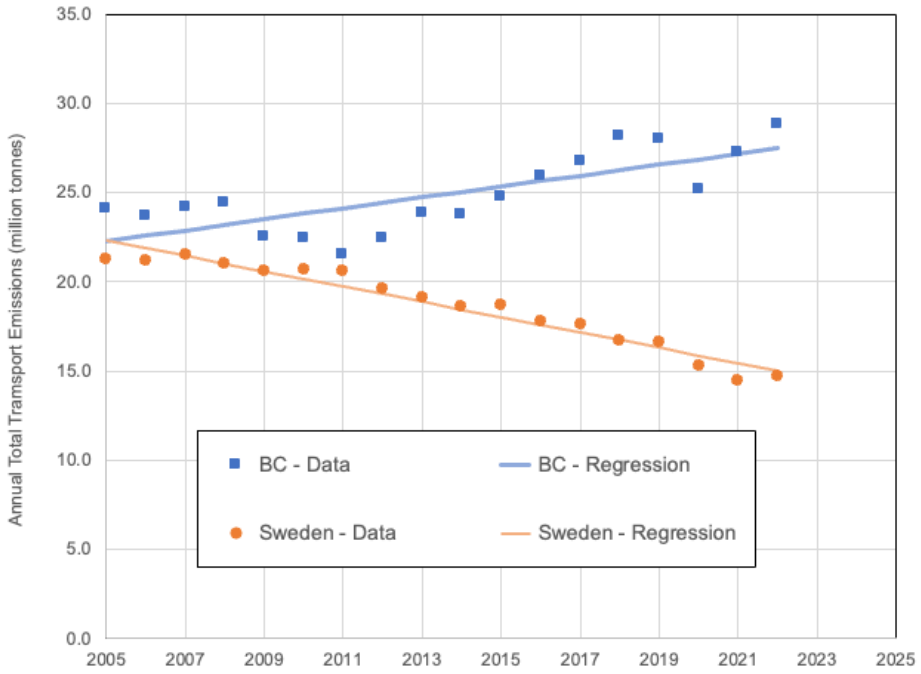

Figure 6. Time-Series Trends of Total Transport Emissions for BC and Sweden (2005 to 2022)

The two jurisdictions show clear, but dramatically contrasting trends. Interestingly the transport emissions suggested from respective regressions for the two jurisdictions in 2005 are virtually the same, i.e., 22.3 million tonnes. Emission trends then, however, immediately diverge, with BC increasing, while Sweden declining. Importantly, it is obvious from this plot that transport emissions did decline for BC over the period of 2008 through 2011, after the carbon tax was introduced, although never quite getting as low as Sweden.

This situation could provide some validation of initial findings by researchers like Murray and Rivers (2016), but also strongly emphasizes the important deficiency that reevaluations never occurred. Immediately after 2011, BC transport emissions increased rapidly (indeed with higher upward slope). This key fact has never been prominently discussed. At the same time, as noted earlier in Section 2.3, the period just following the onset of the 2008 recession is one of only two time periods that showed general emission declines across Canada, and can be directly attributed to the economic downturn. Other BC observers noted the successful carbon tax findings at that time likely more reflected coincidence (i.e., associated with the economic downturn) rather than causation. The emission reduction due to COVID in 2020 for BC was more dramatic, but while Swedish emissions then continued to generally decline, BC emissions rebounded dramatically (with even higher upward slope).

The comparison of emission trends shows that BC's carbon tax has not caused any appreciable or sustained reductions in transport GHG emissions over the 15-year period it was in place from 2008 through 2022. The results also represent an indictment of the common practice in earlier

analyses to consider per-capita emissions. Sweden has a population more than twice that of BC, meaning that by 2022 per-capita transport emissions in BC were more than four-times higher than Sweden, hardly a leadership position.

Statistical results for linear regressions of the two time-series trends are presented in Table 7. These confirm the dramatic contrast. The trend for Sweden represents a consistent downward linear slope with emissions declining about 0.4 million tonnes annually, an average of -2.3% change per year, and the trend for BC represents a consistent upward slope with emissions increasing about 0.3 million tonnes annually, an average of +1.2% change per year. While the coefficient of determination for Swedish data is significantly higher, both trends are shown to be statistically significant, i.e., with small resulting probability (p) values.

Table 7. Results of Linear Regressions for Transport Emissions 2005 through 2022

Jurisdiction	Regression Slope (million tonne per year)	r^2 value	Statistically Significant
British Columbia	+0.305	0.56	Yes ($p < 0.01$)
Sweden	-0.429	0.95	Yes ($p < 0.01$)
Results show the Swedish carbon tax was associated with consistent emissions decline, hence useful, while BC carbon tax was associated with consistent emissions increase, hence of questionable value for achieving emissions reductions			

3.2 Estimating Reduction and Costs Associated with Carbon Tax on Liquid Fuels

Over the past several years, sequential classes of MBA students, as part of graduate-level studies in sustainability economics, have been evaluating emission reductions, total costs and costs per tonne of reduction associated with the federal back stop carbon pricing system as applied to two designated liquid fuels, on-road gasoline and on-road diesel, across four applicable provinces, namely Alberta, Saskatchewan, Manitoba and Ontario.

While the original intent of such analyses had been to undertake annual, year-to-year comparisons, the procedure was altered due to impacts of the COVID pandemic. As noted in Section 2.4.4, COVID precipitated anomalous apparent positive-behaviour for price elasticity of demand values, with demand and price both dropping in 2020, and then demand and price both increasing in 2021 and in 2022. In order to obtain more meaningful results, the most recent analysis by students during the Winter term of 2024 considered a three-year period, using calendar 2019 as the baseline through to calendar 2022.

For these analyses, a slightly different measure was employed instead of the carbon “price-signal,” but one that is consistent with costing methods used for other GHG reduction activities, namely the “cost per tonne of reduction.” Notably this parameter was used by the Working Group on Specific Mitigation Measures (2016) in their report as part of activities under the 2016 Pan-Canadian Framework. The use of this parameter also addresses concerns summarized in Section 2.4.3, regarding the price-signal.

A raw value for the cost per tonne of reduction in this case can be calculated by dividing the total carbon tax cost paid on relevant fuels over the time period by the difference in fuel emissions over the same period (i.e., total net reduction in consumption over the period), as outlined in Equation (4), with nominal costs considered for this analysis:

Cost per Tonne Reduction ($ per tonne) = ∑Carbon Taxes Charged on Relevant Fuels ÷ ∑Net Emissions Reduction	Equation (4)

Data on sales of on-road gasoline and diesel fuel sales are readily available for Canada overall and for individual provinces from Statistics Canada (2023a). These data are provided by calendar year, whereas carbon tax levies are stipulated by fiscal year, such that an approximation was assumed for given calendar years, based on Equation (5):

Assumed Calendar Year Fuel Levy Value = ¼ Levy for Previous Fiscal Year + ¾ Levy for Current Fiscal Year	Equation (5)

Resulting estimated calendar year levy values are summarized in Table 8.

Table 8. Estimated Fuel Levy Values Employed for Individual Calendar Years

Calendar Year	Levy on Gasoline Blend Fuel	Levy on Diesel Blend Fuel
2020	$0.0608 per Litre	$0.0738 per Litre
2021	$0.0829 per Litre	$0.1006 per Litre
2022	$0.1050 per Litre	$0.1274 per Litre

Applicable fuel volumes for the four provinces covering 2019 through 2022 are summarized in Table 9 for gasoline blends and Table 10 for diesel blends.

Table 9. On-Road Consumption of Gasoline Fuel Blends 2019 through 2022 in Applicable Provinces

Province	2019 (Litres)	2020 (Litres)	2021 (Litres)	2022 (Litres)
Ontario	16,842,931,000	13,896,078,000	13,943,943,000	15,554,002,000
Manitoba	1,627,412,000	1,434,375,000	1,495,759,000	1,510,656,000
Saskatchewan	1,759,737,000	1,469,529,000	1,673,155,000	1,649,974,000
Alberta	6,215,900,000	5,430,400,000	5,501,100,000	6,024,802,000
Applicable Total	26,445,980,000	22,230,382,000	22,613,957,000	24,739,434,000

Table 10. On-Road Consumption of Diesel Fuel Blends 2019 through 2022 in Applicable Provinces

Province	2019 (Litres)	2020 (Litres)	2021 (Litres)	2022 (Litres)
Ontario	5,569,736,000	5,182,354,000	5,507,779,000	5,572,449,000
Manitoba	771,768,000	726,194,000	751,117,000	784,479,000
Saskatchewan	1,326,923,000	1,086,577,000	1,310,955,000	1,317,942,000
Alberta	3,623,500,000	3,153,900,000	3,244,700,000	3,666,924,000
Applicable Total	11,291,927,000	10,149,025,000	10,814,551,000	11,341,794,000

Two key observations are notable from these data. Compared to 2019, by 2022 the total quantity of gasoline blends sold declined by about 6.5%, but the total amount of diesel sold increased by approximately 0.5%. This might suggest a net overall decline in fuel of about 6%,

however, diesel fuel has an appreciably higher emission intensity than gasoline, which must be considered.

Based on estimated annual unit levies and relevant fuel volumes, the total amounts of carbon tax paid by consumers during 2020, 2021 and 2022 can be estimated for the two fuel blends, with results presented in Table 11.

Table 11. Carbon Taxes Paid by Consumers for Designated Fuels Over Period			
Calendar Year	**Levies on Gasoline**	**Levies on Diesel**	**Combined Levies**
2020	$1,351,607,225	$748,998,045	$2,100,605,270
2021	$1,874,697,035	$1,087,943,830	$2,962,640,865
2022	$2,597,640,570	$1,444,944,555	$4,042,585,125
Total Over 3 Years	$5,823,944,830	$3,281,886,420	$9,105,831,250

As seen, the amount of carbon tax paid is high, more than $9.1 billion over the three combined-years within the four applicable provinces. The breakdown in costs is about 64% from gasoline and about 36% from diesel. The aggregate value of $9.1 billion collected for the designated fuels further represents approximately 55% of the total collected-levies from the applicable four provinces of approximately $16.6 billion estimated for the three calendar years in total.

A further important simplifying assumption for emission reduction calculations is the following intensity values used for the respective fuels:

- Gasoline fuel-blend emission intensity = 2.3 kg CO_2e per Litre; and
- Diesel fuel-blend emission intensity = 2.7 kg CO_2e per Litre.

The changes in GHG emissions from fuel consumption over the three years from 2019 to 2022 are summarized in Table 12.

Table 12. Change in GHG Emissions over Three-Years for Designated Fuels			
Year	**Gasoline (tonnes)**	**Diesel (tonnes)**	**Combined (tonnes)**
2019 Emissions	60,825,754	30,488,203	91,313,957
2022 Emissions	56,900,698	30,622,844	87,523,542
Net Change	-3,925,056	+134,641	-3,790,415

Overall, due to reduced consumption, emissions from the designated fuels did reduce over the three-year period in the applicable provinces. This was entirely due to reduced gasoline consumption, with diesel consumption actually increasing. Compared to Canada's emissions in 2019 of 752 million tonnes CO_2e, the net reductions from the carbon tax of roughly 3.8 million tonnes CO_2e for the applicable provinces, represented no more than 0.5%. This is much smaller than the reduction of 6% since 2019 suggested by the EFC group (Open Letter… 2024), discussed earlier in Section 2.4.4.

A critical assumption employed in analysis is that all emission reductions were due to carbon tax, however, it is well understood, as outlined by ECCC (2022 and 2023d) that COVID instead

was the primary reason for changes. The reductions noted above thus represent an upper maximum limit, with actual emissions reductions due to the tax, likely much lower.

From overall figures, the raw cost per tonne of reduction can be finally calculated as follows in Equation (6), translating on a raw basis to approximately **$2,400 per tonne**.

Cost per Tonne Reduction ($ per tonne) = $9,105,831,250 ÷ 3,790,415 tonnes reduction = $2,402.3	Equation (6)

The calculated raw value is outrageously high, and represents the legitimate cost per tonne reduction for any entity not receiving reimbursement. For household consumers, it can be legitimately argued that the net cost per tonne reduction would be lower given that households are reimbursed a portion of carbon tax, discussed in more detail later in Section 4.4.1.
HERE
One expressly-intended purpose of the *Greenhouse Gas Pollution Pricing Act* (Government of Canada 2018), is to provide reimbursement back to individual households of roughly 90% of collected proceeds. Except, as outlined later in Table 25, the actual cumulative return over a three-year period has been less, calculated as approximately 88%. Based on this level of return, a net cost per tonne reduction for households can be estimated as outlined in Equation (7).

Net Cost per Tonne Reduction for Households ($ per tonne) = $2,402.3 per tonne × (1.00 – 0.88) = $288.3 per tonne	Equation (7)

The implications of this value, calculated as almost $290 per tonne, are significant:

- Firstly, as outlined earlier in Section 2.1, the Government of Canada recently revised the social cost of carbon (SCC) upwards to approximately $260 per tonne. As also noted, the SCC value effectively represents the “cost of doing nothing.” As such, even if the net cost per tonne reduction for households includes rebates, the cost per tonne reduction for the carbon tax is still greater than the cost of doing nothing.
- Secondly, the average carbon price signal value over the three-years considered was only approximately $37.5 per tonne, almost 8-times lower that the calculated net cost per tonne reduction, even including rebates.

The work of reducing emissions can be costly, and indeed in some cases painful. The current Liberal government for too long has appeared to imply to Canadians that achieving large emission reductions is easy, low-cost and painless. The carbon tax, especially as espoused by advocates like EFC, has ended up supporting this fiction. Canada by 2024 has made little real progress, with the likely probability now that the country will most certainly miss its ambitious reduction targets for 2030.

Canada remains well identified as the poorest performing nation of the G7 group in terms of emission reductions. On a broader international basis, independent organizations like the Climate Change Performance Index (CCPI 2024) suggest Canada is near the “bottom of the

barrel.” For 2024, Canada ranked at #62, with score of 31.55. Most closely comparable is Russian, ranking #63, with score of 31.00, hardly desirable company to keep.

The CCPI is illuminating, being broken down by four categories. On one aspect, climate policy, Canada ranks reasonably well, but for remaining bottom-line measures Canada is near or literally in last place. This reflects a recurring pattern by the current government of high-toned aspirations followed by poor performance never matching promises.

It can be thus reasonably argued that it is less costly and more effective to simply terminate the commodity carbon tax. This also reiterates the concern that the carbon tax itself has become an impediment, and has diverted attention away from more legitimate reduction measures, e.g., with grid decarbonization mentioned briefly one specific example. The Working Group on Specific Mitigation Measures (2016) identified a host of potential reduction measures with costs per tonne of reduction upwards of $250 per tonne. Problematically, based on seductively low-costs suggested by carbon tax price-signal values, attention shifted away from the costly but important work of undertaking more legitimate reduction measures.

The results of this analysis are significant and highly legitimate, in particular compared to earlier analyses that focused solely on BC. Over the earlier period of 2008 through 2011, which represented much of the focus of earlier analyses that reflected positively on carbon taxes, BC’s overall transport emissions represented only about 12% of Canada’s annual transport emissions, and only 3% of Canada’s overall emissions. For this current work considering emissions from designated gasoline and diesel fuels for four applicable provinces over the period from 2019 through 2022, the emissions involved represent almost 44% of Canada’s annual transport emissions, and close to 12% of Canada’s overall emissions. As such, this work is based on data that is roughly 4-times more representative of Canada’s situation.

4. Updated Evaluations of Carbon Tax Fairness

This section combines results of two main analysis approaches undertaken regarding the carbon tax and associated fairness. First is clarifying more precisely the distribution of funds collected from federal carbon tax applied to commodity fuels versus incentives provided from the Federal Government, determining net result per household. This is largely undertaken by Parsons, based on initial work by the student group involved. Second involves additional findings of the analysis undertaken by the student group, and associated recommendations.

In order to provide a concrete assessment of distributions based on actual data rather than computer modelling, fairness is assessed for a single year and province with data available for the federal back stop program, in this case Manitoba and Fiscal 2021-22 selected for review using data from the GGPPA annual report for that period (ECCC 2023c). Two aspects are separately assessed for this year and province, in order to understand the situation more clearly: (a) carbon tax revenue (termed proceeds); and (b) distribution of funds as rebates. Significant triangulation is possible using relevant information from other sources, however, not all data, e.g., fuel consumption, is available by fiscal year so some approximations and adjustments are required for information available by calendar year.

4.1 Household Numbers and Structure for Manitoba in 2021

A critical starting point central to the examination of fairness is clarifying the number and structure of households within Manitoba. In examining federal carbon tax data, important inconsistencies emerge between apparent assumptions in presentation of data, versus authoritative information from the most recent census, undertaken in 2021. Key census values noted by Statistics Canada (2023b) are summarized in Table 13.

Table 13. Demographic Parameters for Manitoba during 2021

Parameter	Value	Percentages
Total population	1,342,153	100% of total population
Rural population *	338,894	25% of total population
People in private households	1,307,185	97.4% of total population
Total private dwellings	571,528	100% of private dwellings
Dwellings regularly occupied	518,054	90.6% of private dwellings
* Selected data from Statistics Canada (2022)		

For the same year, Natural Resources Canada (NRCan 2021) suggests a total of 555,500 residential “buildings,” which does not match either of the values cited by Statistics Canada (2023b), although higher than the number of regularly occupied dwellings, which makes sense. For the purpose of this analysis, the value of 518,054 is selected as most representative of the number of households within Manitoba, with this value representing 90.6% of total private dwellings (Statistics Canada 2023b), and 93.3% of residential “buildings” (NRCan 2021).

From above data the number of people per regularly-occupied dwelling can be estimated, i.e., average household size. The value can be more precisely calculated to be 2.525 from occupancy distribution data also provided by Statistics Canada (2023b), and summarized in Table 14. The number of people per average household of 2.525 is employed for analysis. If Manitoba's total population value is applied to the occupied dwellings, it works out to 2.591 people per household, less than 3% different.

Table 14. Estimate of People per Household Based on Occupancy Distribution for 2021

No. People	Households	Percent	Population	Contribution
1	146,225	28.2%	146,225	0.282 people/household
2	173,990	33.6%	347,980	0.672 people/household
3	74,615	14.4%	223,845	0.432 people/household
4	69,480	13.4%	277,920	0.536 people/household
5+	53,740	10.4%	311,215 *	0.603 people/household
Total	518,054	100.0%	1,307,185	2.525 people/household

* Population in this category derived by differences, resulting in estimate of 5.8 people per household based on 311,215 people ÷ 53,740 dwellings

The calculation of carbon tax rebates, discussed later, is determined primarily by household composition, with it important to best estimate:

- Number of first individuals in households;
- Number of second individuals in households, either spouses or partners in married or common-law families, or first children in single-parent families; and
- Number of additional children, both in individual households and separate.

Statistics Canada (2023b) also includes a breakdown of "census families." This term is defined as involving a married couple (with or without children), a common-law couple (with or without children) or a single-parent family, with this latter obviously involving children. In terms of households and census families, by simple calculation from above, the estimated number of such households would be 371,829 (i.e., 518,054 less identified single households of 146,225), however, the reported value is slightly lower at 359,585 (i.e., about 3.3% lower).

Several key figures are noted as follows regarding the distribution of children with families for triangulation of rebate values per household:

- Couple-based census families (married or common-law) totaled 298,295, of which 154.265 have children, hence based on a total of 306,475 children as noted, resulted in averages of roughly 2.0 children for families with children or roughly 0.5 children if considering all, and thus overall average household members of about 3.0 for this category.
- Single-parent census families totaled 61,295, with total of 103,070 children, which resulted in average of roughly 1.7 children for family and overall average household members of about 2.7.

- One somewhat anomalous group to consider is foster children, which as part of the 2021 census in Manitoba totaled 4,905 (Robertson 2022), representing a relatively high number on a national basis. Foster children do not appear to be included as part of any census-families with children, being rather separate individuals. They are assumed to be included in households for the purpose of carbon tax rebates, and categorized here as children.

The calculation of carbon tax rebates, discussed later, is determined primarily by household composition. Important details in determining the relevant breakdown of household members for 2021 are outlined as follows (primarily Statistics Canada 2023b or sources otherwise as noted):

- Married spouses or common-law partners in census families totaled 596,590;
- Parents in one-parent families totaled 61,290;
- Children totaled 409,545, of which 306,475 were in two-parent families, and 103,070 were in single-parent families;
- Single individuals living alone in a private household although not in a census family, totaled 146,225;
- Single individuals not living is a household but instead with a relative (42,720) or non-relative (50,815) totaled 93,353; and
- Latter group includes foster children, which totaled 4,905.

4.2 Carbon Tax Proceeds from Manitoba in Fiscal 2021-22

As outlined by ECCC (2023c), the levies applied for Fiscal 2021-22 are summarized in Table 15, both overall and for prominent commodity fuels.

Table 15. Carbon Tax Levies Applicable for Fiscal 2021-22

Item / Commodity	Levy Value
GHG Emissions (overall)	$40 per tonne
Gasoline	$0.0884 per Litre
Diesel	$0.1073 per Litre
Propane	$0.0619 per Litre
Natural Gas (Marketable)	$0.0783 per cubic metre

ECCC (2023c, Table 4, page 7), as part of the GGPPA report, lists the total proceeds (carbon tax revenues) for Manitoba as **$369 million**, but with no further breakdown. ECCC (2023c) also lists an estimated average cost impact of the federal system in Manitoba as $462 per household. Using a figure of 518,054 households, this translates to proceeds of only **$239.3 million**, or less than 65% of total proceeds. Using the same number of households, total proceeds translate to approximately $712 per average household, as also presented earlier in Table 3 (Section 2.4.6), In order to reconcile values on the proceeds, the three main commodities of natural gas, gasoline and diesel, are each analyzed separately, with additional fuels lastly clustered together, in the following subsections.

4.2.1 Natural Gas and Other Home-Heating Proceeds

Manitoba Hydro acts as the major distributor for natural gas within Manitoba, with total federal carbon charges of $114 million reported for Fiscal 2021-22, conveniently the same fiscal year (Manitoba Hydro 2022, page 45). Total natural gas deliveries for the period were also noted as 2,111 million cubic metres. Using the unit levy of $0.0783 per cubic metre, carbon taxable quantities of natural gas can be back-calculated to represent 1,456 million cubic metres, or roughly 69% of total natural gas deliveries. The difference is made up mainly of facilities under the OBPS, described in more detail earlier in Section 2.4.6, with their approximate volumes totaling 636 million cubic metres. A reconciliation of natural gas volumes is presented in Table 16, shows that of Manitoba Hydro's total deliveries, all but approximately 0.2% could be readily accounted. Also of note, while the proportion of commodity-based carbon tax passed-on is treated as a variable, values for the assumed target of 80% passed-on to households and 20% not passed-on are also presented.

Table 16. Reconciliation of Natural Gas Volumes Reported within Manitoba Fiscal 2021-22

Category	Responsible Facility	Sub-Quantity (m^3)	Volume (m^3)
Total deliveries	Manitoba Hydro		2,111 million
Carbon tax applicable	Direct to households*	595 million	
	Indirect pass-on target (80%):	689 million	
	Indirect not passed-on (20%):	172 million*	
	Sum of all indirect	861 million	
	Sub-total	1,456 million	1,456 million
OBPS applicable	Koch Fertilizer	377 million	
	Minnedosa Ethanol	42 million	
	Simplot, Portage	33 million	
	Gerdau Steel	20 million	
	Bunge, Altona	20 million	
	Diageo, Gimli	18 million	
	McCain, Portage	17 million	
	Bunge, Russell	16 million	
	U of Manitoba	16 million	
	McCain, Carberry	14 million	
	Maple Leaf Foods	11 million	
	Roquette, Portage	10 million	
	CertainTeed	9 million	
	Darling	8 million	
	HyLife, Neepawa	6 million	
	Consumer Foods	7 million	
	17 Wing DND	6 million	
	Viterra, Ste. Agathe	6 million	
	Sub-total	636 million	636 million
Total Accounted			2,092 million
Unaccounted	Calculation by difference		19 million
* Also shown in Table 6 in Section 2.4.6.			

Breakdowns of natural gas volumes for households can be determined from available data.

NRCan (2021) provides a detailed breakdown of residential units by heating system, although as noted this is based on 555,500 residential buildings. Percentage data from NRCan (2021) is provided, which can be applied to the selected representative number of households of 518,054 for analysis purposes. The results are summarized in Table 17.

Table 17. Breakdown of Heating Systems by Household within Manitoba for Fiscal 2021-22

Heating System Type*	**Percent**	**Households****	**Fossil**	**Non-Fossil**
Heating Oil – mid-efficiency (86%)	0.4%	2,072	2,072	None
Natural Gas – mid-efficiency (80%)	9.6%	49,733	49,733	None
Natural Gas – high efficiency (94%)	43.8%	226,907	226,907	None
Electric	37.5%	194,270	None	194,270
Heat Pump	3.7%	19,168	None	19,168
Other: Coal/Propane*** (82%)	0.4%	2,072	2,072	None
Wood	0.2%	1,036	None	1,036
Dual: Wood/Electric	3.3%	17,096	None	17,096
Dual: Wood/Heating Oil (86%)	0.6%	3,108	1,554	1,554
Dual: Natural Gas/Electric (80%)	0.1%	518	259	259
Dual: Heating Oil/Electric (86%)	0.3%	1,554	777	777
Unaccounted	0.1%	520	Uncertain	Uncertain
Total		518,054	283,374	234,160
Percentage	100.0%	100.0%	54.7%	45.2%

* All efficiencies are based on data provided by Manitoba Hydro (2023a). All dual systems are assumed to operate half on each fuel, with those involving fossil fuels assumed as involving mid-efficiency for respective fuel.
** NRCan (2021) data percentages based on 555,500 buildings, but proportional adjustment to 518,054 reflect total normally occupied households as defined by Statistics Canada
*** Although “other” category is defined as including both coal and propane, these are assumed to be entirely propane based on mid-efficiency (82%) given earlier requirement by Manitoba to eliminate coal use (Manitoba 2013).

Manitoba represents a fairly unique situation within Canada whereby the division of home heating between fossil and non-fossil sources is relatively evenly split, i.e., 54.7% using fossil fuels, and 45.2% not using fossil fuels. Manitoban households can be divided into four distinct groups, albeit with the first two together representing 98.6% of all household-equivalents, and thus by far most important:

1. Those employing non-fossil fuel heating, primarily resistive-electric, numbering 234,160 household-equivalents, which are all effectively exempt from carbon taxes.
2. Those employing natural gas, numbering 276,899 household-equivalents (i.e., high-efficiency plus mid-efficiency plus dual natural gas/electric), with aggregate efficiency of 92%. This relatively high value makes complete sense in Manitoba due to the earlier “furnace regulation” (Manitoba 2009).
3. Those employing heating oil, numbering 4,403 households equivalent, with 86% efficiency.
4. Those employing propane, numbering 2,072 households equivalent, with 82% efficiency.

The resulting annual space heating loads, based on data from Manitoba Hydro (2023a) and using efficiencies as outlined in Table 17, are presented in Table 18. In addition to space heating loads, households also have water heating loads, which are outlined in Manitoba Hydro (2023b). In these cases where fossil fuels are employed, the same fossil fuel for water heating is assumed, with only "conventional" water heaters assumed, in order to be conservative. Given that Manitoba Hydro (2023b) water-heating loads are presented for 2.4 people per household, they are further adjusted upward to 2.525 people per household, as the representative value. Resulting fuel consumption for major cases are presented in Table 18, along with anticipated annual carbon tax, using the levy values outlined earlier in Table 15.

Table 18. Summary of Heating Loads and Carbon Tax Impacts for Major Fossil Fuel Options

Fossil Fuel	Space Heating	Hot Water	Total Load	Carbon Tax
Natural Gas	1,676 m^3	474 m^3	2,150 m^3	$168 annually
Propane	2,856 Litres	715 Litres	3,571 Litres	$221 annually
Fuel Oil	1,806 Litres	490 Litres	2,296 Litres	$246 annually

Total estimated carbon tax proceeds for annual home heating in Manitoba in 2021 based on household-equivalents are summarized for major fossil fuel options in Table 19. For reference, electrically heated homes are excluded given they are effectively exempt for home heating.

Table 19. Estimated Carbon Tax Proceeds for 2021 for Household Heating via Fossil Fuels

Fossil Fuel	Annual Unit Cost	Household Equivalents	Carbon Tax Proceeds
Natural Gas	$168	276,899	$46,519,000
Propane	$221	2,072	$458,000
Fuel Oil	$246	4,403	$1,083,000
Total	$170 *	283,374	$48,060,000

*Average annual unit cost per household-equivalent using fossil fuels is back-calculated from total carbon tax proceeds divided by household equivalents, with obvious overwhelming domination of natural gas. Natural gas-based proceeds (from residential applications) represent approximately 41% of Manitoba Hydro total carbon tax payments for 2021.

From household-equivalent values, residential natural gas applications represent approximately 595 million cubic metres for Fiscal 2021-22. This volume of natural gas represents approximately 28% of total natural gas deliveries for the year, and approximately 41% of carbon-taxable quantities. The remaining 861 million cubic metres correspond to commercial and industrial loads. While not directly applied to consumer households, these costs would be passed on the extent possible, with a reasonable target assumption of 80% being passed-on as noted. These costs can also be assumed to be passed-on relatively equally across household-equivalents. As such, costs from this additional natural gas translate to $104 per household (i.e., $67,481,000 × 0.80 ÷ 518,054 household-equivalents). This value is almost as significant as costs for individual households using natural gas for heating. (Likely target pass-on means that approximately $26 per average household is not passed-on, with the total maximum possible pass-on in this case for indirect natural gas thus being $130 per household).

Manitoba Hydro (2022) lists total natural gas customers as 293,256 but those include commercial and industrial. Subtracting 293,256 less 276,899 residential equivalent = 16,357

commercial and industrial. The latter would thus represent about 6% of total customer base. Additional triangulation approaches include the following:

- Values from 2019-20 General Rate Application Appendix 7.2 (Manitoba Hydro 2019) are largely redacted but are available for 2014-15, being 233,497 residential, 16,325 SGS commercial and 7,352 large general service with overall total of 273,465; thus 85% residential and 8.7% for the two commercial/industrial classes. This value is close.
- Comparison in terms of electrical customers (Manitoba Hydro 2022) shows that of a total of 608,554, only 73,342 are industrial or commercial, representing 12%, also showing that the above value is not unrealistic.
- Wikipedia (2024) lists Manitoba Hydro natural gas customers for 2008 as 238,000 residential, and 24,700 commercial and industrial customers, totaling 262,700, with as such, commercial and industrial representing 9%, which is close. Residential customers are further indicated as representing approximately 48% of Manitoba natural gas consumption. While this value is not consistent with the estimated roughly 28% of total natural gas delivered, it is closer to the estimated 41% of overall carbon-tax applicable natural gas sales.

In summary, from the above analysis it can be estimated that for fiscal 2021-22, natural gas-based carbon tax proceeds are **$114 million**, as outlined by Manitoba Hydro, but broken down into two key portions:

- **$46.5 million** for home-heating, which is distributed solely to natural gas households, numbering approximately 276,899; and
- **$67.5 million** for commercial and industrial customers, with this passed-on the extent possible, with the assumed 80% pass-on target meaning totals of **$54.0 million** passed-on to households and $13.5 million not passed on, further with these costs distributed across all 518,054 households irrespective of energy source of the household.

In addition to the above, approximately **$1.5 million** in carbon taxes are calculated for households heating using fuel oil and propane, but these are relatively small by comparison.

4.2.2 Gasoline Proceeds

The second major category of fossil fuels applicable to carbon taxes is gasoline, used primarily for motor vehicles. Sales of on-road based fuels are available through Statistics Canada (2023a, specifically selecting Manitoba as geographic location, and considering calendar years 2021 and 2022). For on-road gasoline, fuel consumption for Manitoba for Fiscal 2021-22 is estimated as involving ¾ of fuel consumption listed for calendar 2021 and ¼ consumption listed for calendar 2022, summarized in Table 20.

Table 20. Estimate of On-Road Gasoline Sales for Manitoba in Fiscal 2021-22			
Period	**Calendar 2021**	**Calendar 2022**	**Fiscal 2021-22**
Annual Sales	1,495,759,000 Litres	1,510,656,000 Litres	
Proportion	0.75	0.25	
Applicable Volume	1,121,819,250 Litres	377,664,000 Litres	1,499,483,250 Litres
Unit Levy Value			$0.0884 per Litre
Total Carbon Taxes			$132,554,319

Combined off-road and on-road quantities for gasoline sales are provided by Statistics Canada, which by the same method as above translates for Fiscal 2021-22 to approximately 1,611 million Litres. Off-road use represents only 7% of overall consumption, so is relatively small. This fuel proportion is excluded from analysis, but reasonably so, given that fuels related to farming, fishing and a number of other selected cases are exempt under the GGPPA (Government of Canada 2018).

Gasoline is employed overwhelmingly as the fuel for light-duty motor vehicles, which indeed dominate vehicle registrations across Canada. Recent data on the average number of vehicles for an individual household are not available. Slightly older data from NRCan (2010) suggested the average number of vehicles per household in Manitoba to be approximately 1.42. This value is employed for calculation purposes, and translates to an approximate total of 735,637 light-duty vehicles being used by households (i.e., 1.42 x 518,054). Statistics Canada (2023c) also outlines total vehicle registrations for Manitoba for calendar years 2021 and 2022. Using their data and the same method as above, total light duty vehicle registrations are estimated to be 834,162. This further suggests that light-duty vehicles operated by businesses, governments and other organizations total approximately 98,525 (or roughly 12% of all vehicles).

From total on-road gasoline consumption of just under 1.5 billion Litres and total vehicles just over 834,000, average consumption of gasoline per vehicle for Fiscal 2021-22 translates to approximately 1,800 Litres (1,797.6 Litres). Assuming annual travel per vehicle of about 15,000 km within Manitoba (NRCan 2010), this further translates to approximate average fuel consumption of about 12 Litres per 100 km, which is entirely reasonable (i.e., 1,797.6 Litres ÷ 15,000 km approximate average annual travel = 11.98 Litres per 100 km).

Total carbon taxes applicable to on-road gasoline total approximately **$132 million**, as noted in Table 20. Carbon taxes attributable to household vehicles translate to about **$117 million** ($132,554,319 × 735,637 ÷ 834,162 = $116,897,991), or approximately $226 per household ($116,897,991 ÷ 518,054 = $225.65). Indirect gasoline consumption by company and other vehicles translate to total carbon taxes of approximately **$16 million** ($132,554,319 × 98,525 ÷ 834,162 = $15,656,329), or a maximum possible of about $30 per household ($15,656,329 ÷ 518,054 = $30.22). Based on the target of 80% of such indirect costs, costs to households translate to a total of about $13 million, or roughly $24 per household as passed-on, and about $3 million, or roughly $6 per household as not passed-on. This means taxes associated with approximately 68 million Litres of gasoline are not passed-on, also noted earlier in Table 6.

The situation in this case could be construed as being more complicated, given for example vehicles used by governments and other non-profit organizations. A relatively high pass-through target assumption is still highly reasonable in two ways. Firstly, within Manitoba, the large majority of relevant vehicles are involved with businesses rather than governments or non-profit agencies. For example, the City of Winnipeg and Province of Manitoba, two of the largest government operators of vehicles, have only about 2,200 vehicles (WFMA 2024) and 2,600 vehicles (VEMA 2024) respectively, and many of these are not light-duty vehicles. Secondly, as noted earlier, many governmental and non-profit organizations operate based on specified budgets. For this, carbon taxes just become one component of costs, and as costs rise, so too must the organizations' budgets in order to maintain the same level of service or activity. The process of pass-on would certainly be longer, but ultimately would make its way back to consumers or taxpayers in terms of fees or taxes. For Crown corporations, like Manitoba Hydro, carbon taxes on fuels ultimately become part of their overall costs of services, and thus too would be ultimately and legitimately passed-on on to customers through rates.

4.2.3 Diesel and Other Middle-Distillate Proceeds

The third major category of fossil fuels applicable to carbon taxes is diesel (as well as other middle-distillate fuels). As with gasoline, sales of on-road based fuels for vehicles are available through Statistics Canada (2023a), albeit based on calendar years rather than fiscal years. As with gasoline, on-road diesel fuel consumption for Manitoba is estimated as involving ¾ of fuel consumption listed for calendar 2021 and ¼ consumption listed for calendar 2022, summarized in Table 21.

Table 21. Estimate of On-Road Diesel Sales for Manitoba in Fiscal 2021-22

Period	**Calendar 2021**	**Calendar 2022**	**Fiscal 2021-22**
Annual Sales	751,117,000 Litres	784,479,000 Litres	
Proportion	0.75	0.25	
Applicable Volume	563,337,750 Litres	196,119,750 Litres	759,457,500 Litres
Unit Levy Value			$0.1073 per Litre
Total Carbon Taxes			$81,489,790

Diesel is rarely used by households themselves, instead being used primarily in transportation of freight and goods. On-road diesel fuel carbon taxes total about $81.5 million for Fiscal 2021-22, with this representing the maximum amount that could be potentially transferred to households, translating to approximately $157 per average household (i.e., $81,489,790 ÷ 517,054 households). Based on the likely target pass-on of 90% and 10% not passed-on, the values translate to $73.3 million or $141 per household passed-on, and $8.2 million or $16 per household not passed-on. The latter corresponds to an on-road diesel volume of 75.9 million Litres, also noted earlier in Table 6. The assumption of a higher proportion of diesel costs being flowed through the consumer households is entirely reasonable in the context of diesel's overwhelming role in supporting goods and freight transport, essential for our economic, and the nature of the transport industry, where economic survival requires pass-on to the extent possible, and where the pass-on of fuel costs is already a well-established practice.

Off-road diesel, unfortunately is not reported by Statistics Canada. Given the nature of its biofuels mandate, Manitoba Environment and Climate Change (2022) has reported overall gasoline and diesel consumption over time, albeit not quite as recent as Fiscal 2021-22. Their data shows overall diesel consumption over the ten-year period from 2010 through 2019 averaged 1,145 million Litres ± 2.6%, so relatively stable. On-road diesel figures of 759 million Litres translate to 66% of approximate overall diesel. As in the case with gasoline, off-road diesel is excluded, which is reasonable given a significant proportion of such fuel is used in agriculture and other exempted applications, including volumes under the OBPS. Diesel employed for railways is also off-road and can be separately calculated.

Data on total emissions for railways attributed to Manitoba are summarized in the National Inventory Report (ECCC 2024a), but by calendar year. Based on the same approach as above, total diesel emissions for railways are estimated using calendar year National Inventory Report data. To be approximately 537,000 tonnes for Fiscal 2021-22, which at a rate of $40 per tonne, means $21,480,000. This further translates to an average cost per household of $41, which is quite small. Using the levy value of $0.1073 per Litre from Table 9, this cost translates to about 200 million Litres. A reconciliation of know diesel consumption values is presented in Table 22.

Table 22. Reconciliation of Diesel Volumes within Manitoba for Fiscal 2021-22

Category	Responsible Facility	Sub-Quantity (Litres)	Volume (Litres)
Total consumption	Government of Manitoba		1,145 million
Carbon tax applicable (on-road diesel)	Indirect pass-on target (90%):	683 million	
	Indirect not passed-on (10%):	76 million*	
	Subtotal of on-road indirect	759 million	759 million
OBPS applicable quantities	Canadian Kraft Papers	0.9 million	
	Hudbay complex	1.0 million	
	Hudbay mine	4.3 million	
	Vale operations	3.9 million	
	Gerdau Steel	1.5 million	
	Sub-total	11.6 million	12 million
Railway Applications	Indirect pass-on target (90%):	180 million	
	Indirect not passed-on (10%):	20 million	
	Subtotal of railway indirect	200 million	200 million
Total Accounted			971 million
Unaccounted	Calculation by difference – likely agriculture		174 million
* Also shown in Table 6 in Section 2.4.6.			

Based on these estimates, the residual volume likely employed for agricultural applications translates to about 174 million Litres, or roughly 15% of total diesel consumption in Manitoba. This is not unrealistic. CER (2024) reported for 2019 that diesel consumption in Manitoba was about 1,072 Litres per capita, roughly 25% higher than the national average of 855 Litres per capita for the same year. The estimated proportion of diesel employed for agriculture beyond average levels is reasonably in line, being neither overly low nor overly high.

One further fuel type is relevant to include, namely aircraft fuel. This is overwhelmingly middle distillate, very close to diesel, having the same emissions intensity and levy fee under the commodity-based carbon tax. Like diesel for railways, this is also not large. The similarly estimated total fuel emissions associated with aircraft for Fiscal 2021-22 are approximately 371,500 tonnes, which at a rate of $40 per tonne, means $14,860,000. This translates to maximum average cost of $29 per household (i.e., $14,860,000 ÷ 518,054 household), which is small. Again, using the levy value of $0.1073 per Litre from Table 9, also applicable to the main aircraft fuels, this translates to close to 140 million Litres. This is a reasonable quantity.

At first glance, it would be reasonable to suggest that air travel relates only to higher-income households. Within Manitoba, however, there is a known heavy dependency of Northern communities on air transport, in particular indigenous communities without reliable year-round road connections. Relatively high costs for air travel with such communities has been notably raised as a concern (CBC News 2023), suggesting that the distribution of such costs across income quintiles is more uniform than would be normally expected. As such for analysis, these costs, albeit small, are simply evenly distributed. Based on the assumed target pass-on of 90% for diesel and middle distillate fuels, passed-on costs translate to $26 per household, and not passed-on costs translate to $3 per household.

4.3 Overall Breakdown of Proceeds for Fiscal 2021-22

Total identified costs of the carbon tax for Manitoba in Fiscal 2021-22 are presented in Table 23, broken down by fuel type, and whether costs are incurred more-directly by households or indirectly passed-on from businesses and other entities.

Table 23. Breakdown of Carbon Tax Proceeds for Manitoba during Fiscal 2021-22

Approach	**Item**	**Amount**	
Direct Proceeds	Natural gas home heating	$46,519,000	
	Propane home heating	$458,000	
	Fuel oil home heating	$1,083,000	
	Household vehicles	$116,898,000	
Total Direct Proceed Costs		$164,958,000	
Average Cost per Household (518,054 households)		$318	
Indirect Proceeds		Maximum	Reasonable Target
	Natural gas heating	$67,481,000	$53,985,000
	Other vehicles	$15,656,000	$12,525,000
	Diesel transport vehicles	$81,490,000	$73,341,000
	Diesel railways	$21,480,000	$19,332,000
	Aircraft fuels	$14,860,000	$13,374,000
Total Indirect Proceed Costs		$200,967,000	$172,557,000
Average Cost per Household (518,054 households)		$388 per	$333
Total Proceeds (More-Direct and Passed-On)		$365,925,000	$337,515,000
Average Cost per Household (518,054 households)		$706	$652
Total Proceeds outlined for Fiscal 2021-22*		$369,000,000	
Proportion of Proceeds Accounted		99.1%	91.5%

The above table shows a good reconciliation in accounting for carbon tax proceeds levied during Fiscal 2021-22, this considering the maximum amount of indirect taxes involved, translating to more than 99% of total proceeds. This is a positive result, showing that it is readily possible to reasonably account for where levied proceeds originate.

Levies likely to be most directly paid by households only involve only approximately 45% of the total amount. These represent heating fuels and household vehicles, which overwhelmingly employ gasoline for fuel. Importantly, carbon taxes on gasoline used by households represents the single largest item identified, representing about $116 million, just over 30% of total levied proceeds.

Indirect costs represent the majority of overall costs, roughly 55%, involving the proceeds potentially passed on to consumers by businesses and other entities. The two largest contributing factors in this regard are: firstly, diesel costs as passed-on primarily from transport companies and activities; and secondly natural gas heating costs passed on from businesses and other entities. Two sets of results were presented in Table 23: (a) maximum amount of indirect costs; and (b) a reasonable target, involving 80% pass-on of indirect natural gas and gasoline costs, and 90% of indirect diesel and other middle-distillate fuel costs. The summary results show that for the target pass-on levels as employed, overall, approximately 86% of all indirect costs are passed-on. Further, combined with direct costs, this reasonable target level suggests that a total of about 91% of proceeds is passed ultimately to households.

This nature of the results in Table 23 help explain the logic of the federal Liberal government desiring to emphasize only costs most directly paid by households. Such a tactic, however, is misleading regarding the true nature of costs for individual households. Data suggest that the passed-on costs are important. The overall total cost per average household (i.e., including both more-direct proceeds and passed-on costs) translates to approximately $706 per household, if maximum possible costs are considered. Based on a reasonable pass-on target, these are reduced to approximately $652 per average household. As discussed later, these values are dramatically larger than the cost figure of $462 per household suggested by ECCC (2023c), which as outlined in Table 3 and Table 5, translates to only about 65% of total proceeds, both direct and indirect, being ultimately passed-through to households, with consistent assumptions from the PBO (2019 and 2020).

At the same time, while Table 23 shows total and overall average values, it is known that costs incurred by individual households depend on the nature of the heating system involved. A breakdown of costs per household based on heating system is outlined in Table 24. Data from the previous table show indirect proceeds translate to a maximum $388 per household, with reasonable target pass-on translating to $333 per household, with no further breakdown provided. Further, in Table 24, percentage change from average values (Table 23) are also presented for: (a) direct costs compared to average of $319 per household; and (b) overall direct and indirect costs compared to maximum average of $706 per household, and likely target average value of $652 per household.

Table 24. Breakdown of Carbon Tax Costs per Household based on Heating System Type				
Heating Type → Cost Component ↓	**Electrical**	**Natural Gas**	**Propane**	**Fuel Oil**
Household Heating	$0	$168	$221	$246
Household Vehicles	$226	$226	$226	$226
Total Direct Proceeds	$226	$394	$447	$472
Proportion of Average Direct (Average = $318 per household)	71%	124%	141%	148%
Change from Overall Average	-29%	+24%	+41%	+48%
Maximum Indirect Costs	$388	$388	$388	$388
Maximum Total Proceeds	$614	$782	$835	$860
Proportion of Maximum Average (Average = $706 per household)	87%	111%	118%	122%
Change from Maximum Average	-13%	+11%	+18%	+22%
Likely Target Indirect Costs	$333	$333	$333	$333
Likely Target Total Proceeds	$559	$727	$780	$805
Proportion of Likely Target Average (Average = $652 per household)	86%	111%	120%	123%
Change from Likely Target Average	-14%	+11%	+20%	+23%

As illustrated, while the nature of the heating system does have impacts, cost differences are significantly dampened when passed-on proceed costs are included, with percentage differences from maximum average or likely target average less than half in all cases. This illustrates the importance of properly considering passed-on costs.

One cost factor that could be suggested as important is whether or not a household uses an electric vehicle. This would translate to significantly reduced carbon tax cost for the household, The carbon tax cost for household vehicles was already identified on average as the largest individual cost item. Importantly, information from Statistics Canada (2023c) shows that for Fiscal 2021-22, the estimated number of battery electric and plug-in hybrid electric vehicles in Manitoba totaled only about 1,835. Compared to the total number of light-duty vehicles of 834,162, from the same source, means these zero-emission vehicle types represented only about 0.2% of light-duty. Such vehicles thus affected only a very small number of households and are still largely inconsequential.

4.4 Carbon Tax Rebates for Fiscal 2021-2022

The next major factor in evaluating fairness is the nature of rebates paid to households. Review shows three significant concerns can be immediately observed with regard to data presented by ECCC (2023c) regarding rebates, each described in more detail in the following subsections.

4.4.1 Clarifying Proportion of Proceeds Actually Returned

A first concern with the *Greenhouse Gas Pollution Pricing Act* (Government of Canada 2018) is clarifying the proportion of proceeds actually returned. Data for Fiscal 2021-22 as provided (ECCC 2023c) shows for Manitoba:

- Total incentive payments to households of $342 million; but
- Incentive payments, however, include a deliberate transfer of $16 million from earlier years to try make back earlier shortfalls, when households were significantly short-changed.

The Liberal government has consistently asserted that 90% of collected proceeds are returned to households in respective provinces. Reviewing data for Fiscal 2021-22 shows this is not true, with significant carry over from previous years and shifting of funds in order to achieve a better reconciliation. As such, in order to establish the precise level of returns, it is best to consider aggregate funding distribution data over three fiscal years combined: Fiscal 2019-20 and Fiscal 2020-21 (ECCC 2022b), and Fiscal 2021-22 (ECCC 2023c), as summarized in Table 25.

Table 25. Total Return Distributions for Fiscal 2019-20, 2020-21 and 2021-22 Combined

Item (Each involving three years)	Amount	Proportion of Proceeds
Total Assessed Proceeds (Revenue)	$822.7 million	
Payments to Households (Rebates)	$731.0 million	88%
Allocated to Other Federal Programs	$88.6 million	11%
Remainder Not Allocated	$3.1 million	<1%

Three important observations are apparent:

- Over time the federal government has moved closer to achieving their desired distribution of 90% return, however, actual figures are not quite as touted, with, based on actual data, only roughly 88% returned in aggregate to households over the three-year period.
- Over the three years, households thus have not received the full amount as promised, including significantly lower proportions in earlier years, with $16 million of funding deliberately transferred forward for rebate payments in Fiscal 2021-22 from previous years to try make up for earlier shortfalls.
- Allocations to Federal Programs are only notional, not reflecting actual payouts. This aspect of the Federal system appeared to have been poorly received, especially by small businesses, with these funds largely accumulating over time, e.g., Solberg (2024).
- This has been a significant problem, but not considered further here, given a focus on household impacts.

With these factors in mind, a more realistic analysis of Fiscal 2021-22 data is possible. As such, the payments provided back to households, based solely on funds collected for that year, were thus only $326 million (i.e., $342 million less $16 million from transferred from earlier years). Importantly, this adjusted value represents roughly 88% of proceeds collected in Fiscal 2021-22, consistent with three-year aggregate data.

It would be only legitimate for the government to include the $16 million for Fiscal 2021-22 if the government had prominently acknowledged in the previous two years that Manitoba residents were significantly short-changed. No such statement has ever appeared, implying that consumers consistently over the entire time had been already receiving the full amount, which is not true.

4.4.2 Clarifying Number of Households Actually Receiving Rebates

A second concern is that it is not clear how many households are included. ECCC (2023d) does not actually indicate the numbers of households involved. Not presenting this value means that results could be misleading.

In this review the standard number of 518,054 households is employed as per the official Statistics Canada Census results, discussed in depth earlier (Section 4.1). It is not clear, however, what value is employed by ECCC, as becomes apparent very quickly.

4.4.3 Clarifying Average Rebates Actually Received by Households

The third, and most significant, concern is the value of the average rebate, indicated as $705 per household. Given the clear formula for rebate calculation, based on household size with some allowance for a higher rebate to rural recipients but without any reference to income (ECCC 2023), the suggested value is **mathematically impossible**. As such, this represents a serious problem with both the reporting and the credibility of the Government of Canada.

Government rebate values can be used to back-calculate implied household sizes. In terms of rural households, Statistics Canada (2022) data suggests approximately 25% of Manitoba's population is designated as rural, such that the average basic household rebate (before rural allowance is added) can be calculated, as follows:

$705 ÷ (1.00 + 0.10 rural rebate × 0.25 proportion of population) = $688 per household

It is then possible to estimate the implied household size based on the standard formula employed by ECCC (2023d), as follows:

$360 (first individual) + $180 (second individual) + N × $90 (additional) = $688
N = 1.64 additional people in household, thus
Assumed total household size for rebate = 3.64 people per household

The exact numbers of households overall receiving rebates and those receiving rural-based increases are not indicated. As earlier discussed in extensive detail (Section 4.1), the average number of people per household for Manitoba in 2021 was 2.525, based on official census results. Implied family size from rebates as outlined is not even remotely close, and without any significant explanation. Statistics Canada also provides an estimate of average size of census-families as being 3.0, which would translate to a household rebate of $630, which is also

significantly lower. Based on an overstated estimate of family sizes beyond reasonable levels, the size of rebates as provided is dubious at best, indeed as stated, mathematically impossible.

One explanation could be that a smaller number of households applied for and received rebates with the further assumption that households actually applying involved larger numbers of family members. This can be worked out, using the government's own total rebate value as follows:

$342 million ÷ $705 per household = 485,106 households

While this situation could be considered plausible, it is still problematic, and unrealistic. Making adjustment to the earlier breakdown of households (i.e., assuming removal of 32,948 single individual households), means the overall average number of people per household only rises to just around 2.62, still well below the household numbers suggested from government data.

A situation whereby some households are excluded from rebates, however, raises an even more dire concern regarding fairness, which is outlined later (Section 4.5.5). Using these implied values suggest that roughly 6.4% of households may be excluded from rebates.

For comparison, the expected average household rebate, and total aggregate rebates can be calculated based on two separate approaches:

- First involves using overall average household size with assumed household member breakdown for rebate eligibility, which translates to $602 per average household;

Average Household Size-Based Estimate Summary:

Using official census data for Manitoba and the formula for rebate calculation as outlined by ECCC (2023d), the expected value of a basic average rebate can be calculated based on average household size of 2.525:

Basic rebate: $360 (first individual) + $180 (second individual) + 0.525 × $90 (additional) = $587 per average household (basic)

Additional allocation of 10% is provided for rural households, earlier estimated for Manitoba as 25% of the population, providing an overall total:

Full rebate: $587 per average household (basic) × (1.00 + 0.10 × 0.25) = **$602 per average household**

and

- Second involves grouping all individuals by their rebate eligibility and calculating overall average based on number of households, with eligibility data for Manitoba's population in 2021 summarized in Table 26, and which translates to $614 per average household.

Table 26. Breakdown of Manitoba Population by Rebate Eligibility			
Census Groupings	**First Individuals**	**Second Individuals**	**Additional Children**
Single-households	146,225	0	0
Couple-families	298.295	298.295	306,475
Single-parent	61,290	61,290	41,780
Single with relative	42,720	0	0
Single with non-relative	45,910	0	4,905
Total individuals	594,440	359,585	353,160
Unit rebate amount	$360 each	$180 each	$90 each
Total rebates	$213,998,400	$64,725,300	$31,780,400
Individuals total to 1,307,185 (i.e., 594,440 + 359,585 + 353,160), which matches exactly the number of people living in in private households, as outlined earlier in Table 13.			

Individual Rebate-Eligibility Based Estimate Summary:

Total basis rebate total: $310,504,100
Average household rebate: $599 per average household

Full rebate total (with rural): $310,504,100 × (1.00 + 0.10 × 0.25) = $318,266,702
Average full household rebate: **$614 per average household**

Based on the first approach, using average-household size, total rebates come to approximately $312 million (i.e., $602 per average household × 518,054 households = $311,868,508). This value is less than both the $342 million value suggested by ECCC (2023c) and the modified value of $326 million based on 88% returns, but within 5% of the latter.

Based on the second approach, using anticipated individual rebate amounts across the province, total rebates come to approximately $318 million (i.e., $614.35 per average household × 518,054 households = $318,266,702). This is the larger of the two calculation methods. Importantly the two estimated values are less than 2% different, providing cross validation. The second approach value, which is employed further, is less than both the $342 million value suggested by ECCC (2023c) and the modified value of $326 million based on 88% returns, but within 3% of the latter.

Using even the larger average rebate value of $614 per household, which is based on Manitoba's population, shows that the rebate estimate from ECCC (2023c) is unrealistically high, effectively impossible based on Manitoba's official census and population makeup. This is very concerning given the discrepancy of values, and suggests a need for further investigation, including thorough auditing.

4.5 Overall Carbon Tax Balances for Fiscal 2021-2022

ECCC (2023c) categorically states for Fiscal 2021-22, that, “Most households receive more in CAI payments than their increased costs resulting from the federal carbon pollution pricing system.” They further specifically assert for Manitoba in Fiscal 2021-22 that:

- Estimated average cost impact of the federal system was $462 per household; and
- Average rebate payment was $705 per household (i.e., discussed in detail above).

A comparison of values and overall balances is presented in Table 27, in order to evaluate the above claim, with the higher estimated household rebate value from the last section assumed.

Table 27. Carbon Tax Household Balances for Manitoba in Fiscal 2021-22

Household Fuel Type	Cost per Household *	Rebate per Household	Balance per Household
Calculation based on ECCC (2023c) Assumptions as Presented			
Average Household **	$462	$705	+$243
Calculation in this Report for Direct Household Costs Only			
Average Household	$321	$614	+$293
Calculation in this Report for Direct Costs Plus Maximum Indirect Costs			
Average Household	$706	$614	-$92
Electric Household	$614	$614	Breakeven
Natural Gas Household	$782	$614	-$168
Propane Household	$835	$614	-$221
Fuel Oil Household	$860	$614	-$246
Calculation in this Report for Direct Costs Plus Likely Target Indirect Costs			
Average Household	$652	$614	-$38
Electric Household	$559	$614	+$55
Natural Gas Household	$727	$614	-$113
Propane Household	$780	$614	-$166
Fuel Oil Household	$805	$614	-$191

* Excludes GST which is levied on carbon taxes.
** Costs and rebates presented in ECCC (2023c).
Note in this case a positive value is beneficial while a negative value is detrimental.

If the figures directly presented by ECCC (2023c) are accepted at face value, the Liberal government’s claim that a majority of households obtain net refunds could indeed be true, however, their values are unsupported and/or are seriously in doubt. Their rebate amounts are mathematically impossible, and household costs presume that no more than 65% of total collected proceeds are passed-on, which is unrealistically low, and not explained.

Values calculated, if only direct household proceed collections are included, outlined in this analysis provide a very similar net positive result, although with lower costs and lower rebates in absolute terms. Further it only direct-proceeds are considered, the nature of household heating has no significant impact, given all households would receive a net rebate.

If both direct and indirect proceed costs are included together, the results change dramatically across the board. Households are shown to be generally worse off, with significantly lower net benefits, even translating to net costs in most cases. An average household in particular shows a net cost due to the carbon tax system. This means the assertion that 8 of 10 households receive a net benefit is utterly false. The results strongly emphasize the importance of indirect costs, and ensuring that they are properly accounted for by government, with reasonable explanation, and are maintained fully transparent as passed down supply chains, as further discussed in Section 4.6.3.

Households with electrical heating turn out to be much better off regarding the carbon tax. If all indirect costs are considered, they still show at least a break-even. If a more realistic likely target pass-through is employed for indirect costs, there is a small positive result, but absolutely no windfall. On the other hand, the use of any fossil fuels for household heating shifts the value significantly negative. Given data on home-heating types within Manitoba outline earlier in Table 17, the Liberal government could legitimately indicate within Manitoba that roughly 4.5 households in 10 receive a small net rebate, although with an emphasis on “small.”

This, however, raises further concerns on cost and affordability, especially for lower-income households. As outlined by Manitoba Hydro (2023a), natural gas home-heating offers a significant economic advantage over electric-heating, with costs roughly less than half annually, even with carbon taxes. Thus, while lower-income households in particular might receive on average a small net rebate on carbon taxes if electric, the extent of the rebate is far too small to make up for the much higher costs of electric-heating. Manitoba Hydro (2023a) also does identify that the lowest annual heating cost is achieved for ground-source heat pumps (GSHP), which have zero-emissions implications within Manitoba too. GSHP, however, require implementation of a relatively expensive system. As outlined by Parsons (2024b), one-off implementation costs in the range of $30,000 to $40,000 per household make this unaffordable for lower-income households, when there is no practical plan on how to reduce costs. Air-source heat pumps (ASHP), touted by the federal government, turn out on the prairies to be inadequate. Although they involve lower upfront capital costs than GSHP, Manitoba Hydro (2023a) notes their annual electricity costs are almost as high as purely electric-heating, hence much higher overall costs.

The estimated average cost impact of the federal system, listed as $462 per household by ECCC (2023c), is merely presented as a single number, without any backup information whatsoever, and is unrelated to either proceeds or rebates information presented. The figure presented translates to a total of $239.3 million (i.e., $462 × 518,054 = $239,341,000), representing less than 65% of total proceeds. This value is larger than the direct proceeds cost of $165.0 million or $321 per household presented here, as calculated using triangulated data, and which represents about 45% of the total proceeds. It is, however, much lower than a reasonable estimate of combined direct and indirect proceeds costs. There is no explanation whatsoever included in the report as to how this figure was derived (ECCC 2023c). One embedded concern is the number of households assumed.

The nature of whether or not the net balance is positive or negative depends both on the type of household heating involved, and the proportion of proceeds costs ultimately being passed on to households, especially indirect costs. This is assessed further in Table 28, showing the breakeven pass-through proportion for each type of heating system, as well as for an average household. The apparent assumption of ECCC (2023c), and the likely target pass-on level are also presented. The latter is based on reasonable pass-on values for indirect costs of 80% for natural gas and gasoline, and 90% for diesel and other middle distillate fuels, which translates overall for indirect proceeds as 86%, or if considering all proceeds at 91%.

Table 28. Pass-Through of Carbon Tax to Achieve Overall Breakeven for Household

Household Type	**Pass-Through Level for Breakeven on Carbon Tax**	
	Overall Proceeds Pass-On	**Indirect Proceeds Pass-On**
Average Household	87%	76%
Electric Household	100%	100%
Natural Gas Household	79%	57%
Propane Household	74%	43%
Fuel Oil Household	71%	37%
Pass-Through Values Used		
ECCC (2023d) Assumption	65%	
Likely Target Pass-Through	91%	86%
Note: higher breakeven level is more positive in this case, indicating the tolerable pass-on level at which a net rebate is still provided.		

The level of pass-on presumed by ECCC (2023c) is excessively low. One important cost that is entirely indirect involves diesel used for transporting goods and freight. This is the largest single passed-on cost. The freight transport industry, in particular, is in no position to simply “eat” costs, and must as a matter of economic survival pass on carbon tax costs to the maximum extent possible (Chidley 2021). The same is largely true of all other major indirect cost categories. The assumptions of ECCC (2023c) are at best naïve and could even be construed as deliberately misleading.

The analyses undertaken in this report are based on reasonable triangulations of data from different sources, and as outlined in this report, they are backed up. The same cannot be said for ECCC (2023c). There is absolutely no back up either regarding the nature of average costs or average rebates presented in order to provide justification. As such, it can only be stated in the strongest terms that results presented by ECCC (2023c) are suspect. Based on information as available, ECCC (2023c) appears to be significantly understating costs and overstating rebates to households beyond what is reasonable, this without any backup information to clarify and justify results.

The average rebate value of $705 per household from ECCC (2023c), must be characterized as mathematically impossible, and thus unrealistic. This conclusion was based on estimating anticipated rebates in two ways: (a) using average household size based on official 2021

Census data, combined with the rebate formula, or (b) grouping Manitoba's population based on the official 2021 Census into rebate-eligibility categories from which an overall value could be derived. Both approaches yield similar results, in the range of $602 to $614 per household, with the larger value used in calculations. Both are dramatically lower than that suggested by ECCC (2023c). The excessively high value cannot be reconciled. In summary, the values employed by the Liberal government literally do not add up.

4.6 Further Fairness Issues Identified in Student Team Review

During the Winter 2024 term all MBA students were involved in evaluating the cost per tonne reduction calculations regarding the carbon tax. In addition, one specific group of three MBA students undertook an independent review regarding fairness. Their preliminary analysis revealed discrepancies in the impact of the carbon tax, particularly concerning its burden on lower-income households. While the Liberal government continues to claims that 8 out of 10 Canadians benefit from the tax, analysis by the team suggested otherwise, with the carbon tax found to disproportionately affect lower-income quintiles, exacerbating economic disparities.

Their preliminary analysis using initial data regarding Fiscal 2021-22 for evaluation was updated in more detail in conjunction with Parsons, with more comprehensive analysis of costs and rebate distributions undertaken, as outlined just previously in Section 4.2 through Section 4.4. At the same time, the student group identified a series of additional concerns regarding fairness, as well as recommended solutions, which are relevant to outline.

These are presented in subsequent subsections, considering the following identified issues:

- Carbon tax and rebate systems being inherently biased against lower-income households;
- No consideration of economic equity in rebate formula, with improvements identified;
- Lack of transparency in carbon taxes passed-on;
- Lack of significant ramping up of public transport as affordable alternative to private vehicles;
- Significant number of Canadians not filing taxes and thus ineligible for carbon tax rebates;
- Impacts on First Nations and indigenous citizens; and
- Inflationary impacts, as an added consideration.

4.6.1 Inherent Biases Against Lower-Income Households

In order to justify its claim that a majority of households benefit net from the carbon tax, the Liberal government had relied significantly on computer model-based reports undertaken through the PBO. Based on the role of the PBO, however, the nature of such reporting focuses on future oriented costs, especially budget costs.

Significant controversy occurred regarding one particular report (PBO 2022), which has been quoted extensively by both the Liberal government and the Opposition. This particular report

suggested on a “fiscal” basis that a majority of households receive more in rebates than paid in carbon tax, but at the same time on an “economic” basis that households have faced a general net loss. Further controversy erupted when it was disclosed that a relatively minor error was identified in the 2022 PBO report (Wherry 2024). That said, this controversy between the Liberal government and the PBO confirmed that debate was centred primarily on future-oriented results of “dueling computer models,” rather than actual outcomes for the carbon tax, based on data for recent past years. Nevertheless, various analyses by the PBO provide useful insight in that they highlight inherent biases that are disadvantageous for lower-income Canadians.

Despite controversies that have clouded work by the PBO and indeed the nature of their analyses, significant insights are provided in earlier reports by the PBO (2019 and 2020), including the following points:

- Key point specifically noted in PBO (2020) is that GST is indeed charged on carbon tax levies, but this is never acknowledged by the Liberal government, with impacts for Fiscal 2021-22, summarized as follows:

GST Impacts on Carbon Tax Balances for Fiscal 2021-22

The GST adds a further 5% on top of levies. For Fiscal 2021-22, PBO (2020, Table 2-1) projected this for Manitoba as $12 million. Based on actual data, 5% on total proceeds of $369 million for that year translates to $18.45 million, or roughly $36 more per household in costs that need to be considered.

Including GST means the average household net loss is increased to $128 per household if all indirect costs are included, or net loss of $74 if likely target pass-on is considered.

Additional costs are incurred across households irrespective of heating system employed, although not uniformly. Again, based on a likely target pass-on, values for electrical-heated homes still translate to a slight positive net balance, albeit further reduced to only about $27 (i.e., $614 rebate per average household – 1.05 × $559 cost with GST = $27).

- PBO (2019, Appendix A) clarifies for fiscal-based analysis what are considered for individual households as direct-costs and indirect-costs, with relevance to low-income households summarized as follows:

Household Direct- and Indirect-Costs of Carbon Tax

Extensive investigation of significant issue of carbon-tax pass through is described in extensive detail in Section 2.4.6, with the suggestion that ECCC (2023c) grossly underestimated the proportion of indirect costs passed on from businesses and other entities to consumer households during Fiscal 2021-22.

Earlier in Section 4.2, two very large indirect-cost categories were identified which directly impact households: (a) pass-on of diesel-based costs associated with transport of good and freight (Section 4.2.4); and (b) pass-on of natural gas heating costs associated with

businesses and other entities (Section 4.2.1). These are in order the largest two indirect-cost categories identified for Fiscal 2021-22. Using a likely target pass-on proportion, these two items together represent roughly $127 million. These costs on their own represent approximately 38% of proceeds based on likely target pass-on, and translate to costs of $245 per average household. Implications for lower-income may be somewhat reduced, but they too are directly impacted, and likely more than might be expected.

All goods purchased by consumers are affected by the carbon tax on diesel, which by economic necessity must be passed-on relatively quickly by transport companies in order to survive. Virtually all food products are impacted, with these, importantly, being necessities. Given that food products are an essential item, and that diesel transport emissions are incurred on product-mass basis rather than product-price basis, suggests that differences in impacts between quintiles are likely to be less significant than would be expected.

- A significant limitation in PBO reports (and carried on by ECCC 2023c) is the "fiction of progressivity" with the carbon tax. This problem has primarily to do with assumptions of energy use and associated costs.

Fiction of Progressivity on Energy Costs

PBO (2019, page 10) directly includes a statement of the assumption that "[a]s a rule of thumb, larger and richer households consume more [energy], and as a result will bear higher [carbon tax] costs." This ignores the growing problem of "energy poverty." It is true that higher income households can afford to spend more on energy in total, however, lower-income households spend a significantly higher proportion of disposable income on energy, in particular for home heating and household vehicles. These households are thus subject to energy poverty burdens.

Sustainable Prosperity (2011), a network of policy researchers within Canada, long ago raised the concern that "… carbon pricing tends to disproportionately impact lower-income groups, who spend a greater proportion of their income on carbon-intensive goods, and have less ability to make substitutions towards lower-carbon alternatives." This good background understanding of relevant issues appeared to have been neglected in the final development of the federal carbon tax system, in particular, the problem of energy poverty.

Canadian Urban Sustainability Practitioners (CUSP 2019), a network involving 17 large municipalities across Canada, noted that there is no formal or official definition for energy poverty in Canada, most commonly characterized by high home-energy cost burdens. They define an affordability threshold as being households spending twice the national average of 3% of disposable income on their home-energy needs, i.e., spending more than 6%, but excluding transportation.

NRCan (2023) considers household energy expenditures, discussing the notion of energy poverty, in this case defined as households paying more than 10% of disposable income on home-energy needs, but excluding transportation. This is a more-strict definition. Based on data for 2019 they indicate average home-related energy expenditures of about $2,102 for heating/cooling spaces, lighting and operating appliances, these representing about 3% of household disposable income. They note both for Canada and for Manitoba that roughly 6% of all households spend more than 10% of disposable income on home-energy expenditures,

more than triple the national average. Further, data are provided on energy poverty, as defined, by income quintiles, both for Canada and for Manitoba, summarized in Table 29.

Table 29. Home-Based Energy Poverty* Rates (excluding transportation fuels)

Quintile by Jurisdiction	Canada	Manitoba
Lowest Quintile	21%	21%
Second Quintile	6%	7%
Third Quintile	2%	1%
Fourth Quintile	0%	0%
Highest Quintile	0%	0%
Overall Average	6%	6%

* Defined as spending more than 10% of disposable income on home-energy costs.

The data from NRCan (2023) show that home-based energy poverty is most critical for lower income quintiles. As noted, 21% of households in the lowest quintile spend more than 10% on home-energy (with small percentages in the second and third quintiles, and none in highest income quintiles). The Fraser Institute (Green *et al*. 2016) noted the concern of energy poverty being exacerbated when gasoline expenditures are included along with home-energy, this to cover essential household transportation.

Using the same 10% threshold of disposable income as NRCan, they found that when household transportation costs are included, energy poverty levels more than double across the country. NRCan (2023) notes, based on 2019 data, that average households spent about $2,422 for transportation-energy expenditures in addition to home-related energy expenditures of about $2,102, and that together these two costs represent about 6.6% of disposable income for average households. They do not, however, consider any further analysis regarding energy poverty or affordability.

Energy poverty represents a growing issue of concern worldwide, with relevant recent information from the U.S. (ACEEE 2024). The American Council for an Energy-Efficient Economy specifically examined the twin burdens of home- and transportation-energy across the U.S. They specifically define threshold values associated with “high” and “severe” burdens, as outlined in Table 30, showing consistencies with other sources for Canada.

Table 30. ACEEE Defined Energy Poverty Thresholds as Applied to U.S.

Threshold Level	Percentage Income	Consistent Sources
Home-energy high burden	6% disposable income	CUSP (2019)
Home-energy severe burden	10% disposable income	NRCan (2023)
Combined-energy high burden	12% disposable income	
Combined-energy severe burden	20% disposable income	

Sustainable Prosperity (2011, Figure 2) showed using much older data within Canada that the lowest income quintile spent more than twice the proportion of disposable income than the highest income quintile on fossil energy. More recent data for the U.S. from ACEEE (2024) shows for 2022 that average households spent approximately 5.6% of disposable income on combined home- and transportation-energy needs. Specifically, average home-energy expenditures represented about 2.4% and transportation-energy expenditures represented about 3.1% of disposable income, the latter more than half the combined total. They showed for the U.S. overall that low-income households spent on average more than three times the national average.

Relevant for comparison to Canada, ACEEE (2024, Figure 2, page 8) include an analysis by income quintiles, with approximate values presented in Table 31, data based on 2022.

Table 31. Approximate Combined-Energy Costs and Relative Burdens for U.S.

Income Quintile	Combined-Energy Cost	Precent Disposable Income
Lowest Quintile	$800	17%
Second Quintile	$1,000	10%
Third Quintile	$1,250	7%
Fourth Quintile	$1,400	4%
Highest Quintile	$1,550	3%

This more recent data confirms a stark contrast that is relevant to the carbon tax within Canada. It is absolutely true for the U.S. too that well-off households spend more on energy, just as in Canada, with the highest quintile roughly double the lowest. That said, the proportion of disposable income spent on energy increases even more sharply for lower income quintiles in the U.S., with the lowest quintile having a burden more than five-times higher than that for the highest quintile.

No more-recent, comparable analysis for Canada could be readily located, but similarities to the U.S. suggest a consistent and likely growing problem here. It is clear from information on energy poverty that carbon taxes on fossil fuels have a disproportionately heightened impact on lower-income households. It is also clear from earlier information by Sustainable Prosperity (2011), that this concern was well known more than five-years in advance of the design of the federal carbon tax, but appears to have been not considered. Designing a carbon tax that from an economic equality perspective depends solely on assuming that wealthier citizens use more fossil energy and by extension that lower-income citizens use less fossil energy and will be less impacted, appears to have been a poor choice and not well thought-through. The government could claim the use of revenue recycling inherently addresses energy poverty, however, as noted earlier, the revenue recycling as employed appeared oriented to enhancing political acceptability as an overriding priority (Section 2.2).

- Estimates of calculated carbon tax rebates in PBO (2019) and PBO (2020) show significant problems, in particular in terms of implied household sizes, as follows:

Rebate Estimate and Household Size Impacts for Lower-Income Households

The two early reports by the PBO solely discuss fiscal implications so it is thus possible to back-calculate implied rebates projected in both reports for Fiscal 2021-22 by income quintile and for average households, and compare changes. It is also thus possible to back-calculate implied household sizes, and compare to Manitoba's actual census for that timeframe.

Implied rebate calculations start with net benefits (cost) per household suggested from computer modeling (PBO 2019, Table 2-5 and PBO 2020, Table 2-4). These data show some immediate concerns. Data presented in PBO (2019) suggested that households across all quintiles would receive net overall benefit, estimated on average as $163 per household. Such a result is mathematically questionable, and it is important to note that the PBO merely accepted this, and did not question the result internally. Alterations in PBO (2020) showed reductions of net benefits (costs) across all quintiles. The highest income quintile was shown to have a net cost, albeit with the third quintile showing the largest reduction in absolute

terms. There were obvious problems with the first analysis that the PBO sought to correct, hence the second report as a "review." In contrast ECCC (2023c) showed an average net rebate value even higher at $243 per household (i.e., $705 average rebate less $462 per household cost of the carbon tax), but with rebate and cost figures unsupported. That even the PBO was consistently suggesting much lower average rebates per household raises further doubts about the Liberal government claims.

Having the assumed net benefits (cost) per household, as above, the assumed gross carbon taxes per household (PBO 2019, Table 2-3 and PBO 2020, Table 2-2) can be then added back to estimate the implied household rebate. Implied household sizes can be further back-calculated using the rebate formula, including rural addition, discussed in more detail in earlier sections. The comparative results from the two reports for the same fiscal year are outlined in Table 32.

Table 32. Implied Household Rebates and Sizes from PBO (2019) and PBO (2020) Reports

Income Quintile	Implied Household Rebate		Implied Household Size	
	PBO (2019)	PBO (2020)	PBO (2019)	PBO (2020)
Lowest	$490	$472	1.66	1.56
Second	$546	$525	1.96	1.85
Third	$599	$580	2.49	2.29
Fourth	$674	$652	3.31	3.07
Highest	$761	$723	4.25	3.84
Average	$614	$590	2.72	2.52

These results show intriguingly odd behaviour. The PBO (2019) implied rebates per average household that match very closely the calculation in this report, based on population data (Section 4.4.3), but the implied average household size is about 8% too high. On the other hand, the PBO (2020) implied rebate per household was lower, while the implied average household size indeed matches the census data for 2021 (Section 4.1).

More importantly, however, the PBO shows household sizes to be much smaller for lower-income, increasing large as income increases. They consistently show the highest quintile households as being roughly 2.5-times larger than the lowest quintile. Effectively they assume no children for lowest and second quintile households. Intuitively this is entirely false.

There continues to be strong evidence of significant, and increasing, child poverty in Canada, estimated in 2021 at 17.8% (Racine and Premji 2024). Specifically for Manitoba in 2021, a report issued under the Campaign 2020 (2024) coalition group suggests the total number of children living in poverty to be about 74,960.

Further, Statistics Canada (2024) shows for Manitoba during 2021 that the highest median incomes for both couple-based and single-parent families, involved families with two children. In both cases income declined as the number of children increased further. These results are contradictory to suggestions in both PBO reports showing a very strong correlation of increasing household size as income quintile increases.

These results suggest that computer model-based household sizes assumed by the PBO are in error: too small for lower income quintiles; and too large for higher income quintiles. Their assumptions do not reflect the realities in Manitoba and Canada, and downplay concerns about children-in-poverty.

4.6.2 Inequality Concerns with Rebate Formula and Improvements

The suggestion by the Liberal government that the carbon tax provides a significant benefit to lower-income households appears to be based on a questionable assumption, which was investigated in more detail in the last section. This key assumption is that well-off households bear higher carbon-tax costs, as directly outlined by PBO (2019), but also then by extension that lower-income households bear lower carbon tax-costs. Indeed, both in PBO (2019) and PBO (2020), data presented on assumed carbon costs per household for Manitoba in Fiscal 2021-22 across income quintiles, are strongly and a linearly correlated to the quintile, i.e., with coefficient of determination (i.e., r^2) values greater than 0.90, and statistically significant.

Beyond this assumption of presuming lower-income households pay less, there is absolutely no income testing included in the allocation of rebates under the federal GGPPA (Government of Canada 2018). This is a significant deficiency, with no real assurance that lower-income households are actually being made better off. This is particularly true in the light of findings outlined earlier in this report that: (a) stated average household rebates in ECCC (2023c) are unrealistically high; (b) stated carbon tax costs per household in ECCC (2023c) are unrealistically low; and (c) Manitoba households on average pay more in carbon tax costs than receive in rebates.

The idea of income-testing rebates associated with carbon taxation is not new and has already been employed, for example by the Government of Manitoba (2023). In this case the Government of Manitoba provided carbon tax “relief” rebates, but only when family income was less than $175,000 based on the 2021 taxation year.

Regarding the federal carbon tax, one suggested improvement by the student group assessing carbon tax fairness involved deliberately adjusting rebates according to approximate income quintile in order to ensure that lower-income households are indeed made better off. There are several ways this could be done, but upon further examination, one possibility involves employing approximate rebate multipliers that vary based on income quintile. Interestingly adjustments do not need to be overly extreme in order to achieve a desirable result. The impacts of one possible example set of quintile-based multipliers is illustrated in Table 33, with estimated approximate household after-tax income levels limits between quintiles included (Statistics Canada 2024b). Importantly the choice of multipliers is completely wide-open, meaning further analysis and consideration of such an approach can be readily undertaken.

Table 33. Household Carbon Tax Costs and Rebates incorporating Assumed Multipliers

Household	Multiplier	Income Limit *	Cost **	Rebate	Net ***
Average (Table 27)	1.00	Average	$652	$614	-$38
Lowest quintile	1.50	$34,600	$652	$921	+$269
Second quintile	1.25	$57,100	$652	$768	+$116
Third quintile	1.00	$82,700	$652	$614	-$38
Fourth quintile	0.75	$119,500	$652	$461	-$191
Highest quintile	0.50	All higher	$652	$307	-$345

* Approximate household after-tax limit based on calculations from Statistics Canada (2024b) and reflects after-tax income for economic families and persons not in an economic family.
** Costs reflect application of likely target pass-on of indirect costs
*** Positive value reflects a net overall rebate and negative value reflects a net overall cost

As noted earlier in Table 27, based on more-realistic estimates of carbon tax burdens and rebates, an average household pays net more carbon tax overall. As illustrated in Table 33, the use of the example set of multipliers ensures that the middle (third) quintile is effectively unchanged while lower-income quintiles receive increasing net rebates, and higher income quintiles pay increasingly higher net costs.

4.6.3 Lack of Transparency in Pass-On of Carbon Taxes by Businesses

Passed-on carbon taxes represent the largest portion of the burden borne by individual Manitoba households, as outlined in Section 4.3, yet an important problem identified by the student group is the lack of any transparency in subsequent pass-on of carbon taxes through supply chains. This raises the possibility of even greater price increases being imposed through supply chains under the cover of the “carbon tax.” This means that cost burdens actually felt by households could be larger than as outlined in this report, but as yet uncertain.

The root of the problem regarding lack of transparency goes directly back the Liberal government. They have been loath to any discussion of carbon tax pass-on implications and embedded carbon footprints, even though pass-on of carbon taxes has been an intrinsic part of the carbon tax design (ECCC 2021c). Ignoring pass-through indirect costs appears a byproduct of an over-focus on trying to assert that household are somehow mostly better off.

A solution to this problem starts intrinsically with the federal government being transparent about carbon taxes, especially passed-on costs. One theoretical possibility is an administrative system to treat carbon taxes like GST, with the passed-on amount of the tax clearly visible to consumers as goods with embedded emissions move forward through supply chains. Such an approach at this point is only considered as a possibility, and may be too administratively complex or expensive to be practical. More work on transparency is needed.

4.6.4 Lack of Support for Public Transit as Alternative to Household Vehicles

The lack of affordable low-emission alternatives represents a general concern likely contributing to the poor performance of Canada’s carbon tax in not adequately reducing emissions. This was outlined in more detail earlier (Section 2.4.3). Of particular importance is transportation, with, as noted in Table 23, direct household use of vehicles being the single largest component of the carbon tax incurred by average households in Manitoba during 2021-22. This leads directly to considering the problems associated with a lack of sufficient available public transit as an alternative to fossil-fuel dominated personal vehicles. This requires specific attention.

One obvious option is personal electric, or other zero-emission, vehicles. However as identified by Parsons *et al*. (2023), their high prices represent a major barrier. Personal electric vehicles of all types, even after a decade of being on the market, remain too expensive for most Canadians, even after government incentives. High-income households can purchase expensive electric vehicles and acquire virtue-signaling advantages for saving the planet, but lower-income households are stuck with conventional vehicles that pollute more, if they can afford them at all. Significantly enhancing public transit systems across the country was identified as a better option, whether zero-emission buses or even conventional diesel buses. The result is not just significant emission reductions, but at the same time enhanced economic equality, and a net positive economic payback across the board.

Enhanced public transit makes good sense. Indeed, it was even identified early-on by Sustainable Prosperity (2011) as an important option to be part of any proposed carbon taxation system in order to ensure social equity and reduce poverty. Yet, this has not really happened across Canada, indeed the opposite. Examining the situation surrounding the COVID pandemic, the reduction in all transportation activities was dramatic, but the biggest standout was the staggering decline in public transit ridership beginning in March 2020, Monthly ridership dropped by more than 80% across the country, and monthly transit revenue declined by as much as 85% (Larson *et al*. 2020, SSHRC and FSC 2022). Private vehicle use dropped too, but not nearly to the same extent.

These changes had dramatic financial impacts on transit systems and municipalities across the country. As directly noted by the Federation of Canadian Municipalities (FCM 2020), “Municipalities with public transit systems face significant revenue losses at the fare box - estimated at $400 million per month nationwide. This accounts for 30 to 50 percent of monthly net losses for these municipalities.” A relevant report by the consultant Deloitte around the same time (Iacobacci and Dixon 2020) recommended to government to undertake, “Financial compensation covering a relatively large share of the drop in transit ridership revenues, with a commitment to provide support for a period long enough (e.g. six to nine months) to enable transit authorities to provide an initial, evidence-based assessment of the factors behind the ridership drop and ridership recovery prospects.” Based on the above figures, suitable minimum assistance from the Government of Canada would have been in the range of $2,400 million to $3,600 million as a short-term response.

Some assistance was ultimately provided, but while gratefully received, it amounted to only a total one-time payment of $750 million to cover municipalities across the country (Office of the Deputy Prime Minister 2020). This represented only in the range of 20% to 30% of the suggested urgent short-term need. At the same time, the Liberal government continued on with funding zero-emission transit vehicles as a priority, announcing in 2021 the $2.75 billion Zero Emission Transit Fund (ZETF) (Infrastructure Canada 2021).

Yet, major bus manufacturers, like New Flyer, did not see production operations returning to normalcy until mid-2023, three years after COVID and two years after the ZETF (Brass 2023). The Canadian Urban Transit Research and Innovation Consortium (CUTRIC) has tracked by

year the numbers of zero-emission buses (ZEB) at various stages of implementation (Jaricha *et al*. 2024). Their results, while useful, are somewhat problematic given inclusion of those merely "announced" in tabulations. For 2023, they indicated a total of 5,426 ZEB, well over the ZETF target of 5,000, but 2,800 merely announced (52%), and only 236 in actual service. For 2024, however, their total reduced to 4,945, this under the ZETF target, but 2,620 merely announced (53%), an increased proportion, and only 255 in actual service. The slow growth of ZEB in service, combined with the lengthy process toward final implementation, suggest the ZETF target is unlikely to fully be meet. Considering ZEB identified by CUTRIC at stages of funding, procurement, commissioning or in-service, a more-likely number by 2026 is only around 2,000, less than half the target. Decline in interest was ascribed by CUTRIC to high costs of ZEB, in particular taking into account inflation. This also indicates affordability concerns for municipalities, with associated hesitancy on actual large financial commitments.

Problematically, reduced ridership has continued to persist long after, as illustrated in updated data on monthly transit ridership across Canada in Figure 7, from Statistics Canada (2024c). Based on available data, transit ridership is not anticipated to return to pre-COVID levels until into 2025, roughly five years from the start of the pandemic.

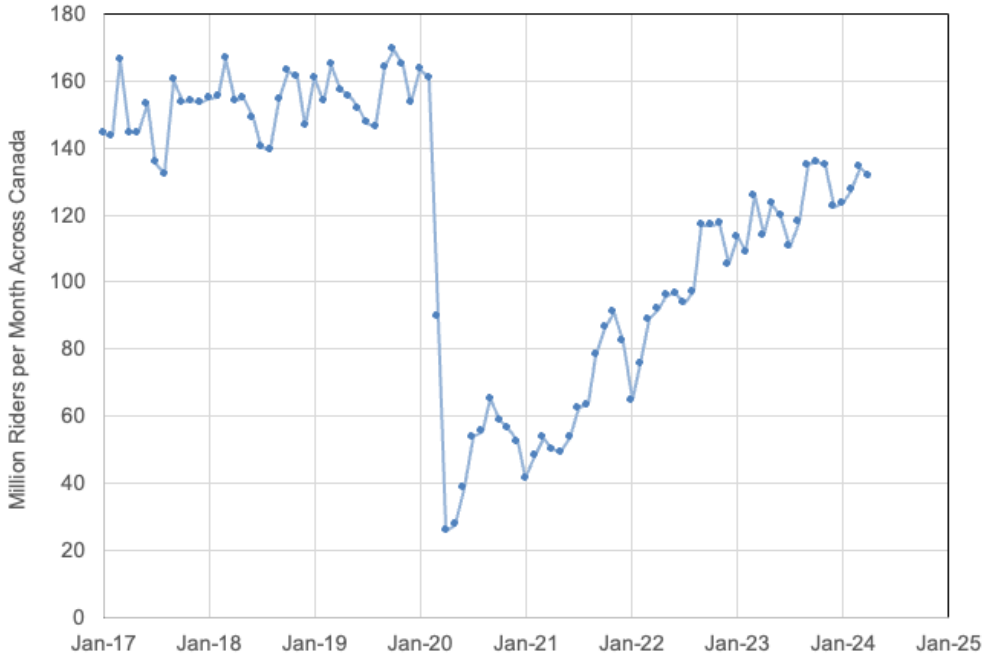

Figure 7. Monthly Transit Ridership Across Canada Illustrating Enduring Impact of COVID

Transit buses are well-identified as a method to reduce emissions, but mere presence alone is insufficient. Reductions, whether for ZEB or conventional buses, depend fundamentally on getting people on-board and out of personal vehicles. The above data shows the emission reduction potential for public transit has not yet even recovered to pre-COVID levels.

The Liberal government missed an important opportunity. Their priorities remained unchanged, and misaligned to address the harsh realities faced by public transit across Canada; unable to pivot and focus on the urgent need to help to get public transit back on its feet, and help ridership rebound. Having ZEB is a noble goal, but cannot actually reduce emissions if no one is riding them. Further, mishandling of the public transit emergency has impacted lower-income households most severely.

The financial woes encountered by municipalities, on-going over several years, have led to undesirable outcomes for public transit including service cuts and fare increases. Examples abound across the country. These include Calgary (Babych 2022), Edmonton (Boothby 2024), Montreal (Magder 2023), Ottawa (Pringle 2023), Toronto (Murphy 2023), and Winnipeg (Woelk 2024), with general commentaries including Armstrong (2023), Wallace (2023), Haider (2024) and the Affordability Action Council (2024). Reductions of public transit availability and accessibility hurt lower-income households the worst. Addressing both emission reductions and income-inequality concerns requires public transit to be reestablished as an important priority.

4.6.5 Canadians Not Filing Taxes and Ineligible for Rebates

An issue identified by the student group assessing fairness, has been that a significant number of Canadians do not file for taxes and thus do not receive benefits. The federal government relies on the Canada Revenue Agency (CRA) to deliver a wide-range of benefits to individuals, both income-tested and non-income tested. The latter includes carbon tax rebates, but being eligible to obtain rebates requires filing for taxes.

A relatively recent paper by Robson and Schwartz (2020) suggested that Canadians not filing for taxes are typically understood to be in the range of 10% to 12%, and thus do not receive benefits for which they are otherwise eligible. They note that not everyone is legally required to file a tax return, for example if they do not have any taxable income or do not have taxes owing except in special circumstances. Many people, for a variety of reasons do not file. Importantly, a disproportionately high number of those that do not file taxes are of lower socio-economic status and categorized in lower income-quintiles.

In characterizing non-filers, Robson and Schwartz specifically found that close to 20% of those in households with total disposable income less than the Market Basket Measure of poverty do not file taxes, with this latter parameter officially adopted as the measure of poverty by the Government of Canada. While the work by Robson and Schwartz was based on taxation data from 2015 and 2016, the problem of non-filing by Canadians who are missing out on benefits continues to persist (Al Mallees 2022).

If it is assumed for the lowest-income quintile that a 20% proportion of households do not receive benefits because of not filing, the impact on net results for an average such household when likely target pass-on indirect costs are included, changes from a net loss of $38 to a net loss of about $161 (i.e., $614 × 0.80 rebate - $652 cost). Even if these households were all using electric-heat, the result changes from a positive net gain of $55 to a net loss of $68 (see

Table 27). A reduced level of rebates, as occurs is households do not file for tax has a dramatically negative impact on lower-income households.

In this report (Section 4.4.3), using the government's own values (ECCC 2023c), the number of apparent households receiving rebates was calculated as 485,106 households. This value could suggest approximately 6.4% of Manitoban households appear to be not filing. However, as also noted earlier, even the use of this smaller number of households means the implied number of people per household is still mathematically impossible, and unrealistic. In all their promotion of the carbon tax as a measure of fairness, the Liberal government has never directly mentioned nor discussed the issue of Canadians not filing taxes, and thus not receiving carbon tax benefits.

4.6.6 Impacts on First Nations and Indigenous Citizens

An especially concerning negative impact on fairness identified by the student group is with regard to indigenous peoples and First Nations communities. Manitoba in particular has the highest proportion of Indigenous citizens of all Canada's main provinces, roughly 20% or one-in-five, such that negative effects are exacerbated.

Under Section 87 of the federal *Indian Act* (Government of Canada 1985), indigenous citizens and First Nation communities have certain tax exemptions. In general, this has been interpreted to mean that income of someone registered, or eligible to be registered, as a "Status Indian" under the Act will be exempt if that income is located on a reserve, but with a variety of intricacies (Bryan 2022).

Across Canada, the overall rate of indigenous citizens living in a low-income situation is roughly double that of non-indigenous citizens, with a rough breakdown by categories specifically for Manitoba presented in Table 34 (ISC 2023). For different classifications of indigenous peoples, the values vary but again well over double that of non-Indigenous citizens. Given exemptions but also more generally relative lower income, many indigenous citizens do not owe tax and may not make a tax filing, thus subject to the more general problem noted in Section 4.5.5. Yet, indigenous citizens and communities still must pay carbon tax on fuels and as embedded in goods, including for example food.

Table 34. Indigenous and Non-Indigenous Citizens in Low-Income Situation for Manitoba

Category	**Proportion Living in Low Income Situation**
Registered Indian on reserve	38.5%
Registered Indian off reserve	30.6%
Non-Status Indian	31.0%
Metis	14.5%
Indigenous Overall	26.0%
Non-Indigenous	11.5%

Most striking are legal concerns. As noted by Campney (2021), irrespective of their position regarding the carbon tax, indigenous communities appeared to have been conspicuously

ignored in legal actions involving the federal and provincial governments over the carbon tax, including in particular at the Supreme Court. In late 2023, an indigenous advocacy group representing 133 Indigenous communities in Ontario launched legal action against the Government of Canada regarding the carbon tax. Specifically, they claim that the national carbon-tax regime leaves their communities worse off than others in the country, violating the principles of reconciliation as well as their constitutional rights (Tait and Steucken 2023). The same group also noted they had tried to negotiate with the federal government, but to no avail. Addressing the broad range of indigenous concerns will require significant further consultation, with the need for the federal government to act in good faith, and not merely obfuscation.

4.6.7 Inflationary Impacts

A more recently emerging concern with the carbon tax involves inflationary impacts, with this having become a significant focus of criticism from the Official Opposition, and thus hotly debated. Initially the Liberal government appeared to suggest that the carbon tax did not result in any inflation, based on the premise that money was being largely refunded. This, however, is not true based on fundamental economics. The Consumer Price Index (CPI) reflects the costs of a basket of goods and services, with changes in CPI used as one important measure of inflation. The CPI reflects changes in market prices, and includes energy. Thus, even if there may be rebates, the measure of CPI includes the implications of the carbon tax on market prices, before considering any rebate.

Ultimately by 2022, the Governor of the Bank of Canada, Tiff Macklem, clarified to the parliamentary Standing Committee on Finance (2022, page 12) that there was an inflationary impact, although it was estimated by them to be relatively small. This was importantly clarified in a further letter to the Chair of the House of Commons Standing Committee on Finance dated March 11, 2022, as follows (Zinchuk 2022 showing text copy):

> I committed to reply to the question of the impact of the carbon pollution charge on the rate of inflation. According to the Bank's calculations, if the charge were to be removed from the three main fuel components of the consumer price index (gasoline, natural gas and fuel oil) it would reduce the inflation rate by 0.4 percentage points. In other words, if that policy had come into effect at the start of the year, January's inflation rate would have been 4.7% instead of 5.1%.
> For clarity, the 0.1 percentage point figure I provided during the hearing referred to the impact on CPI stemming from the increase in the carbon pollution charge over the previous year.

Initially the annual increase in carbon tax was $10 per tonne, however, starting April 1, 2023, the annual increase in carbon tax went up to $15 per tonne. Later in September 2023, the Governor further clarified at a meeting of the Calgary Chamber of Commerce that 0.15 percentage points of the inflation increase can be attributed to the carbon tax (Markusoff 2023).

These statements suggest the Bank of Canada’s position involves two key points:

- That while there have been differences in the annual carbon tax increases, the inflationary increase consistently corresponds to 0.10 percentage points for each $10 per tonne annual rise; and
- Annual increases are cumulative, with total inflationary impacts over time thus corresponding to the calculation in Equation (8).

$\text{Inflation Impact} = 0.10 \text{ percentage points} \times \frac{\text{Carbon Tax (\$ per tonne)}}{\$10 \text{ per tonne}}$	Equation (8)

Interesting new evidence regarding inflationary impacts comes from Manitoba. Based on an election promise to help reduce inflationary pressures, the new NDP government proceeded to temporarily lift the provincial road tax on fuels, including both gasoline and diesel (Government of Manitoba 2023). For both fuels, the road tax translates to $0.14 per Litre, which, importantly, is relatively close to the carbon taxes levied on the same fuels in 2023 and 2024. As it has turned out, the inflationary impacts of this tax relief appear to be significant, and suggest a potential need for the Bank of Canada to reassess its estimated impacts of the carbon tax.

The estimated carbon-tax equivalence of the Manitoba reduction is outlined in the Table 35.

Table 35. Carbon Tax Equivalent of Manitoba Road Tax Reduction

Item ↓ Fuel Type →	**Gasoline**	**Diesel**
Manitoba Road Tax Reduction	$0.1400 per Litre	$0.1400 per Litre
Levy at $50 per tonne	$0.1105 per Litre	$0.1341 per Litre
Levy at $65 per tonne	$0.1431 per Litre	$0.1738 per Litre
Implied Equivalents	$63.60 per tonne	$52.20 per tonne
Assumed Rough Contribution	2/3	1/3
Contribution Equivalent	$42.40 per tonne	$17.40 per tonne
Overall Rough Equivalent	$59.80 per tonne	

The implied inflationary impact as outlined by the Bank of Canada suggestions translates to:

$59.80 per tonne equivalent ÷ $10 per tonne × 0.10 percentage points = 0.60 percentage points

Annual monthly inflation rates, based on annual CPI changes, for Canada overall and by province are tabulated by Statistics Canada (2024d), with comparative results for the first half of 2024 summarized in Table 36.

Over the period from January through June 2024, Manitoba's annual inflation rate was on average 1.9 percentage points lower than Canada, consistently at the lowest annual inflation level in Canada. The implied reduction of the road tax reduction translates, based on Bank of Canada suggestions, to a total of only about 0.6 percentage points, meaning the effects of Manitoba's road tax reductions in practice were more than three times higher than the suggested level from the Bank of Canada.

Table 36. Annual Inflation Rates and Differences for Manitoba by Month in 2024				
Month	Canada Rate	Manitoba Rate	Rate Difference	Comments
January	2.9	0.8	-2.1	Lowest PE next
February	2.8	0.9	-1.9	Lowest PE next
March	2.9	0.8	-2.1	Lowest SK next
April	2.7	0.4	-2.3	Lowest SK next
May	2.9	1.3	-1.6	Lowest SK next
June	2.7	1.4	-1.3	Tied lowest with SK
Average Rate Difference			-1.9	Consistently lowest

It is true that Manitoba did show lower inflation than average in the final six months of 2023, prior to the reduction (Statistics Canada 2024d). The province, however, did not consistently show the lowest inflation rate. The results presented for Manitoba may not necessarily be conclusive, but strongly suggest a need for review of inflationary estimates by the Bank of Canada. They appear to have significantly underestimated the inflationary impact of the carbon tax in practice.

One potentially contributing factor in this case, as identified by students, may be the lack of transparency in pass-on of carbon taxes down supply chains, as discussed in Section 4.6.3. Regrettably, the over-focus of the Liberal government to trying to assert that households are somehow made better off, has meant that the government ended up lapsing in its responsibility to ensure that the tax was properly and accountably passed-on.

5. Conclusions

This report provides a relatively detailed analysis of carbon tax implications in practice within Canada, and outlines key points identified by MBA students in assessing the effectiveness and fairness of the carbon tax as implemented within Canada. In both cases, the focus has been on actual annual recent data rather than computer models. Regarding effectiveness, recent data on annual emissions and annual fuel consumption levels across a number of provinces were employed. Regarding fairness, data for Fiscal 2021-22 specifically involving Manitoba were evaluated. Key findings of reviews and analyses undertaken are summarized as follows:

- Carbon taxation (and related cap-and-trade) involves use of economic instruments, specifically a form of emission-fee system (or tradeable permit system), to attempt to control, and hopefully reduce, GHG emissions. This general approach is legitimate, but its use is not necessarily guaranteed to achieve policy objectives merely by its presence.

- In terms of major UNFCCC criteria for evaluation of GHG reduction measures, carbon taxation has been reasonably well shown to perform strongly on the criterion of (a) efficiency, but with question marks in practice on the other major criteria involving: (b) political acceptability; (c) fairness; and, most importantly, (d) effectiveness.

- Regarding political acceptability, it is undeniable that the carbon tax in Canada has been controversial and divisive. There is no question that carbon taxation has performed poorly on this criterion within Canada since 2019, despite efforts by the Liberal government.

- Canada's record for emission reductions since 2005 has been poor, irrespective of the government in power, with appreciable reductions only seen in two years: 2008, linked to the world recession at that time; and 2020, linked to the COVID pandemic. No Government of Canada policy has appeared to result in any appreciable reductions of emissions over the timeframe since 2005. Time series analysis of Canada's overall data to 2022 suggests our reduction by 2030 will likely be no more than 9%, well short of the 40% to 45% promised.

- Canada's emission reduction performance continues to be rated poorly internationally, with Canada under the current government ranking even lower than under earlier governments.

- The use of revenue recycling for distribution of proceeds from the carbon tax appears to have been initially motivated as a means to address political acceptability, but as the popularity of both the carbon tax and the government declined, the apparent purpose of the carbon tax was shifted more towards being a quasi-social program to apparently address affordability, with a key refrain that "eight of ten households receive more in rebates then pay in taxes." Such statements increase importance of evaluating fairness of the tax.

- Concerns regarding inelasticity of demand for major fossil fuels (i.e., gasoline, diesel and natural gas), and unresponsiveness of consumers, in particular given a lack of affordable alternatives, appear to have been largely overlooked or dismissed, despite being important for achieving effective performance.

- A subtle but important problem is the over-reliance on computer models, especially sophisticated input-output macroeconomic models not just in projecting anticipated reductions but in assessing effects as well. This problem appears to be common with academics too, with some seeming to prefer models over direct analysis of available data.

- Much of the theoretical justification for the national carbon tax in Canada was based on a selected, older, papers published during the early 2010s that, firstly, focused exclusively on British Columbia over a relatively short time period, and, secondly, tended to focus on transportation fuels, in particular gasoline. While undertaken by competent researchers, these papers appear to contain subtle and not immediately obvious flaws, suggesting researchers found correlation rather than causation. Most importantly, these papers wee too readily accepted as gospel, with, critically, no re-evaluation based on additional experience in the same jurisdiction, i.e., British Columbia may have initially shown selected reductions over the period of time considered, but have such trends been borne out over time?

- While carbon taxation is an elegant theoretical approach, it is the practical outcomes rather than the normative theoretical results that ultimately determine effectiveness. Unfortunately, from an academic perspective, there has been often much emphasis on theory, resulting in some academic proponents being "conspicuously selective" in justifying the carbon tax. One prominent assertion of effectiveness claims that "[s]ince federal carbon pricing took effect in 2019, Canada's GHG emissions have fallen by almost 8 percent …" Such statements are misleading, ignoring acknowledgements by Environment and Climate Change Canada itself that COVID was the overwhelmingly dominant cause of emission reductions, not government policies. Since COVID, GHG emissions have shown an upward trajectory.

- An intrinsic aspect of carbon taxation in Canada, even in the original design, has been acknowledgement that carbon taxes imposed on selected upstream companies would be passed down supply chains to their own customers, and so on ultimately to consumers. While anticipated and discussed, the pass-through of indirect carbon tax costs appears to have been significantly downplayed or even ignored by the Liberal government, in particular relating to claims that "eight of ten households are made better off." Calculated proportion values, apparently assumed for indirect carbon pass-through as employed by both the Parliamentary Budget Officer, and by Environment and Climate Change Canada, appear to be very similar, suggesting relatively similar computer model calculations. For Fiscal 2021-22 in Manitoba, the presumed values as employed all appear to represent no more than about 65% of total proceeds. Such a value, however, is unrealistically low in the context of modern supply chain operational realities.

- As a first evaluation of effectiveness, updated data were used to compare time-series trends over an extended period for British Columbia and Sweden. The two have comparable scale emissions and both implemented carbon tax systems, the former since 2008, notable as the first in North America. Total transport-related emissions for the two jurisdictions were considered, given this was a major focus of earlier papers, but in this case now examining 18 years starting 2005 through 2022. Regressions of both jurisdictions show strong linear correlations that are statistically significant. Sweden shows a consistent downward linear slope, declining about 0.4 million tonnes per year, averaging about -2.3% change, while BC shows a consistent upward linear slope, increasing about 0.3 million tonnes annually, averaging about +1.2% change.

- Available data tend to validate the performance of Sweden's carbon tax as being able to demonstrate appreciable GHG reductions. BC's results, however, show questionable performance, at best. Indeed, while initially touted as a leader in addressing climate change, the province has never been a strong performer on GHG reductions within Canada. This includes most recently in 2022 when based on National Inventory Report emissions data, it ranked as third worst performer of Canadian provinces referenced to 2005. Enthusiasm to adopt their carbon tax system appears upon closer re-examination to have been unjustified. Updated data shows BC has not reduced emissions, contrary to earlier papers.

- As a second evaluation of effectiveness, sequential classes of students, as part of graduate-level studies in sustainability economics, have been evaluating emission reductions, total costs and costs per tonne of reduction associated with the federal Back-Stop carbon pricing system applied to two designated liquid fuels, on-road gasoline and on-road diesel, across four applicable provinces: Alberta; Saskatchewan; Manitoba; and Ontario. Fuel consumption data in this case is readily available from Statistics Canada.

- To avoid awkward positive relationships between prices and consumption if considering year-to-year changes in the recent past, the aggregate change in fuel consumption (and associated emissions) was calculated for 2022 using 2019 as the baseline. Unlike many economic-related evaluations, results involved calculating the cost per tonne of emissions reduction. This parameter is legitimate and was for example employed in the 2016 report of the Specific Mitigation Measures Working Group under the Pan-Canadian process. As such, the total cost of carbon taxes paid over the three years (i.e., 2020, 2021 and 2022) was divided by the net reduction (or increase) in emissions in 2022 relative to 2019. This estimation method is also understood to be optimistic for the carbon tax, given that all reductions observed are ascribed to be due to the carbon tax. In reality, other factors, for example COVID impacts, are known to have been more important.

- Emission reductions by 2022 were calculated to be approximately 3.8 million tonnes CO_2e for the relevant jurisdictions and fuels. Gasoline-related emissions declined, while diesel emissions increased. Indeed, across Canada, overall diesel consumption was greater in 2022 than in 2019. The cost of cumulative carbon tax payments over the three years for these fuels, in order to achieve the reductions, totaled more than $9.1 billion.

- The raw cost of reductions translated to $2,400 per tonne, a high figure. Given that a significant portion of these costs are returned to households, it is legitimate to reduce the cost based on the returned proportion. That said, actual returns to households over the three years have not fully met return-objectives, with on average approximately 88% returned to households. Using this value, the revised cost of reduction translated to approximately $290 per tonne, again a high figure.

- The reduction of 3.8 million tonnes over three years is small, especially in the context of annual reductions of 31 to 37 million tonnes required annually year-on-year by Canada starting in 2006 in order to achieve the 2030 reduction target. As such, optimistically, the carbon tax contributed no more than about 0.5% reduction, which is trivial and not consequential in terms of the country trying to meet the 2030 target.

- More concerning is the high cost. In 2023, the value of the social cost of carbon was increased by the Minister of Environment and Climate Change from approximately $50 per tonne to approximately $260 per tonne. Importantly, this cost effectively represents the “cost of doing nothing.” Based on calculations, even optimistically, the cost per tonne reduction for the carbon tax turns out to be higher than the cost of doing nothing. Such a result is hardly positive, and suggests there may be valid economic reasons for not continuing with the commodity-based carbon tax system into the future.

- So far, considerations of fairness regarding the carbon tax have tended to focus on “dueling computer model result.” These include differences in interpretations of results from the Parliamentary Budget Officer or between the Liberal government and the Official Opposition; issues between the PBO and the Liberal government. Various academics are also involved computer model results, in some cases expressing skepticism regarding direct calculations.

- Unfortunately, there has been little consideration of evaluating and assessing actual data for past years as provided by Environment and Climate Change Canada. In this case, the focus here is precisely on examining actual data, making this work relatively unique in context.

- To evaluate fairness, and in particular the claim by the Liberal government that “eight of ten households are better off,” the focus was on data for a single year and a single province, namely Manitoba for Fiscal 2021-22. Environment and Climate Change Canada provides a summary report for the year in question. Unfortunately, there is little in the way of backup or explanation of how and where several important figures were derived. Further investigation then uncovered serious concerns regarding various of these figures.

- Carbon tax “proceeds” from the commodity-based carbon tax for Fiscal 2021-22 are listed, but only as a single total value, $369 million for Manitoba. Unfortunately, no further breakdown of costs by major fuel type was provided. It is nevertheless relatively straightforward to validate this figure using data from separate sources to make reasonable estimates of component costs, including: $133 million for on-road gasoline; $114 million for natural gas; $82 million for on-road diesel; $21 million for railway diesel; $15 million for

aircraft fuels; and less than $2 million for other home heating fuels. The estimated breakdown reconciles well, representing more than 99% of the provided figure, thus a reasonable balance.

- It is reported for Fiscal 2021-22 that a total of $342 million was provided as incentive rebate payments to households in Manitoba, representing close to 93% of collected proceeds for the same period. Initially this would sound positive, except it is also acknowledged to include $16 million of proceeds from earlier years to try make back earlier shortfalls in rebates, when households were already significantly short-changed. Over a three-year period, it was determined that an aggregate average of about 88% of collected proceeds was returned to households. If the $16 million is more appropriately considered as payment in arrears for earlier shortfalls, the remaining $326 million translates almost exactly to 88%, and in terms of establishing a fiscal balance, it represents the legitimate return of proceeds collected in Fiscal 2021-22. This situation confirms that the Liberal government's assertion that 90% of proceeds are returned to households in the province collected, is not quite true.

- More problematic are two figures provided that are essential for determining fairness, however with no essential explanation or justification provided in either case. These are, firstly, the average rebate per household, and secondly, the average household cost incurred due to the carbon tax.

- In terms of rebates, it is stated for Fiscal 2021-22 that average payments provided within Manitoba were approximately $705 per household. This value is mathematically impossible, based on the clearly outlined household rebate formula of the Liberal government and the true nature of Manitoba's population and household makeup. The year 2021 also coincided with the official census by Statistics Canada, such that extremely good data on population and household characteristics are directly available.

- Manitoba's total population for 2021 numbered 1,342,153, of which the rural population represented 338,894, or roughly 25%. Total private dwellings numbered 571,538, of which 518,054 were noted as being regularly occupied. The latter figure is thus most relevant to consider in this case and is employed. Further, the total number of people living in private households, i.e., occupied dwellings, numbered 1,307,185. This latter figure, representing more than 97% of the total population, was employed as most appropriate for determining household size, and a more-realistic rebate value. Further the average number people per household works out to just over 2.5.

- For 2021-22, the formula for rebates within Manitoba involved: $360 for the first household member; $180 for the second household member; and $90 for each additional child per household. On top of this a further add-on of 10% was provided for households in rural areas. A more-realistic population-based average household rebate was calculated in two ways: firstly, using the average population makeup and corresponding rebate multiplied by the number of households; or secondly, estimating the number of Manitobans in each of the three eligibility categories and dividing total eligible rebates by the number of households.

- A further suitable add-on for rural households was then included. The results of the two approaches ranged from $602 to $614 per household, very close together (less than 2% different). These reasonable estimates of rebates, based on population, are dramatically different (13% to 15% lower) from the claimed value by the Liberal government.

- If their purported rebate figure is considered accurate, then employing the rural top-up and eligible rebate values for household members, $705 per household translates to a household size of 3.64. This value is clearly out of line with Manitoba's population reality, being more than 40% too high, and literally impossible to achieve. Concern is exacerbated given the lack of any justification or explanation of its precise derivation.

- One possible line of explanation is that the number of households receiving rebates may have been lower. If the government's own total rebate figure of $342 million is divided by the purported household rebate of $705, it translates to total households of 485,100. Even assuming this smaller number of households, however, does not resolve the quandary of the household sizes still being excessively large. At the same time, this situation raises the even more serious concern in terms of economic inequality of a significant number of Manitoba households not receiving rebates at all, a particular concern associated with lower-income households not filing for taxes and not receiving any rebates.

- In terms of household costs incurred due to the carbon tax, it is stated for Fiscal 2021-22 that average costs within Manitoba were approximately $462 per household. Multiplying by 518,054 households as the reasonable number within the province, yields $239 million, which is only 65% of total proceeds for the year, noting this total cost was further considered in analysis. If the government's implied number of 485,100 households is used instead, it translates to only $224 million, which is only 60% of total proceeds.

- Such proportions, asserted to be fiscal-based and involving both direct and indirect costs, are unrealistically low in the context of modern supply chain operational realities. As already noted, the proportions of overall proceeds assumed for pass-through are suspiciously close to values noted by the Parliamentary Budget Office in earlier analyses. This similarity implies that the government's figure came from similar computer model calculations, rather than reflecting any factual evidence. The reality of cost pass-through down supply chains was fully understood and acknowledged from the start in the design of the carbon tax, but appeared later to be selectively down-played or ignored. This prompted more precise analysis of what would represent more realistic pass-through and costs.

- Estimates of direct costs, associated with household heating and vehicle use were undertaken based on additional information sources, and determined to represent a total of $165 million, or roughly 45% of total proceeds. The average cost translated to $318 per household, but was also, importantly, observed to depend on the nature of heating. Manitoba, unique in Canada, involves roughly 45% of households using non-fossil energy, overwhelmingly electric-resistive heating (albeit expensive), and 55% using fossil energy, overwhelmingly natural gas (small contributions from propane and heating oil). Direct costs

thus vary from the average, representing: $226 per electric household; $394 per natural gas household; $447 per propane household; and $472 per heating-oil household.

- The fact of all households incurring some direct costs, irrespective of heating, is directly due to household vehicles using gasoline. Indeed, this direct cost, representing $117 million or more than 30% of total proceeds in Fiscal 2021-22, was the largest single item, direct or indirect, faced by all households on average.

- Indirect costs turn out to be very important, representing potentially as much 55% of proceeds as collected, and thus cannot be ignored.

- Indirect costs were broken down by fuel type, and incorporated two more-realistic estimates of pass-through: 80% pass-through for indirect natural gas and gasoline costs; and 90% pass-through for indirect diesel and other middle distillate fuel costs. These factors translated to somewhat over 90% pass-through of overall proceeds (direct and indirect). This compares to only about 65% pass-through appearing to be assumed by the PBO and the Liberal government.

- Indirect costs associated with diesel are important to specifically highlight. Diesel costs are entirely indirect, given almost no households use diesel-powered personal vehicles. On-road diesel instead is overwhelmingly used in the movement of goods and freight. Fuel represents one of the top-two costs for transport and logistics companies. Intrinsically such firms cannot afford to absorb the carbon tax cost. They must instead, as normal practice, quickly pass carbon tax on as part of their fees, meaning these costs move relatively rapidly down supply chains to ultimate consumers. Based on reasonable pass-through, these costs represented more than $73 million, the second largest single cost to households.

- Almost as important as diesel are indirect costs associated with natural gas heating that are passed-on from businesses or other entities, including stores, offices, malls, etc. Based on reasonable pass-through, these costs represented almost $54 million, the third largest single cost to households, indeed larger than the cost of natural gas used directly by households themselves. Other fossil fuel costs as ultimately passed on to consumers, total about $45 million.

- Based on more realistic pass-through, total costs directed to households can be calculated as $338 million, or on average roughly $652 per household. As noted earlier, home-heating affects direct household costs, with this translating forward to overall costs. Total average costs per household thus vary from the average, but not to the same magnitude as direct costs, representing: $559 per electric household; $727 per natural gas household; $780 per propane household; and $805 per fuel-oil household.

- Overall, the Liberal government suggested for Fiscal 2021-22 that Manitobans received an average net rebate of $243 per household, this based on an assumed average rebate of $705 per household versus an assumed cost of $462 per household.

- From this analysis, if only direct household costs are considered, a reasonably similar average net rebate is determined, roughly $293 per household. This is based on an average calculated rebate of $614 per household versus an average calculated direct cost of $321 per household. This however, ignores important indirect costs.

- From this analysis, if direct costs are considered along with a realistic pass-through of indirect costs, the overall results are very different, translating to an average net cost of $38 per household. This is based on an average calculated rebate of $614 per household versus an average calculated overall cost of $652 per household.

- Net results are also affected by the nature of home heating. Interestingly and importantly, electrically-heated households appear to receive a net rebate of $55 per household, this based on average calculated rebate of $614 per household versus calculated cost of $559 per household. This is, however, cold comfort for such households, given that as well identified by Manitoba Hydro, resistance-based electrical heating is by nature dramatically more expensive than natural gas.

- The use of any fossil fuel for home heating, however, dramatically increases carbon-tax impacts, resulting in much higher net costs. Natural gas is the single most common heating approach in Manitoba, with such households incurring on average a net overall cost of $113 per household, this based on average calculated rebate of $614 per household versus calculated cost of $727 per household. Propane or fuel-oil are even more negative, with higher net overall costs of $116 per propane household and $191 per fuel-oil household, respectively.

- From this analysis, an average household in Manitoba for Fiscal 2021-22 paid net more in carbon tax than received in rebates. The claim of the Liberal government that “eight of ten households are better off” cannot be corroborated, contradictory results showing it as false.

- Further, the analysis undertake shows two key problems. Firstly, the purported average rebate per household is unrealistically high, indeed mathematically impossible based on the nature of Manitoba’s population and household-makeup characteristics, determined in relative detail at the same time through the 2021 census. Secondly, the purported average cost per household for the carbon tax system is unrealistically low. This suggests that the realities of modern supply chain operations and pass-through of costs, while actually acknowledged in the design of the tax, have been downplayed or largely ignored in the presentation of results.

- Finally in terms of net rebates, if the Liberal government had been a bit more careful in its claims, and more diligent in assessing cost and benefit analyses, the results of this work indeed would support them making a claim that “more than four of ten households within Manitoba receive a modest rebate.” Importantly, however, the difference in this case is based entirely on the nature of home-heating selection, and has nothing to do with household income, thus not related to the issue of fairness.

- In addition to clarifying that the main fairness-related claim of Liberal government has been false, the student group also identified a series of additional factors that exacerbate unfairness in the nature and application of the carbon tax.

- Investigations suggested inherent biases in the carbon tax and rebate system against lower-income households. Firstly, on this, while rarely discussed, the Liberal government charges GST on levies, increasing the costs imposed on households by a further 5%, and with none of this rebated. Addition of GST increases the average net cost in Manitoba to $71 per household, and even reducing the net rebate to only $27 per average electric-heated household. Secondly, on this, is a perpetuated “fiction of progressivity” with the carbon tax. This misimpression is based entirely on the assumption that higher-income households use more energy, and thus bear higher carbon tax costs, with the implication that lower-income households correspondingly use less energy, and bear lower carbon tax costs. Totally ignored in this train of thought is that lower-income household must devote a significantly higher percentage of their scarce disposable income to pay for energy, with indeed with many living in “energy poverty”. This means extra cost burdens associated with the carbon tax have more severe impacts on lower-income households. Thirdly, the fiction of progressivity is exacerbated by use of computer-based models suggesting that lower income households have lower household sizes than higher income households, even to the extent of suggesting that lower-income percentiles have few or no children. The prominent concern of “children living in poverty” shows such presumptions to be false.

- Investigations suggested inequality concerns with the current rebate formula used by the Liberal government, but also identified potential improvements. Beyond this assumption of presuming lower-income households pay less, there is absolutely no income testing included in the allocation of rebates under the federal system. Rebates are allocated strictly by designated eligible rebates per household member, with a further add-on for household in rural areas. This represents a serious deficiency in fairness, with no real assurance that lower-income households are actually being made better off. The idea of income-testing rebates associated with carbon taxation is not new and has already been employed in some locations. Regarding the federal carbon tax, one suggested improvement involved deliberately adjusting rebates according to approximate income quintile in order to ensure that lower-income households are indeed made better off. There are several ways this could be done, but upon further examination, one possibility involves employing approximate rebate multipliers that vary based on income quintile. Interestingly adjustments do not need to be overly extreme in order to achieve a desirable result. Results for one example set of multipliers were estimated, based on: lowest quintile receiving 1.50 times rebate; second quintile receiving 1.25 times rebate; third quintile receiving 1.00 times rebate, fourth quintile receiving 0.75 times rebate, and highest income quintile receiving 0.50 times rebate. In this case results show that even though the average household would still be subject to a net cost, the lowest two income quintiles would still receive net positive rebates. The choice of multipliers is completely wide-open, suggesting the need for further analysis and consideration of such approaches.

- Investigations suggested a significant concern having important inequality implications has been the lack of adequate support for public transit, in particular as an affordable alternative to household vehicles. Enhancing public transit has been already identified as an important measure to simultaneously reduce GHG emissions and reduce inequalities, while at the same time producing a significant net positive economic benefit. COVID devastated public transit across Canada, with public transit ridership levels not anticipated to return to pre-COVID levels until well into 2025, roughly five years after the beginning of the pandemic. The Liberal government did not adequately pivot to address this emerging crisis, and instead maintained the bulk of transit-related funding to promote implementation of zero-emission bus technologies. Problematic financial situations led to cutbacks and service quality deterioration, and cutbacks in interest from transit agencies on zero-emission buses. It is now likely that only anticipated zero-emission bus implementations may reach no more than about 40% of the intended target, and zero-emission buses cannot achieve reductions if no one is riding them. Reductions of public transit availability and accessibility have hurt lower-income households the worst. Addressing both emission reductions and income-inequality concerns requires public transit to be reestablished as an important priority, with corresponding funding also directed to transit in the immediate to near term to rebuild trust and ridership.

- Investigations identified an important problem associated with Canadians not filing taxes and thus ineligible for rebates, with relevant individuals tending to be clustered in lower-income households. Estimates suggest as many as 10% of Canadians do not file for taxes with the Canada Revenue Agency, but doing so is a necessary requirement in order to achieve carbon tax rebates. The extent of the problem and inequality impacts are not fully understood, but warrant further investigations to clarify. Importantly, in all of the messaging by the Liberal government, this concern is never mentioned nor acknowledged in the context of the carbon tax.

- Investigations identified a particularly concerning the treatment of Indigenous citizens and First Nations. Manitoba in particular has the highest proportion of Indigenous citizens of all Canada's main provinces, roughly 20% or one-in-five, such that negative effects are exacerbated. Recently legal action was brought against the federal government regarding by a consortium of First Nations communities within Ontario, claiming that the carbon-tax regime leaves their communities worse off than others in the country, violating the principles of reconciliation as well as their constitutional rights.

- A last identified problem relates to inflationary effects of the carbon tax and associated affordability impacts, especially for lower-income households. Initially the Liberal government claimed no inflation, based on money being largely refunded. This, however, is not true based on fundamental economics. Ultimately by 2022, the Governor of the Bank of Canada identified that there were some inflationary effects but not significant. This might have ended the matter, except for newer evidence emerging in Manitoba. The province's new NDP government, based on an election promise to ease inflationary pressures, began temporarily suspending the provincial road tax on gasoline and diesel starting January 2024.

- The amount of Manitoba road tax involved, i.e., $0.14 per Litre, turns out similar to the levies on gasoline and diesel under the carbon tax. For the following six months, Manitoba has consistently shown the lowest inflation in the country, averaging 1.9 percentage points lower on a year-to-year basis. Using estimates of proportion inflation increases due to the carbon tax as suggested by the Bank of Canada, which also appear to be based on computer model results, the likely reduction for Manitoba, based on the size of reductions, should only involve an average reduction of about 0.6 percentage points. Yet actual results are three times that magnitude. These initial results are obviously not conclusive, but raise doubts that the inflationary effects and affordability impacts carbon tax may be greater than what was suggested. Investigations as part of this work identified a further concern with the carbon tax that could relate directly to this finding, namely the lack of transparency in the pass-through of indirect carbon tax costs. Pass-through is a reality of the operations of supply chains, but one that the Liberal government in reporting results appears to have conspicuously downplayed or ignored, given a focus on trying to show the tax provide overall net benefits. As a result, there has been little to no attention on carbon tax pass-through. This has left the situation wide open for a variety of costs to be inappropriately passed-on using the broad justification of "carbon taxes." Excessive exuberance to show overall net benefits indeed may well have resulted in a lack of oversight by government, resulting in higher costs than justified.

- The commodity-based carbon tax has been a highly controversial and divisive policy within Canada. Investigations as part of this work, using updated actual data rather than computer models, show that the carbon tax is ineffective. It has produced little in the way of tangible reductions and shows an excessively high costs per tonne reduction, indeed greater than the cost of doing nothing. In terms of fairness, investigations based on actual data for Manitoba, further triangulated using additional sources, show the claim that "eight of ten households are better off" is entirely false. In Manitoba an average household was found to pay more in carbon tax than received in rebates. The analysis of information in this regard has been particularly troubling, showing that purported average rebates are excessively high, indeed mathematically impossible based on Manitoba's population and household characteristics, and that purported average costs per household are excessively low, in particular seeming to downplay or outright ignore the important pass-through of indirect costs to households down supply chains. The commodity-based carbon tax has failed and shows no redeeming features. As such, suspending the commodity-based carbon tax would likely be a prudent course of action for the current government. A last important comment in this regard is that investigations undertaken deal solely with the commodity-based carbon tax, and not the Output Based Pricing System, which is a completely separate matter.

References

Affordability Action Council. 2024. Rethinking urban mobility: Providing more affordable and equitable transportation options. Institute for Research on Public Policy (January 29, 2024), Montreal, Canada. https://irpp.org/research-studies/rethinking-urban-mobility/

Al Mallees, N., (Canadian Press). 2022. As many as 1 in 10 Canadians don't file their taxes — and Ottawa owes many of them money: Those who haven't filed in years discover they're owed for years of missed benefits. *CBC News* (Posted: December 16, 2022 2:44 PM CST). https://www.cbc.ca/news/business/canadians-taxes-filing-money-owed-1.6688986

Armstrong, L. (Canadian Press). 2023. Canadian cities cutting transit services could cause 'death spiral,' researcher warns. *Global News* (Posted: March 1, 2023 6:44 am). https://globalnews.ca/news/9519242/canada-public-transit-service-reduction/

Andersson, J.J. 2019. Carbon taxes and CO_2 emissions: Sweden as a case study. American Economic Journal: Economic Policy 11(4): 1-30. https://www.aeaweb.org/articles?id=10.1257/pol.20170144

AngusReid Institute. 2023. Carbon Tax: Perceptions of insufficient rebates, cost of living concern & questions over efficacy send support plummeting. (Posted November 13, 2023). https://angusreid.org/carbon-tax-perceptions-rebates/

Antweiler, W. and S. Gulati. 2016. Frugal cars or frugal drivers? How carbon and fuel taxes influence the choice and use of cars. *Social Science Research Network (SSRN)* electronic journal (Posted: 12 May 2016). Portal: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2778868

Antweiler, W. and S. Gulati. 2018. Taxpayers will back a carbon tax if they get a cheque in the mail. Conversation Canada (Published: July 12, 2018 4.17pm EDT). https://theconversation.com/taxpayers-will-back-a-carbon-tax-if-they-get-a-cheque-in-the-mail-99825

Asdourian, E. and D. Wessel. 2023. Commentary: What is the social cost of carbon? Brookings Institute (Posted March 14, 2023), Washington, D.C., U.S.A. https://www.brookings.edu/articles/what-is-the-social-cost-of-carbon/

Babych, S. 2022. Calgary Transit scales back service as transmission of Omicron stunts staff levels: Starting Monday morning, several routes around the city will be temporarily changing to accommodate for staffing shortages. *Calgary Herald* (Published: January 16, 2022). https://calgaryherald.com/news/local-news/calgary-transit-scales-back-service-as-omicron-stunts-staff-levels

Beugin, D., B. Frank, G. Hodgson, R. Lipsey, N. Olewiler and C. Ragan. 2018. *Clearing the air: How carbon pricing helps Canada fight climate change*. Canada's Ecofiscal Commission (EFC), c/o Department of Economics, McGill University, Montreal, Canada. https://ecofiscal.ca/wp-content/uploads/2018/04/Ecofiscal-Commission-Carbon-Pricing-Report-Clearing-the-Air-April-4-2018.pdf

Bishop, G. 2023. Ottawa's exemption of heating oil from carbon tax is surprising and shameless. *The Globe and Mail* (Published October 31, 2023). https://www.theglobeandmail.com/business/commentary/article-ottawa-carbon-tax-heating-oil-exemption/

Brass. E. 2023. Electric bus market powers back up after pandemic setbacks: New Flyer CEO, Workers laid off earlier in pandemic return to Winnipeg plant as bus manufacturer eyes growth. *CBC News* (Posted: August 25, 2023 5:00 AM CDT). https://www.cbc.ca/news/canada/manitoba/new-flyer-electric-bus-market-1.6946690

Boothby, L. 2024. Edmonton hikes transit fares in 2025 amid revenue shortfall, looks to fill low-income pass gap: "Compared to 2019, fewer people are using transit to commute to and from work due to hybrid work arrangements." *Edmonton Journal* (Published May 23, 2024). https://edmontonjournal.com/news/local-news/edmonton-hikes-transit-fares-in-2025-amid-revenue-shortfall-looks-to-fill-low-income-pass-gap

Boyton, S. 2024. 'We've had enough': Protests over carbon price hike halt traffic across Canada. Global News (Posted April 1, 2024 5:39 pm, Updated April 2, 2024 4:19 pm). https://globalnews.ca/news/10395581/carbon-price-hike-protests-canada/

Bryan, B. 2022. Indigenous people pay taxes: Demythologizing the Indian Act tax exemption. *The Conversation - Canada* (Published: August 23, 2022 3.31pm EDT). https://theconversation.com/indigenous-people-pay-taxes-demythologizing-the-indian-act-tax-exemption-186100

Campaign 2000. 2024. Manitoba Child and Family Poverty. Social Planning Council, Winnipeg, Canada, in conjunction with Campaign 2000 Coalition, Toronto, Canada. https://campaign2000.ca/wp-content/uploads/2024/04/ManitobaReport_2023.pdf

Canada Energy Regulator (CER). 2024. Provincial and Territorial Energy Profiles – Manitoba. Government of Canada, Calgary, Canada. https://www.cer-rec.gc.ca/en/data-analysis/energy-markets/provincial-territorial-energy-profiles/provincial-territorial-energy-profiles-manitoba.html

CBC News (Staff). 2023. Perimeter Aviation's delays, high fees cause hardship for remote Manitoba First Nations: chiefs: Chiefs want Transport Canada to investigate company's 'monopoly' on northern Manitoba air travel. *CBC News* (Posted: September 06, 2023 4:29 PM CDT). https://www.cbc.ca/news/canada/manitoba/island-lakes-perimeter-aviation-concerns-1.6958671#:~:text=The%20chiefs%20of%20four%20First%20Nations%20in%20northeastern%20Manitoba%20that,air%20transport%20in%20the%20north.

Canadian Press. 2024. Saskatchewan government refuses to send carbon tax funds to Ottawa: SaskEnergy Minister Dustin Duncan says the decision wasn't made lightly and the province realizes there will be consequences. *National Post* (Published Feb 29, 2024). https://nationalpost.com/news/canada/saskatchewan-government-refuses-to-send-carbon-tax-funds-to-ottawa#:~:text=SaskEnergy%20is%20breaking%20federal%20emissions,that%20burden%20on%20the%20province.

Carr, B. 2024. *Protecting the Environment for our Future*. (Circular from Member of Parliament for Winnipeg South-Centre to Constituents, Distributed by Mail to Constituent, May 2024).

Cash, C. 2023. Liberal hypocrisy on full display with regional carbon-tax carve-out: The feds told the courts carbon was a national concern but quickly made an exception for a high-emitting fuel for purely political reasons. *National Post* (Published Oct 31, 2023). https://nationalpost.com/opinion/liberal-hypocrisy-on-full-display-with-regional-carbon-tax-carveout

Center for Climate and Energy Solutions (C2ES). 2013. *Options and Considerations for a Federal Carbon Tax. Center for Climate and Energy Solutions* (February, 2013), Arlington, U.S.A. https://www.c2es.org/wp-content/uploads/2013/02/options-considerations-federal-carbon-tax.pdf

Center for Climate and Energy Solutions (C2ES). 2015. *Market Mechanisms: Understanding the Options. Center for Climate and Energy Solutions* (April, 2015), Arlington, U.S.A. https://www.c2es.org/wp-content/uploads/2015/04/market-mechanisms-brief.pdf

Chidley, J. 2021. Carbonomics: Trucking and the carbon tax - How federal policy could affect the transportation sector and consumers. *National Post* (Published July 14, 2021) https://nationalpost.com/sponsored/business-sponsored/carbonomics-trucking-and-the-carbon-tax

Chung, E. 2023. In your province or territory, what industry emits the most CO2? Variations in top greenhouse gas sources across the country show policies needed for all sectors. *CBC News* (Posted December 25, 2023 3:00 AM CST). https://www.cbc.ca/news/science/provincial-emissions-1.7068185

Climate Change Performance Index. 2024. CCPI 2024: Ranking and Results. https://ccpi.org

Common. D. 2024. Energy minister says Poilievre 'should stop lying to Canadians' about carbon tax. CBC, Rosemary Barton Live (Video Interview, posted March 17 2024). https://www.youtube.com/watch?v=jhLuqP-JDt8

Cuming, V. 2021. *How COP26 Climate Pledges Compare in Run-up to Earth Day*. Bloomberg NEF. https://assets.bbhub.io/professional/sites/24/BloombergNEF-NDC-comparison-note-2021.pdf

Dahlkvist, E. 2016. Elasticity of demand for gasoline in Sweden. Master degree thesis No 1047. Swedish University of Agricultural Services, Upsalla, Sweden. https://stud.epsilon.slu.se/9487/1/dahlkvist_e_160831.pdf

Dobson, S. and J. Winter. 2018. Assessing policy support for emissions-intensive and trade-exposed industries. *SPP Research Papers* 11:28 (October, 2018). https://journalhosting.ucalgary.ca/index.php/sppp/article/view/43673/43107

Canada's Eco-Fiscal Commission (EFC). 2016*. Choose Wisely: Options and Trade-offs in Recycling Carbon Pricing Revenues*. c/o Department of Economics, McGill University, Montreal, Canada. https://ecofiscal.ca/wp-content/uploads/2016/04/Ecofiscal-Commission-Choose-Wisely-Carbon-Pricing-Revenue-Recycling-Report-April-2016.pdf

Canadian Urban Sustainability Practitioners (CUSP). 2019. *Energy Poverty in Canada: CUSP Backgrounder*. https://energypoverty.ca/backgrounder.pdf

The Economist. 2022. How to avoid energy rationing: Politicians should pay attention to the latest economic literature (August 25, 2022). https://www.economist.com/finance-and-economics/2022/08/25/how-to-avoid-energy-rationing

Eitches, E. and V. Crain. 2016. Using gasoline data to explain inelasticity. *Beyond the Numbers: Prices and Spending* (U.S. Bureau of Labor Statistics) 5: 1–5. https://www.bls.gov/opub/btn/volume-5/using-gasoline-data-to-explain-inelasticity.htm

Elgie, S., and J. McClay. 2013. BC's carbon tax shift is working well after four years ("Attention Ottawa"). *Canadian Public Policy* 39: S1–S10. https://www.utpjournals.press/doi/full/10.3138/CPP.39.Supplement2.S1?role=tab

Energy Information Administration (EIA). 2014. Gasoline prices tend to have little effect on demand for car travel. *Today in Energy*. https://www.eia.gov/todayinenergy/detail.php?id=19191

Environment Canada (EC). 2011. *National Inventory Report 1990–2009: Greenhouse Gas Sources and Sinks in Canada, Canada's Submission to the United Nations Framework Convention on Climate Change, Executive Summary*. Government of Canada, Gatineau, Canada. https://publications.gc.ca/collections/collection_2011/ec/En81-4-1-2009-eng.pdf

Environment and Climate Change Canada (ECCC). 2018. *Estimated impacts of the Federal Carbon Pollution Pricing System*. Government of Canada, Gatineau, Canada. https://www.canada.ca/en/services/environment/weather/climatechange/climate-action/pricing-carbon-pollution/estimated-impacts-federal-system.html

Environment and Climate Change Canada (ECCC). 2021a. *Backgrounder: Updating Canada's Nationally Determined Contribution*. Government of Canada, Gatineau, Canada. https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/climate-plan/updating-canada-nationally-determined-contribution.pdf

Environment and Climate Change Canada (ECCC). 2021b. *Backgrounder: Supreme Court of Canada rules on the constitutionality of the Greenhouse Gas Pollution Pricing Act*. Government of Canada, Gatineau, Canada. https://www.canada.ca/en/environment-climate-change/news/2021/03/supreme-court-of-canada-rules-on-the-constitutionality-of-the-greenhouse-gas-pollution-pricing-act.html#

Environment and Climate Change Canada (ECCC). 2021c. *Pan-Canadian Approach to Pricing Carbon Pollution: Interim Report 2020*. Government of Canada, Gatineau, Canada. https://publications.gc.ca/collections/collection_2021/eccc/En4-423-1-2021-eng.pdf

Environment and Climate Change Canada (ECCC). 2022a. *National Inventory Report 1990–2020: Greenhouse Gas Sources and Sinks in Canada, Canada's Submission to the United Nations Framework Convention on Climate Change, Executive Summary*. Government of Canada, Gatineau, Canada. https://publications.gc.ca/collections/collection_2022/eccc/En81-4-1-2020-eng.pdf

Environment and Climate Change Canada (ECCC). 2022b. Greenhouse Gas Pollution Pricing Act: Annual Report to Parliament for 2020. Government of Canada, Gatineau, Canada. https://publications.gc.ca/collections/collection_2022/eccc/En11-17-2020-eng.pdf

Environment and Climate Change Canada (ECCC). 2023a. *Social Cost of Greenhouse Gas Estimates – Interim Updated Guidance for the Government of Canada*. Government of Canada, Gatineau, Canada. https://www.canada.ca/en/environment-climate-change/services/climate-change/science-research-data/social-cost-ghg.html

Environment and Climate Change Canada (ECCC). 2023b. Greenhouse gas emissions projections. Government of Canada, Gatineau, Canada. https://www.canada.ca/en/environment-climate-change/services/climate-change/greenhouse-gas-emissions/projections.html

Environment and Climate Change Canada (ECCC). 2023c. *Greenhouse Gas Pollution Pricing Act: Annual Report to Parliament for 2021*. Government of Canada, Gatineau, Canada.
Portal: https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/greenhouse-gas-annual-report-2021.html
PDF: https://publications.gc.ca/collections/collection_2023/eccc/En11-17-2021-eng.pdf

Environment and Climate Change Canada (ECCC). 2023d. *National Inventory Report 1990–2021: Greenhouse Gas Sources and Sinks in Canada, Canada's Submission to the United Nations Framework Convention on Climate Change, Executive Summary*. Government of Canada, Gatineau, Canada.
https://publications.gc.ca/collections/collection_2023/eccc/En81-4-1-2021-eng.pdf

Environment and Climate Change Canada (ECCC). 2023e. *Overview of 2021 Reported Emissions*. Government of Canada, Gatineau, Canada.
https://publications.gc.ca/collections/collection_2023/eccc/En81-6-1-2021-eng.pdf

Environment and Climate Change Canada (ECCC). 2024a. *National Inventory Report 1990–2022: Greenhouse Gas Sources and Sinks in Canada, Canada's Submission to the United Nations Framework Convention on Climate Change, Executive Summary*. Government of Canada, Gatineau, Canada.
https://publications.gc.ca/collections/collection_2024/eccc/En81-4-1-2022-eng.pdf

Environment and Climate Change Canada (ECCC). 2024b. How carbon pricing works.
https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/putting-price-on-carbon-pollution.html#

Environment and Climate Change Canada (ECCC). 2024c. Climate Change Canada Data Catalogue, File: EN_GHG_IPCC_BC.xlsx https://data-donnees.az.ec.gc.ca/data/substances/monitor/canada-s-official-greenhouse-gas-inventory/A-IPCC-Sector?lang=en

Federation of Canadian Municipalities (FCM). 2020. Protecting vital municipal services: Urgent federal recommendations to address the financial crisis in our cities and communities due to COVID-19.
https://data.fcm.ca/documents/resources/reports/protecting-vital-municipal-services.pdf?utm_source=elliotlaketoday.com&utm_campaign=elliotlaketoday.com%3A%20outbound&utm_medium=referral

Forrest, M. 2019. 'Completely inconsistent': Carbon taxes applied unequally between provinces, new report says: In provinces whose carbon pricing plans have the federal government's approval, the increase in gas prices is substantially smaller than those under the federal tax. *National Post* (Published May 16, 2019).https://nationalpost.com/news/politics/completely-inconsistent-carbon-taxes-applied-unequally-between-provinces-new-report-says#:~:text=Article%20content,carbon%20pricing%20came%20into%20effect

Gallo, A. 2015. Pricing strategy: A refresher on price elasticity. *Harvard Business Review* (Posted: August 21, 2015). https://hbr.org/2015/08/a-refresher-on-price-elasticity

Gerbeti, A. 2021. Market mechanisms for reducing emissions and the introduction of a flexible consumption tax. *Global Journal of Flexible Systems Management* 22(Suppl 2): 161-178. https://link.springer.com/article/10.1007/s40171-021-00283-9
Full text version at NCBI: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8363487/

Government of Canada. 1985. Indian Act (R.S.C., 1985, c. I-5). https://laws-lois.justice.gc.ca/eng/acts/i-5/page-8.html#h-332811

Government of Canada. 2018. *Greenhouse Gas Pollution Pricing Act* (S.C. 2018, c. 12, s. 186). https://laws-lois.justice.gc.ca/eng/acts/g-11.55/

Government of Canada. 2024. Greenhouse Gas Reporting Program (GHGRP) - Facility Greenhouse Gas (GHG) Data. https://open.canada.ca/data/en/dataset/a8ba14b7-7f23-462a-bdbb-83b0ef629823

Government of Manitoba. 2009. Energy Efficiency Standards for Replacement Forced Air Gas Furnaces and Small Boilers Regulation, MR 181/2009. https://web2.gov.mb.ca/laws/regs/current/181-2009.php?lang=en

Government of Manitoba. 2013. Manitoba Coal and Petroleum Coke Heating Ban Regulation, MR 183/2013. https://web2.gov.mb.ca/laws/regs/current/183-2013.php?lang=en

Government of Manitoba. 2023. New release (January 26, 2023): Manitoba government announces $200-million Carbon Tax Relief Fund: Manitobans need help now: Premier. https://news.gov.mb.ca/news/index.html?item=57800&posted=2023-01-26

Government of Manitoba. 2023. News release (November 23, 2023): Manitoba government introduces legislation to make lives more affordable for Manitobans by lowering fuel taxes: Changes would Introduce a Gas Tax Holiday for Six Months: Sala
https://news.gov.mb.ca/news/index.html?item=60899&posted=2023-11-23

Green, K.P., T. Jackson, I. Herzog and M. Palacios 2016. Energy Costs and Canadian Households: How Much are we Spending. The Frazer Institute, Vancouver, Canada.
https://www.fraserinstitute.org/sites/default/files/energy-costs-and-canadian-households.pdf

Haider, M. 2024. Post-pandemic Recovery of Transit Ridership and Revenue in Canada. Transport Findings (Posted June 15, 2024 AEST). https://findingspress.org/article/118435-post-pandemic-recovery-of-transit-ridership-and-revenue-in-canada

Hughes, J.E., C.R. Knittel and D. Sperling. 2008. Evidence of a shift in the short-run price elasticity of gasoline demand. *The Energy Journal* 29(1-9): 113–134.
https://journals.sagepub.com/doi/10.5547/ISSN0195-6574-EJ-Vol29-No1-9
Also at portal: https://www.nber.org/papers/w12530

Indigenous Services Canada (ISC). 2023. *An update on the socio-economic gaps between Indigenous Peoples and the non-Indigenous population in Canada: Highlights from the 2021 Census: A Compendium Report to the Department's 2023 Annual Report to Parliament*. Government of Canada, Ottawa, Canada.
https://www.sac-isc.gc.ca/eng/1690909773300/1690909797208

Infrastructure Canada. 2021. Government of Canada targets zero emission bus transportation with launch of new fund, $2.75 billion available for infrastructure projects through the Zero Emission Transit Fund (Announcement: August 10, 2021, Ottawa, Ontario). https://www.canada.ca/en/office-infrastructure/news/2021/08/government-of-canada-targets-zero-emission-bus-transportation-with-launch-of-new-fund.html

Iacobacci, M. and S. Dixon. 2020. COVID-19, Tackling public transit's funding gap during the recovery: Short-term fixes and long-term opportunities. Deloitte Canada. https://www2.deloitte.com/content/dam/Deloitte/ca/Documents/public-sector/ca-tackling-public-transits-funding-gap-en-aoda.pdf

Jaccard, M. 2016. Want an effective climate policy? Heed the evidence: Carbon taxes and caps may be most effective in economic theory, but smart regulation will produce better climate policy for our political reality. *Policy Options*. https://policyoptions.irpp.org/magazines/february-2016/want-an-effective-climatepolicy-heed-the-evidence/

Jaricha, D., J. Hanson and J. Petrunic. 2024. Canadian ZEB Database™: Canada's Zero-Emissions Bus Landscape and Transitioning Readiness, Knowledge Series Report #4, 2024.
Canadian Urban Transit Research and Innovation Consortium (CUTRIC), Toronto, Canada.
https://cutric-crituc.org/wp-content/uploads/2024/05/CUTRIC_ZEB-New-Database-report-2024-FINAL.pdf

Kilian, L. and X. Zhou. 2020. Gasoline demand more responsive to price changes than economists once thought. Federal Reserve Bank of Dallas (Posted: June 16, 2020).
https://www.dallasfed.org/research/economics/2020/0616

Lagace-Roy, A., Library of Parliament. 2023a. *Trade and Investment Profile: Alberta's Merchandise Trade with the World 2022*, Research and Education Publication No. 2023-501-E. Government of Canada, Ottawa Canada.
https://lop.parl.ca/sites/PublicWebsite/default/en_CA/ResearchPublications/TradeAndInvestment/2023501E

Lagace-Roy, A., Library of Parliament. 2023b. *Trade and Investment Profile: Alberta's Merchandise Trade with the World 2022*, Research and Education Publication No. 2023-502-E. Government of Canada, Ottawa Canada.
https://lop.parl.ca/sites/PublicWebsite/default/en_CA/ResearchPublications/TradeAndInvestment/2023502E

Lagace-Roy, A., Library of Parliament. 2023c. *Trade and Investment Profile: Manitoba's Merchandise Trade with the World 2022*, Research and Education Publication No. 2023-503-E. Government of Canada, Ottawa Canada.
https://lop.parl.ca/sites/PublicWebsite/default/en_CA/ResearchPublications/TradeAndInvestment/2023503E#:~:text=Exports%20in%202022%3A,decrease%20from%2073.6%25%20in%202021

Lagace-Roy, A., Library of Parliament. 2023d. *Trade and Investment Profile: Manitoba's Merchandise Trade with the World 2022*, Research and Education Publication No. 2023-504-E. Government of Canada, Ottawa Canada.
https://lop.parl.ca/sites/PublicWebsite/default/en_CA/ResearchPublications/TradeAndInvestment/2023504E

Larson, P.D., R.V. Parsons, A. Elias and B. Yasiltas. 2022. *Public Transit and Active Transportation: Activity, Structural and Energy Efficiency Effects on Mobility and the Environment*, Knowledge Synthesis Grant Final Report. I.H. Asper School of Business, University of Manitoba, Winnipeg, Canada. https://umanitoba.ca/asper/sites/asper/files/2022-07/larsonpaul-ksg-draft-jan-18.pdf

Larson, P.D., R.V. Parsons and D. Kalluri. 2024. Zero-emission heavy-duty, long-haul trucking: Obstacles and opportunities for logistics in North America. Logistics 8(3): 64. https://www.mdpi.com/2305-6290/8/3/64

Leveque, C. 2024. Mark Carney says carbon tax served a purpose 'until now,' calls for credible alternative. *National Post* (Published May 08, 2024). https://nationalpost.com/news/politics/mark-carney-on-carbon-tax-senate#:~:text=OTTAWA%20—%20Former%20Bank%20of%20Canada,“credible%20and%20predictable”%20alternative

Lin, C.-Y.C. and L. Prince. 2013. Gasoline price volatility and the elasticity of demand for gasoline. *Energy Economics* 38: 111–117.
https://www.sciencedirect.com/science/article/abs/pii/S0140988313000418
Associated workshop presentation:
https://www.eia.gov/outlooks/documentation/workshops/pdf/2-LinLawell.pdf

Magder, J. 2023. STM making another round of cuts, but insists service won't be affected: Montreal's transit agency said it has identified $18 million in non-recurrent expenses to axe from its budget, on top of service cuts that were made at the start of the year. Montreal Gazette (Published February 21, 2023). https://montrealgazette.com/news/local-news/stm-making-another-round-of-cuts-but-insists-service-wont-be-affected

Manitoba Environment and Climate Change. 2022. Biofuels. Government of Manitoba, Winnipeg, Canada. https://www.gov.mb.ca/sd/environment_and_biodiversity/energy/biofuels/index.html

Manitoba Hydro. 2019. Centra Gas Manitoba Inc. 2019/20 General Rate Application, Appendix 7.2. http://www.pubmanitoba.ca/v1/proceedings-decisions/appl-current/pubs/2019-centra-gra/2019-centra-application/appendix-7-2-2011-12_to_2019-20_customer_and_volulme_summary_schedules-r.pdf

Manitoba Hydro. 2022. Manitoba Hydro-Electric Board 71st Annual Report: For the year ended March 31, 2022. https://www.hydro.mb.ca/docs/corporate/annual_report_2021_22.pdf

Manitoba Hydro. 2023a. Wondering about your energy options for space heating space heating? The chart below shows an example of space heating costs that are based on an average single-family residence, at rates in effect November 1, 2023.
https://www.hydro.mb.ca/docs/resources/space_heating_costs.pdf

Manitoba Hydro. 2023b. Wondering about your energy options for water heating water heating? The chart below shows an example of water heating costs that are based on an average single-family residence, at rates in effect November 1, 2023.
https://www.hydro.mb.ca/docs/resources/home_water_heating_costs.pdf

Manitoba Sustainable Development. 2018. *A Made-in-Manitoba Climate and Green Plan, Discussion Paper: Draft Regulatory Framework for a Made-in-Manitoba Output-based Pricing System*. Government of Manitoba, Winnipeg, Canada. https://www.gov.mb.ca/asset_library/en/climatechange/manitoba-output-based-pricing-system.pdf

Markusoff, J. 2023. There's now a Bank of Canada number for carbon tax's impact on inflation. It's small: Making everything more expensive? Only by a fraction of a percentage point. CBC News (Posted September 8, 2023 9:42 AM CDT). https://www.cbc.ca/news/canada/calgary/carbon-tax-inflation-tiff-macklem-calgary-1.6960189

McKitrick, R. 2016. A practical guide to the economics of carbon pricing. *SPP Research Papers* 9:28 (September, 2016). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2844481 or https://www.policyschool.ca/wp-content/uploads/2016/09/Carbon-Pricing-McKitrickFINAL.pdf

McKitrick, R. 2024. Economists' miss the point about the carbon tax revolt. Financial Post (Published: April 2, 2024). https://financialpost.com/opinion/carbon-tax-economists-letter-misses-point
Also posted: https://www.fraserinstitute.org/article/economists-miss-the-point-about-the-carbon-tax-revolt

Mildenberger, M., E. Lachapelle, K. Harrison and I. Stadelmann-Steffen. 2022. Limited impacts of carbon tax rebate programmes on public support for carbon pricing. *Nature Climate Change* 12: 141-147. https://www.nature.com/articles/s41558-021-01268-3

Murphy, A. 2023. TTC is rolling out service cuts March 26. Find out if your commute will be affected: More than 60 per cent of the announced changes will create longer wait times for TTC customers. Toronto Star (Updated July 19, 2023 at 6:31 a.m.). https://www.thestar.com/news/gta/ttc-is-rolling-out-service-cuts-march-26-find-out-if-your-commute-will-be/article_e27d0684-c6b2-56ab-b8fb-0fea9b96b4cc.html

Murray, B.C. and N. Rivers. 2015. *British Columbia's Revenue-Neutral Carbon Tax: A review of the Latest "Grand Experiment" in Environmental Policy*, Working Paper NI WP 15–04; Nicholas Institute for Environmental Policy Issues, Duke University: Durham, U.S.A. https://nicholasinstitute.duke.edu/sites/default/files/publications/ni_wp_15-04_full.pdf

Natural Resources Canada, Office of Energy Efficiency (NRCan). 2010. 2008 Canadian Vehicle Survey: Update Report. Government of Canada, Ottawa, Canada. https://oee.nrcan.gc.ca/publications/statistics/cvs08/pdf/cvs08.pdf

Natural Resources Canada (NRCan). 2021. Residential Sector: Manitoba, Table 21: Heating System Stock by Building Type and Heating System Type. Government of Canada, Ottawa, Canada. https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&sector=res&juris=mb&year=2021&rn=21&page=0

Natural Resources Canada (NRCan). 2023. Energy Fact Book: 2023–2024. Government of Canada, Ottawa, Canada. https://energy-information.canada.ca/sites/default/files/2023-10/energy-factbook-2023-2024.pdf

Office of the Deputy Prime Minister. 2022. Government of Canada makes significant additional transfers to provinces and territories in support of health care and transit (Announcement: July 14, 2022, Ottawa, Ontario). https://deputypm.canada.ca/en/news/news-releases/2022/07/14/government-canada-makes-significant-additional-transfers-provinces

Office of the Prime Minister. 2021. Prime Minister Trudeau announces increased climate ambition (Announcement: April 22, 2021, Ottawa, Canada). https://www.pm.gc.ca/en/news/news-releases/2021/04/22/prime-minister-trudeau-announces-increased-climate-ambition

Office of the Prime Minister. 2023. Delivering support for Canadians on energy bills (Announcement: October 26, 2023, Ottawa, Canada). https://www.pm.gc.ca/en/news/news-releases/2023/10/26/delivering-support-for-canadians-on-energy-bills

Office of the Parliamentary Budget Officer (PBO), (Ammar, N, N. Beauchamp, and J. Scrim). 2019. *Fiscal and Distributional Analysis of the Federal Carbon Pricing System*. Government of Canada, Ottawa, Canada. https://publications.gc.ca/collections/collection_2019/dpb-pbo/YN5-181-2019-eng.pdf

Office of the Parliamentary Budget Officer (PBO), (Ammar, N, N. Beauchamp, C. Faucher, J. Scrim and R. Vanherweghem). 2020. *Reviewing the Fiscal and Distributional Analysis of the Federal Carbon Pricing System*. Government of Canada, Ottawa, Canada. https://distribution-a617274656661637473.pbo-dpb.ca/d3326e6a3869374060c6add6ae53cad5158274aa6e56b5234e9f5a7ced7c2eb9

Office of the Parliamentary Budget Officer (PBO), (Ammar, N., P. Bagnoli, K. Duncan and T. Scholz). 2022. *A Distributional Analysis of Federal Carbon Pricing under a Healthy Environment and a Healthy Economy*. Government of Canada, Ottawa, Canada. https://publications.gc.ca/collections/collection_2022/dpb-pbo/YN5-245-2022-eng.pdf

Open Letter from Economists on Canadian Carbon Pricing (Open Letter …). 2024. https://sites.google.com/view/open-letter-carbon-pricing

Paas-Lang, C. 2024. Natural resources minister defends carbon tax as provinces pile on: Jonathan Wilkinson says 'there must be consequences' for Saskatchewan's refusal to remit tax. *CBC News* (Posted: Mar 17, 2024 1:26 PM CDT) https://www.cbc.ca/news/politics/wilkinson-carbon-tax-provinces-1.7146585

Parsons, R.V. 2021. Canada as a case study for balanced presentation to address controversy on emission reduction policies. *Sustainability* 13(14): 7909. https://www.mdpi.com/2071-1050/13/14/7909

Parsons, R., C.-C. Chen and R. Shankar. 2023. Funding electric public transit can reduce emissions and address economic inequality. *The Conversation - Canada* (Published: January 10, 2023 12.34 pm EST). https://theconversation.com/funding-electric-public-transit-can-reduce-emissions-and-address-economic-inequality-194434

Parsons, R. 2023a. Asking candidates about a carbon tax problem. *Winnipeg Free Press* (Posted: 2:00 AM CDT Monday, June 5, 2023). https://www.winnipegfreepress.com/opinion/analysis/2023/06/05/asking-candidates-about-a-carbon-tax-problem

Parsons, R. 2023b. Heat pump plan needs workable economics. Winnipeg Free Press (Posted: 2:00 AM CDT Tuesday, July 18, 2023). https://www.winnipegfreepress.com/opinion/analysis/2023/07/18/heat-pump-plan-needs-workable-economics

Parsons, R. 2024a. Still not getting to zero. *Winnipeg Free Press* (Posted: 2:00 AM CDT Friday, May 10, 2024). https://www.winnipegfreepress.com/opinion/analysis/2024/05/10/still-not-getting-to-zero

Parsons, R. 2024b. Ground-source heat pumps promising. *Winnipeg Free Press* (Posted: 2:01 AM CDT Saturday, May. 25, 2024). https://www.winnipegfreepress.com/opinion/analysis/2024/05/25/ground-source-heat-pumps-promising

Pretis, F. 2022. Does a carbon tax reduce CO2 emissions? Evidence from British Columbia. *Environmental and Resource Economics* 83: 115–144. https://link.springer.com/article/10.1007/s10640-022-00679-w

Pringle, J. 2023. OC Transpo reducing bus service by 74,000 hours in 2024. CTV News (Published: Nov. 4, 2023 3:00 a.m. CDT). https://ottawa.ctvnews.ca/oc-transpo-reducing-bus-service-by-74-000-hours-in-2024-1.6630985

Rabson, M. (Canadian Press). 2023a. Carbon emissions are costing Canadians 5 times what Ottawa once thought: minister. *Global News* (Posted April 19, 2023 7:31 pm) https://globalnews.ca/news/9637323/canada-emissions-cost-guilbeault-climate-change/

Rabson, M. (Canadian Press). 2023b. Liberals pause carbon pricing on heating oil, double rural carbon price rebate top-up. *Toronto Star* (Updated: Oct. 26, 2023 at 8:40 p.m.) https://www.thestar.com/politics/liberals-pause-carbon-pricing-on-heating-oil-double-rural-carbon-price-rebate-top-up/article_4867115a-3951-5e5e-b39a-55b778bba3f8.html

Racine, N. and S. Premji. 2024. Child poverty is on the rise in Canada, putting over 1 million kids at risk of life-long negative effects. *The Conversation - Canada* (Published: January 29, 2024 1.13 pm EST). https://theconversation.com/child-poverty-is-on-the-rise-in-canada-putting-over-1-million-kids-at-risk-of-life-long-negative-effects-221565#:~:text=Initially%2C%20it%20seems%20Canada%20is,children%20live%20in%20poverty%20today.

Ragan, C., E. Beale, P. Boothe, M. Cappe, B. Dahlby, D. Drummond, S. Elgie, G. Hodgson, P. Lanoie, R. Lipsey, N. Olewiler and F. St-Hilaire. 2015. *A Practical Approach to Reducing Canada's Greenhouse Gas. Emissions*. Canada's Ecofiscal Commission (EFC), c/o Department of Economics, McGill University, Montreal, QC, Canada. http://ecofiscal.ca/wp-content/uploads/2015/04/Ecofiscal-Commission-Report-The-Way-Forward-April-2015.pdf

Ragan, C., E. Beale, P. Boothe, M. Cappe, B. Dahlby, D. Drummond, S. Elgie, G. Hodgson, P. Lanoie, R. Lipsey, N. Olewiler and F. St-Hilaire. 2016. *Choose Wisely: Options and Trade-offs in Recycling Carbon Pricing Revenues*. Canada's Ecofiscal Commission (EFC), c/o Department of Economics, McGill University, Montreal, Canada. https://ecofiscal.ca/wp-content/uploads/2016/04/Ecofiscal-Commission-Choose-Wisely-Carbon-Pricing-Revenue-Recycling-Report-April-2016.pdf

Rennert, K. and C. Kingdon, 2019. *Social Cost of Carbon 101: A review of the social cost of carbon, from a basic definition to the history of its use in policy analysis*. Resources for the Future, Washington, D.C., U.S.A. https://media.rff.org/documents/SCC_Explainer.pdf

Robertson, D. 2022. Manitoba foster-care rate highest in Canada. *Winnipeg Free Press Sun* (Posted: 4:57 PM CDT Tuesday, Jul. 19, 2022). https://www.winnipegfreepress.com/breakingnews/2022/07/19/manitoba-foster-care-rate-highest-in-canada

Robson, J. and S. Schwartz. 2020. Who doesn't file a tax return? A portrait of non-filers. *Canadian Public Policy* 46(3): 323-339. https://utpjournals.press/doi/10.3138/cpp.2019-063#:~:text=Approximately%2010–12%20percent%20of,which%20they%20are%20otherwise%20eligible.

Rosenbloom, D., J. Markard, F.W. Geels and L. Fuenfschilling, 2020. Opinion: Why carbon pricing is not sufficient to mitigate climate change—and how "sustainability transition policy" can help. *Proceedings of the National Academy of Sciences* 117(16): 8664-8668. https://www.pnas.org/doi/full/10.1073/pnas.2004093117#sec-3

Social Sciences and Humanities Research Council in collaboration with the Future Skills Centre (SSHRC and FSC). 2022. *Evidence Brief: Public transit and active transportation: Activity, structural and energy efficiency effects on mobility and the environment*. Government of Canada, Ottawa, Canada. https://www.sshrc-crsh.gc.ca/society-societe/community-communite/ifca-iac/evidence_briefs-donnees_probantes/mobility_public_transit/pdf/SSHRC%20KSG%20Evidence%20Brief_Larson_Paul_FinalE.pdf

Solberg, B., (Guest Opinion). 2024. The federal gov't owes MB small businesses $144M in carbon tax rebates. Winnipeg Sun (Published March 28, 2024) https://winnipegsun.com/news/opinion-the-federal-govt-owes-mb-small-businesses-144m-in-carbon-tax-rebates

Standing Committee on Finance, 44th Parliament of Canada, 1st Session. 2022. Standing Committee on Finance, Evidence, Number 024, Thursday, March 3, 2022. House of Commons, Ottawa, Canada. https://publications.gc.ca/collections/collection_2022/parl/xc26-1/XC26-1-2-441-24-eng.pdf

Statistics Canada. 2022. Population growth in Canada's rural areas, 2016 to 2021. Government of Canada, Ottawa, Canada. https://www12.statcan.gc.ca/census-recensement/2021/as-sa/98-200-x/2021002/98-200-x2021002-eng.cfm

Statistics Canada. 2023a. Sales of fuel used for road motor vehicles, annual (x 1,000), Table: 23-10-0066-01 (formerly CANSIM 405-0002), Release date: 2023-09-19, Geography: Canada, covering period of 2018 through 2022. Government of Canada, Ottawa, Canada. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2310006601

Statistics Canada. 2023b. Census Profile, 2021 Census of Population: Profile Table, Manitoba. Government of Canada, Ottawa, Canada. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=E&SearchText=Manitoba&DGUIDlist=2021A000246&GENDERlist=1,2,3&STATISTIClist=1,4&HEADERlist=0

Statistics Canada. 2023c. Vehicle registrations, by type of vehicle and fuel type, Frequency: Annual, Table: 23-10-0308-01, Release date: 2023-11-02, Geography: Manitoba. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2310030801

Statistics Canada. 2024a. Census families by total income, family type and number of children, Frequency: Annual, Release date: 2024-06-27, Geography: Manitoba. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1110001301&pickMembers%5B0%5D=1.27&cubeTimeFrame.startYear=2020&cubeTimeFrame.endYear=2022&referencePeriods=20200101%2C20220101

Statistics Canada 2024b. Upper income limit, income share and average income by economic family type and income decile, Frequency: Annual, Release date: 2024-04-26, Geography: Manitoba. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1110019201&pickMembers%5B0%5D=1.10&cubeTimeFrame.startYear=2018&cubeTimeFrame.endYear=2022&referencePeriods=20180101%2C20220101

Statistics Canada. 2024c. Passenger bus and urban transit statistics, by the North American Industry Classification System (NAICS), Frequency: Monthly, Release date: 2024-06-18, Geography: Canada. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2310025101

Statistics Canada. 2024d. Consumer Price Index by geography, all-items, monthly, percentage change, not seasonally adjusted, Canada, provinces, Whitehorse, Yellowknife and Iqaluit, Frequency: Monthly, Release date: 2024-07-16, Geography: Canada. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810000402

Statistics Sweden. 2024. Emissions of Greenhouse Gases from Domestic Transport by Type of Greenhouse Gas and Mode of Transport. Year 1990–2022; Statistics Sweden. Available online: https://www.statistikdatabasen.scb.se/pxweb/en/ssd/START__MI__MI0107/MI0107InTranspNN/

Sustainable Prosperity. 2011. *Carbon Pricing, Social Equity and Poverty Reduction*, Policy Brief for a Low Carbon Economy. Sustainable Prosperity c/o University of Ottawa, Ottawa, Canada. https://institute.smartprosperity.ca/sites/default/files/publications/files/Carbon%20Pricing%2C%20Social%20Equity%20and%20Poverty%20Reduction.pdf

Tait, C. and W. Stuecken. 2023. Ontario First Nations file judicial review over federal carbon pricing, say climate can't 'be healed at the expense' of communities. *The Globe and Mail* (Published November 30, 2023, Updated December 1, 2023). https://www.theglobeandmail.com/canada/article-ontario-first-nations-file-judicial-review-over-federal-carbon-tax/#:~:text=First%20Nations%20across%20Ontario%20are,of%20climate%20change%20and%20poverty.

Thompson, E. 2022. *Escape from Model Land: How mathematical models can lead us astray and what we can do about it*. Basic Books, New York, U.S.A.

Vehicle and Equipment Management Agency (VEMA). 2024. Who are we? https://www.vema.gov.mb.ca/about/#:~:text=We%20manage%20approximately%202%2C600%20vehicles,expenses%2C%20and%20re%2Dmarketing

Wallace, N. 2023. Service cuts to public transit are just the first step in a death spiral. The Globe and Mail (Published January 16, 2023). https://www.theglobeandmail.com/opinion/article-service-cuts-to-public-transit-are-just-the-first-step-in-a-death/

Wherry, A. 2023. Playing defence on the carbon tax has put Trudeau's Liberals on the defensive: By allowing an exception for one type of home heating fuel, the government has painted itself into a corner. *CBC News* (Posted: November 03, 2023 3:00 AM CDT). https://www.cbc.ca/news/politics/carbon-tax-exemption-trudeau-analysis-wherry-1.7016971

Wherry, A. 2024. The carbon pricing debate is somehow getting worse: The government is aggrieved, the PBO is being defensive and voters are losing out. CBC News (Posted: June 05, 2024 3:00 AM CDT). https://www.cbc.ca/news/politics/carbon-tax-pricing-pbo-poilievre-trudeau-1.7224568#:~:text=The%20Parliamentary%20Budget%20Office%20issued,over%20what%20it%20left%20out.

Wikipedia. 2024. Manitoba Hydro. https://en.wikipedia.org/wiki/Manitoba_Hydro

City of Winnipeg, Fleet Management Agency (WFMA). 2024. Winnipeg Fleet Management Agency. https://legacy.winnipeg.ca/fleet/

Winter, J., B. Dolter and G.K. Fellows. 2021. *Carbon Pricing Costs for Households and the Progressivity of Revenue Recycling Options in Canada*, Clean Economy Working Paper Series WP 21-06. Smart Prosperity Institute, Ottawa, Canada. https://institute.smartprosperity.ca/sites/default/files/Winter_Dolter_Fellows__working_version_June2021.pdf

Woelk, D. 2024. 'Death spiral': Winnipeg advocates concerned over transit funding shortage. Global News (Posted: May 24, 2024 6:52 pm). https://globalnews.ca/news/10523730/winnipeg-transit-operating-budget-shortfall-2024/

World Bank, 2022. *Carbon Pricing Leadership Report 2021/22*. World Bank, Washington, DC, U.S.A. https://static1.squarespace.com/static/54ff9c5ce4b0a53decccfb4c/t/6290ddafb9a58932868f4797/1653661106052/Carbon+Pricing+Leadership+Report+2021-22.pdf

Working Group on Specific Mitigation Measures. 2016. Final Report. Environment and Climate Change Canada. (Report prepared under Pan-Canadian Framework. Ottawa, Canada.
Report PDF: https://www.canada.ca/content/dam/eccc/migration/cc/content/6/4/7/64778dd5-e2d9-4930-be59-d6db7db5cbc0/wg_report_specific_mitigation_opportunities_en_v04.pdf

Zimonjic, P. 2023. Liberal government set to miss 2030 emissions targets, says environment commissioner audit. *CBC News* (Posted: Nov 07, 2023 9:41 AM CST)
https://www.cbc.ca/news/politics/environment-comissioner-audit-emissions-charging-stations-1.7020689

Zinchuk, B. 2022. Carbon tax responsible for 0.4% of inflation, Governor of Bank of Canada tells Finance Committee (This includes copy of the text of letter from Tiff Macklem to Peter Fonseca, Chair of the Standing Committee on Finance, House of Commons dated March 11, 2022.
https://pipelineonline.ca/carbon-tax-responsible-for-0-4-of-inflation/#/?playlistId=0&videoId=0

Parsons, R.V., J. Alegria, R. Penner and R. Tan. 2024. *Fairness and Effectiveness of Canada's Commodity-Based Carbon Tax System*. I.H. Asper School of Business, University of Manitoba, Winnipeg, Canada. (Report Version 2.0).

* For more information on this work contact:
Robert V. Parsons, MBA, PhD
Sessional Instructor, Sustainability Economics
Email contacts: robert.parsons@umanitoba.ca or robertvparsons@gmail.com