RMA
RURAL MUNICIPALITIES of ALBERTA

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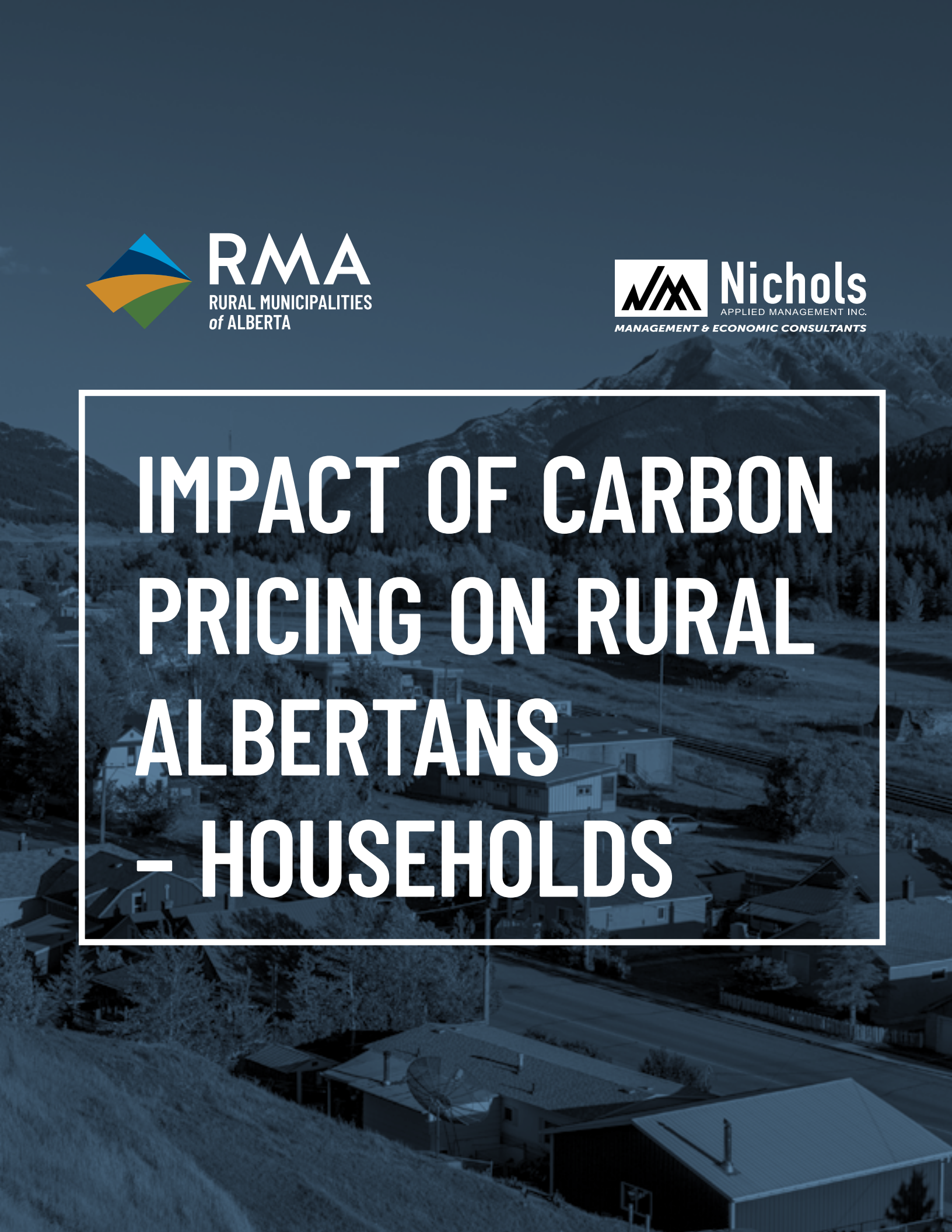

IMPACT OF CARBON PRICING ON RURAL ALBERTANS – HOUSEHOLDS

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1.0 EXECUTIVE SUMMARY

1.1. Introduction

The Rural Municipalities of Alberta (RMA) have expressed concerns with respect to the federal carbon pricing policy, specifically as it relates to the potential disproportionate impacts of the policy on rural Albertans and municipalities compared to their urban counterparts. Accordingly, RMA members have endorsed several resolutions related to carbon pricing and, with respect to Resolution 2-22S, have engaged Nichols Applied Management to pursue two lines of inquiry regarding potential federal carbon pricing policy impacts on RMA members and rural Albertans:

- Part 1: The nature of the carbon pricing policy impacts on rural municipal corporations.
- Part 2: The potential distributional impacts to rural households as compared to urban counterparts.
- This report focuses on Part 2 of this work (the nature of carbon pricing policy impacts rural households compared to urban households), while Part 1 is to be submitted under separate cover.

Policy Review

The *Greenhouse Gas Pollution Pricing Act* came into effect in 2018 and establishes the framework for the federal carbon pollution pricing system. Provinces can design their own carbon pricing system or utilize the federal system as a backstop. There are two components to the federal carbon pricing system:

- Fuel Charge – a regulatory charge applied to 21 different fossil fuels, including transportation and heating fuels such as gasoline, natural gas, and propane.
- Output-Based Pricing System (OBPS) – a performance-based system for large industrial emitters.

Alberta currently uses the federal backstop for the fuel charge and has a provincial policy for large industrial emitters. The federal fuel charge was $50 per tonne CO_2e in 2022 and will increase by $15 per year until reaching $170 per tonne CO_2e in 2030. Some users are exempt from fuel charges for certain types of fuel usage including farmers, fishers, and greenhouse operators.

The federal carbon pricing policy is designed as a revenue-neutral pricing scheme in an effort to reduce distributional inequities associated with the policy. In Alberta and other provinces using the federal backstop, 90% of funds collected are returned directly to consumers through a fuel charge rebate known as the Climate Action Incentive (CAI). The other 10% is returned through other federal programs. In addition to the base CAI payment, there is a 10% supplement for residents of small and rural communities.

Literature Review: Distributional Impacts of Carbon Pricing

With the implementation of any new tax program comes the concern of potential distributional disparity or regressive characteristics of the tax, whereby a relatively larger financial burden is imposed on some subsection of the population. Indeed, there has been some concern that the federal carbon pricing policy may unfairly impact low-income and rural households. A solution to this concern has been the implementation of "revenue neutral" carbon pricing policies, where most or all of the tax revenue is returned or recycled back to the public through a reduction in labour or business taxes or lump sum transfers to households rather than retained by the government.

There have been a plethora of studies that have evaluated carbon pricing policies and whether or not there are disproportionate impacts on different segments of the population. Overall, the current literature suggests that carbon taxes without a revenue recycling component are indeed regressive, placing a larger burden on low-income and rural households when revenue recycling is not incorporated into the taxation policy. However, revenue neutral carbon pricing programs (like the federal carbon pricing policy in Canada) have been shown to mitigate disproportionate impacts across households of varying incomes and locales.

Methods and Data

This analysis includes both quantitative and qualitative approaches, and aims to better understand whether the nature of rural Alberta living lends to a disproportionate impact of the federal carbon policy as compared to urban households. Specifically, we explore the extent to which the federal carbon policy impacts rural and urban households through two key pathways:

- **Price costs:** The direct costs to households of the federal fuel charge as well as the indirect costs associated with price increases of non-fossil-fuel goods and services.
- **Non-price costs:** The indirect costs to households of the federal fuel charge associated with wage adjustments, as well as impacts to investment income.

To estimate the cost of the federal carbon policy on rural Albertan households and assess any potential disproportionate impacts to rural residents as compared to urban residents, the study team employed a microsimulation model and database (the SPSD/M) designed by Statistics Canada for the analysis of tax and transfer policies in Canada (Statistics Canada 2023). This model or database has been used in the past to better understand the implications of the federal carbon pricing policy as the database and model incorporate carbon pricing impacts on average annual household spending. The geographic scale of our analysis included rural areas, small population centres, medium population centres, and large population centres.

Results

Overall, the average net cost of the federal fuel charge for Albertan households in 2023 is negative (-$580). A negative net costs indicates that the average household is better off as it is receiving larger CAI payments than it is spending on price costs associated with the federal fuel charge (Table 1-1).

Table 1-1 Average Household Net Cost of the Federal Fuel Charge, Alberta, 2023

POPULATION CENTRE	AVERAGE HOUSEHOLD FFC COST*	AVERAGE HOUSEHOLD CAI PAYMENT	NET COST
Large Population Centre	$790	$1,370	-$580
Medium Population Centre	$760	$1,440	-$680
Small Population Centre	$770	$1,310	-$540
Rural Areas	$820	$1,390	-$570
Provincial Average	$790	$1,370	-$580

Source: Authors' calculations using SPSD/M version 30.0.

NOTES:

*Price costs (i.e., direct costs of the federal fuel charge and indirect costs associated with price increases of non-fossil-fuel goods and services).

Recent work has shown that by 2030, when the carbon price reaches a maximum of $170 per tonne CO_2e, the price effects of the federal fuel charge will still leave average Albertan households in a net positive position (i.e., receiving larger CAI payments than they are paying in price costs of the fuel charge). But the broader impacts to wages and investment income will move many households into net negative position (i.e., receiving smaller CAI payments than they are paying in price and non-price costs of the fuel charge) (PBO 2023). It is important to note that this analysis assumes there is no behavioural adjustments on the part of households or other economic agents by 2030, which is highly unlikely. However, the results suggest that the non-price costs of the federal fuel charge are likely more impactful to Albertan households than the price costs discussed above. Furthermore, the nature of the economies of rural communities in Alberta relative to the economies of large urban centres would suggest that employment impacts (e.g., reduced wages, increased unemployment) may have a larger effect on rural communities. Carbon-intensive activities like mining and oil and gas are often hosted in rural communities in Alberta. Federal fuel charge impacts imposed on households through reduced wages and increased unemployment in these industries may therefore affect rural Albertan communities in a more pronounced way as compared to urban communities with relatively more diverse assessment bases.

Summary and Discussion

The federal carbon policy imposes real costs on Albertan households both directly and indirectly. Overall, it appears that the price costs of the federal fuel charge affect rural and urban Albertan households relatively similarly, with no discernable disparity in terms of costs incurred. When revenue recycling is considered, the average household net cost of the federal fuel charge is negative in all population centres in Alberta. In other words, households are expected to receive larger CAI payments than they spend directly and indirectly on the federal fuel charge in 2023.

Non-price costs of the federal fuel charge, including impacts to households through wage reductions and unemployment, may have a more pronounced impact on rural households as compared to urban households, as rural communities in Alberta host a relatively larger proportion of the province's labour force in carbon-intensive industries. Furthermore, downward pressures on carbon-intensive activities such as oil and gas may, in the long run, result in an erosion of the assessment base of many rural communities that host these industries. For communities that rely heavily on oil and gas activities for non-residential assessment, there may be a larger burden placed on households for municipal tax revenue as this assessment declines.

Note that the above described analysis focuses on one point in time (2023) and does not capture any behavioural changes associated with the federal fuel charge, a highly unrealistic assumption.

2.0 INTRODUCTION

2.1. About the Rural Municipalities of Alberta and its Members

The Rural Municipalities of Alberta (RMA) represents 69 rural municipal members, including 63 municipal districts and counties, five specialized municipalities, and the Special Areas Board. While the RMA's members are diverse, they also have several common characteristics, including large land masses, high levels of industrial activity in sectors such as oil and gas, forestry, agriculture, and renewable energy, and dispersed populations. Collectively, RMA members provide municipal governance to approximately 85% of Alberta's land mass, and the average RMA member covers an area of over 8,000 square kilometres.

Due to their large size, dispersed populations, and high levels of industrial activity, RMA members may be impacted by government policy and funding decisions in unpredictable or unintended ways. For example, per capita distribution of grant funding, while simple, can be problematic when calculating support for capital and operational costs incurred by rural municipalities because much of the services or infrastructure in rural municipalities exists to support industry and is not captured in per capita metrics. A similar challenge might exist in relation to the impact of carbon pricing on residents of rural municipalities as compared to their urban counterparts.

2.2. Project Purpose

Carbon pricing has long been touted by economists as being a "first-best policy" to address the negative externalities associated with greenhouse gas emitting activities, particularly when the pricing policy is revenue neutral (i.e., tax revenues are redistributed to taxpayers rather than being retained by the government). However, while carbon pricing policies may indeed result in economically efficient levels of activity and associated greenhouse gas emissions, these policies do not necessarily ensure equity amongst economic agents. Indeed, carbon pricing policies (like any tax policy) can result in a range of distributional impacts across different household types depending on how the policy is implemented. For example, under certain conditions, carbon taxes on fuel can have regressive effects[1] as lower-income households spend a larger share of their income on carbon-intensive goods and services (e.g., energy, utilities) as compared to high-income households. Similarly, rural households can be inequitably affected by carbon taxation depending on the policy approach as a result of high energy and utilities spending, as well as relatively higher spending on transportation and fuel, as compared to urban households. The Government of Canada

Understanding the potential distributional effects of government policy is key to addressing potentially inequitable outcomes.

1 A tax is considered regressive if low income households face a larger burden as compared to high income households. Conversely, a tax is considered progressive if high income households face a larger burden as compared to low income households.

has endeavoured to reduce distributional inequities associated with its pollution pricing policy by implementing a revenue recycling program and adjusting the fuel charge rebate (known as the Climate Action Incentive (CAI)) depending on household size and providing a 10% supplement for residents of rural communities. However, the extent to which these efforts reduce distributional inequities across Canadian household types remains to be seen.

Understanding the potential distributional effects of any government policy is paramount to ensuring policies are developed in a manner that not only supports economically efficient outcomes but, where possible, addresses inequitable outcomes across economic agents. The RMA has expressed concerns with respect to the federal carbon pricing policy, specifically as it relates to the potential disproportionate impacts of the policy on rural Albertans and municipalities compared to their urban counterparts. Accordingly, RMA members have endorsed several resolutions related to carbon pricing (Table 2-1).

Table 2-1 RMA Resolutions on Carbon Pricing

RESOLUTION #	RESOLUTION TITLE	SPONSOR MUNICIPALITY	LINK
19-23S	Non-Profit Exemption from Federal Fuel Charge	MD of Smoky River	RMAlberta.com/resolutions/19-23s-non-profit-exemption-from-federal-fuel-charge/
16-22F	Exemption of Natural Gas and Propane for Agriculture Under the *Greenhouse Gas Pollution Pricing Act*	Parkland County	RMAlberta.com/resolutions/16-22f-exemption-of-natural-gas-and-propane-for-agriculture-under-the-greenhouse-gas-pollution-pricing-act/
2-22S	Negative Impact of Carbon Tax on Rural Albertans	Northern Sunrise County	RMAlberta.com/resolutions/2-22s-negative-impact-of-carbon-tax-on-rural-albertans/
9-18S	Exemption of Seniors Housing from Requirement to Pay Carbon Levy	Beaver County	RMAlberta.com/resolutions/9-18s-exemption-of-seniors-housing-from-requirement-to-pay-carbon-levy/
1-17S	Carbon Levy Exemption of Natural Gas and Propane for All Food Production Uses	MD of Willow Creek	RMAlberta.com/resolutions/1-17s-carbon-levy-exemption-of-natural-gas-and-propane-for-all-food-production-uses/
6-16F	Carbon Levy Exemption on Natural Gas and Propane Used for Agricultural Operations	County of St. Paul	RMAlberta.com/resolutions/6-16f-carbon-levy-exemption-on-natural-gas-and-propane-used-for-agricultural-operations/
2-16F	Exemption of Municipalities from Carbon Levy	Leduc County	RMAlberta.com/resolutions/2-16f-exemption-of-municipalities-from-carbon-levy/

With respect to Resolution 2-22S, the RMA has engaged Nichols Applied Management to pursue two lines of inquiry regarding potential federal carbon pricing policy impacts on RMA members and rural Albertans:

- Part 1: The nature of the carbon pricing policy impacts on rural municipal corporations.
- Part 2: The potential distributional impacts to rural households as compared to urban counterparts.

Part 1 was submitted to the RMA under separate cover. Key findings from the Part 1 report are summarized below:

- The additional operating expenditures related to the federal carbon tax represent a real increase in costs to municipalities; however, there are opportunities to mitigate these costs through activities such as the adoption of more fuel efficient vehicles or adding energy efficient materials and features to existing infrastructure.
- The impact to the non-residential assessment base of a municipality is likely the most profound potential impact of a policy environment that seeks to reduce GHG emitting activities. The opportunity to mitigate this outcome does exist — municipalities may choose to work towards diversifying their local economy and by extension, their non-residential assessment base. However, the tools available to municipalities with respect to investment attraction are limited and the timeline for successfully attracting new industrial growth is considerable.

This report focuses on Part 2 of this work (the nature of carbon pricing policy impacts rural households as compared to urban households). The analysis includes both quantitative and qualitative approaches and aims to better understand whether the nature of rural Alberta living lends to a disproportionate impact of the federal carbon policy as compared to urban households. Specifically, this report explores the extent to which the federal carbon policy impacts rural and urban households through two key pathways:

- Directly through the federal fuel charge applied to fossil fuels that directly emit GHGs, and
- Indirectly through price increases of other goods and services, as well as wage adjustments and impacts to investment income.

The balance of this report is outlined as follows:

- Section 3.0 A brief summary of the Government of Canada's carbon pricing policy.[2]
- Section 4.0 A literature review of carbon pricing and potential distributional impacts across households.
- Section 5.0 An overview of the methods and data employed.
- Section 6.0 Details of the analysis conducted, results, and study limitations.
- Section 7.0 A summary and discussion.

2 Note that a detailed review of the Government of Canada's carbon pricing policy, including how the policy is applied in the Alberta context, is provided in the Part 1 report.

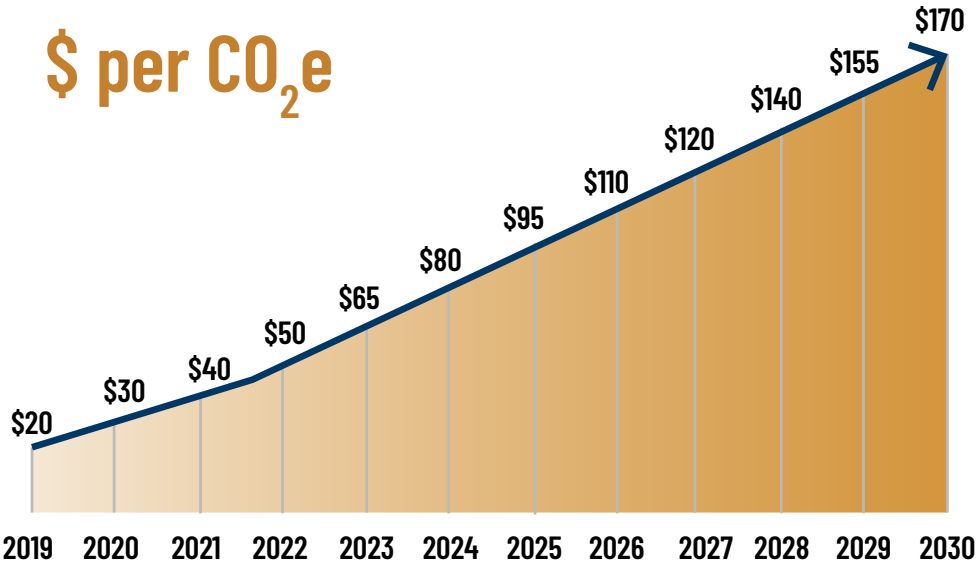
3.0 POLICY SUMMARY

The *Greenhouse Gas Pollution Pricing Act* came into effect in 2018 and establishes the framework for the federal carbon pollution pricing system (*Greenhouse Gas and Pollution Act* 2022). A detailed overview of the federal carbon pricing policy and its application to the Alberta context can be found in the Part 1 report. For the purposes of this report, a brief summary of the policy is outlined below:

- There are two components to the federal carbon pricing system:
  - The "fuel charge" that is applied to 21 different fossil fuels including transportation and heating fuels like gasoline, natural gas, and propane.
  - A performance-based system for large industrial emitters called the Output Based Pricing System (OBPS).
- Each province or territory has the option to design its own carbon pricing policy that meets the requirements of the act; otherwise, the federal system (federal backstop policy) is put in place.
  - Alberta has a province-made policy that aligns with the federal OBPS (the Technology Innovation Emissions Reduction system) but does not have a provincial fuel charge. As such, the federal backstop fuel charge policy applies in Alberta.
- The federal fuel charge was $50 per tonne CO_2e in 2022 and will increase by $15 per year until reaching $170 per tonne CO_2e in 2030, Figure 3-1 (page 12)[3].
  - The federal fuel charge applies when fuel is delivered, transferred, used, produced, imported, or brought into a listed province, and is generally paid initially by fuel producers and fuel distributors

3 The federal fuel charge rates for all 21 fossil fuels through 2030 can be found in Appendix A (page 34).

Figure 3-1 Federal Fuel Charge ($ per CO_2e), 2019 – 2030



Source: GOC 2021

- All of the funds collected through the fuel charge are returned to jurisdictions from where they are initially collected, either directly to provincial or territorial governments or through a combination of Climate Action Incentive (CAI) payments and other federal programming (GOC 2022a; ECCC 2022).
  - CAI payments vary by province and household type. Payments vary across provinces due to the different types and quantities of fuels consumed in each jurisdiction. Payments also vary between household types to ensure households that likely pay more in carbon taxes each year (e.g., couples, families with children) are reimbursed relatively more.
  - CAI payments are distributed through the Canada Revenue Agency (CRA) on a quarterly basis.
  - In addition to the base CAI payment, there is a 10% supplement for residents of small and rural communities (i.e., those residing outside a Census Metropolitan Area (CMA)).
- Some users are exempt from the federal fuel charges including, but not limited to, farmers, greenhouse operators, and fishers (GOC 2022b).

4.0 LITERATURE REVIEW

4.1. Carbon Pricing and Revenue Neutrality

The intention of a carbon pricing policy is to correct the market failure associated with the "free" emission of GHGs. Conceptually, a carbon pricing policy seeks to change the behaviour of consumers and industry, as well as encourage reduction in the production and consumption of products that emit GHGs by incorporating the social cost of emissions into the price of goods and services. Environmental taxes, such as carbon taxes, have been noted to be one of the most effective and welfare-improving policy approaches to fighting climate change (Pigato 2019). A robust carbon tax, one that is high enough to effect changes in behaviour, is also going to generate significant revenue (Carbon Tax Center n.d.). What is done with the resulting carbon tax revenue plays a substantial role in the economic efficiency of the policy. Indeed, while a carbon tax is generally considered the most cost-effective way of reducing GHG emissions (Stiglitz et al. 2017), it is relatively inefficient as a generator of general government revenue (McKenzie 2016; Timilsina 2018). There are different ways governments can allocate carbon tax revenues. The World Bank (Pigato 2019) has suggested that a carbon tax can either be:

- **Revenue neutral**, where most or all of the tax revenue is returned or recycled back to the public through a reduction in labour or business taxes, or through lump sum transfers to households, rather than retained by the government; or,
- **Revenue raising**, where the tax revenue is retained and used for general government spending.

Revenue-neutral carbon policies are more economically efficient than revenue raising approaches.

4.2. Distributional Impacts of Carbon Pricing

With the implementation of any new tax program comes the concern of potential distributional disparity or regressive characteristics of the tax, whereby a relatively larger financial burden is imposed on some subsection of the population. Indeed, there has been some concern that the federal carbon pricing policy may unfairly impact low-income and rural households. Although wealthier households typically use more energy, low-income households may spend more than twice as much (as a percentage of total income) on energy goods, and a relatively larger share of their income on other emissions-intensive goods and services, as compared to high-income households (Murray and Rivers 2015). For rural households, residents often face longer commutes and may drive more frequently as a result of longer distances between amenities and limited public transportation, leading to potentially greater carbon costs as compared to urban households (Beugin et al. 2016). These concerns have resulted in a plethora of academic and non-academic work that has sought to better understand the potential distributional impacts of carbon pricing policies on various segments of the population.

4.2.1 Low-income Households

Much of the early work examining the distributional impacts of carbon pricing policies focused on potential disparities between low- and high-income households. Indeed, many researchers have asserted that, in the absence of a revenue recycling scheme, carbon pricing policies are often regressive, imposing a relatively higher burden on low-income households (Callan et al. 2009; Grainger and Kolstad 2010; Lee and Sanger 2008; Murray and Rivers 2015). However, the literature also suggests that regressive outcomes of a carbon pricing policy can be corrected through a revenue recycling scheme. For example, microsimulation analysis conducted by Grainger and Kolstad (2010) revealed that a GHG pricing policy in the US is regressive with respect to low-income households, but the authors found that this could be alleviated or altogether eliminated through revenue recycling activities such as government transfers, tax cuts, or increasing spending on government programs. Similarly, a recent study published by Canada's Ecofiscal Commission (Beugin et al. 2016) found that a carbon pricing policy that redistributes even a small proportion of the revenues back to households can eliminate regressive outcomes of the tax.

Low-income and rural households spend a larger proportion of their income on emissions-intensive goods and services.

The nature of the revenue recycling scheme may play an important role in the regressivity of a carbon tax. Early work on BC's carbon tax program conducted by Lee and Sanger (2008) found that the tax had the potential to have regressive outcomes over time despite the revenue-neutrality of the program, as tax rebates for low-income households were not scheduled to increase in relation to the tax. More research on this issue by Murray and Rivers (2015) found that while there may be some regressive consequences to BC's carbon tax program, more recent studies have suggested that the overall effects to low-income households are small.

Other studies on this matter have indicated that a fuel or carbon tax may actually be progressive with respect to income categories, whereby relatively higher-income households face a higher tax incidence in absolute terms as compared to lower-income households. For example, Beck et al. (2015) assert that the negative impacts of the BC carbon tax are relatively lower for below-median income households as compared to those with above-median income, before consideration of revenue recycling. The reason for this is twofold. First, carbon pricing is described as having a general downward effect on real wages, as labour is considered relatively immobile between provinces, causing wages to bear the brunt of the tax. Declines in real wages tend to impact high-income households more than low-income households which are relatively less dependent on labour as an income source. Second, the real value of government transfers, which are indexed to the Consumer Price Index (CPI) are noted to increase with

...Revenue recycling can mitigate disproportionate impacts of carbon pricing between low- and high-income households.

a carbon tax in BC.[4] Since transfers make up a relatively larger share of income for low-income households as compared to high-income households, low-income households can see an increase in income under a carbon tax policy. These two factors were found to contribute to a relatively progressive outcome with respect to carbon taxes in BC, which is further enhanced when a revenue recycling scheme is imposed (Beck et al. 2015). Additional work in the US by Fremstad and Paul (2019) also found potentially progressive outcomes of a carbon pricing policy when revenues are rebated equally across household income categories.

Additional work on the topic suggests that the answer may not actually be all that straightforward. Dissou and Siddiqui (2014) revealed that carbon pricing policies may reduce inequality between low- and high-income households through changes in factor prices (e.g., real wages), but may increase inequality through changes in commodity prices. Overall, the authors suggest that there may be a U-shaped relationship between carbon taxes and inequality, whereby inequality is reduced at relatively low tax levels, but increased at higher tax levels.

4.2.2 Rural Households

Academic and non-academic literature has also examined the potential distributional impacts of carbon pricing policies on rural households. Following the implementation of BC's revenue-neutral carbon tax in 2008, there was particularly high opposition to the policy in the rural north portion of the province. Peet and Harrison (2012) identified three primary reasons for this opposition. First, northern residents and businesses shared concerns regarding energy expenses required during colder periods, as compared to communities located in the relatively warmer southern regions of BC. Second, opponents argued that northern rural residents often drive larger vehicles over relatively longer distances. Finally, rural residents cited a lack of alternatives to fossil fuels as compared to urban residents, who can switch to alternative modes of transportation (e.g., biking, public transportation) relatively easily. Others have also argued that rural households tend to have relatively lower incomes compared to urban households, inciting concerns with respect to regressive outcomes (e.g., Rancourt et al. 2021).

Without revenue recycling, carbon taxes can disproportionately affect rural households.

4 This relationship may not hold in all jurisdictions. For example, the Alberta UCP government adjusted the Assured Income for the Severely Handicapped (AISH) support program in 2019 so that payments are no longer indexed to inflation (Jarmain 2022).

Like the literature surrounding distributional effects of carbon taxes across income categories, there is a general consensus that carbon taxes have a disproportionate impact on rural households as compared to urban households in the absence of a revenue recycling program. For example, Fremstad and Paul (2019) found that carbon taxes impact rural Americans disproportionately as a result of their relatively high energy needs coupled with their lower-income status. Similarly, Beck, Rivers, and Yonezawa (2016) evaluated BC's carbon tax and found, that in the absence of a revenue-neutral policy, rural households are disproportionately burdened by a provincial carbon tax as compared to urban households.

Revenue recycling schemes have been highlighted as a means to eliminate disproportionate impacts of carbon taxes to rural households. Fremstad and Paul (2019) analyzed several revenue recycling methods for a carbon tax implemented in the US and found, that while people living in larger urban areas are generally made modestly better off under a revenue recycling scheme, those living in rural areas are made much better off. Beck et al. (2015) found that BC's revenue recycling activities (including both cuts to personal income tax and corporate income tax) improved the welfare of all households in BC significantly and corrected any disproportionate impacts experienced by rural households. As such, the study suggested that the extra lump sum payment to rural households ($200) is likely unnecessary as the basic revenue recycling methods are sufficient to correct rural disparities. Work conducted by Canada's Ecofiscal Commission (Beugin et al. 2016) focusing on Alberta, Ontario, Manitoba, and Nova Scotia also suggests that there are no significant differences in carbon costs across rural and urban households as a result of carbon taxation, even before revenue recycling is considered.

The degree to which farmers are negatively impacted by carbon pricing is uncertain.

4.2.3 Farms

In the prairies, the vast majority of farms are located in rural municipalities. While the literature suggests that farm households are not necessarily disproportionately impacted by a carbon pricing policy, particularly when revenue recycling is in place, farming operations have been noted to bear a potentially unfair burden when it comes to carbon taxation. Registered farms in Canada are exempt from paying a carbon tax on fuel used for the operation of farm machinery. However, farming operations are not exempt from direct carbon taxes on fuels used for heating and cooling of on-farm buildings and structures (e.g., grain dryers) apart from partial relief provided to greenhouse operators. According to Dobson (2021), the most significant fuel uses for primary production operations that are not exempt from the carbon tax include natural gas and propane used for grain and oilseed dryers, as well as for the heating of on-farm buildings and structures (e.g., barns).

In a study conducted by Agriculture and Agrifood Canada (AAFC), AAFC collected a series of grain drying and associated carbon pollution pricing costs from provincial agricultural departments and producer associations, then adjusted the estimates to allow for an appropriate comparison across jurisdictions (AAFC 2021). The results suggest that the average cost of the federal carbon pricing policy as it relates to grain drying activities are relatively small, ranging from roughly $210 to $774 per farm (or 0.05% to 0.38% of net

operating costs) (see Table 4-1 (page 17)). Alberta costs are shown to be on the lower end of this range, at an average of $210 per farm or $0.16 per acre, while Saskatchewan, Manitoba, and Ontario, all face relatively higher carbon costs. It is important to note that AAFC's findings are specific to the conditions for which the data were collected. Alberta and Saskatchewan's estimates are based on historical data and do not include 2019, which was a particularly wet harvest with higher drying costs. Manitoba and Ontario estimates on the other hand are specific to 2019. While AAFC acknowledges that costs are expected to be higher for larger farms, farmers and industry groups have argued that AAFC's approach to averaging carbon taxes paid for grain drying across all farms, as opposed to just those with on-site drying, is flawed, and downplays the cost faced by some farmers (Rabson 2020).

Table 4-1 Estimated Costs of Federal Carbon Pricing Policy for Grain Drying in AB, SK, MB, and ON, ($2019)

	AB	SK	MB	ON	
				GRAIN & OIL SEED FARMS	CORN FARMS
Provincial total ($ millions)	$3	$15	$3	$12	n/a
Average per farm	$210	$774	$467	$750	n/a
Average per acre	$0.16	$0.51	$0.33	$1.92	$5.50
Average as a % of operating costs	0.05%	0.18%	0.10%	0.38%	n/a
Average as a % of net income	0.17%	0.62%	0.32%	1.51%	n/a

Source: AAFC 2021.

The carbon costs of grain and oilseed drying will indeed be specific to individual crops, climate, and harvest conditions. Some have argued that AAFC's estimates are not an appropriate representation of true costs faced by farmers (Rabson 2020). Other farmers have also noted the increased costs of product transportation, as commercial trucking companies are passing carbon costs onto farmers, with one farmer estimating costs to be $500 to $1,000 per load (Djuric 2022).

Generally, it appears that the degree to which farmers are negatively impacted by the federal carbon pricing is uncertain. Should the federal carbon pricing policy create further variability in the profitability of farming in a given year (an already highly variable activity), farmers may adjust with respect to cropping decisions and capital investments. For example, an increase in the

adoption of energy-efficient drying technology may be a feasible option for some farmers. However, this remains to be seen.

In 2021, the House of Commons reviewed a bill proposing a carbon tax exemption for natural gas and propane used to dry grain, but no decisions were made as a federal election was called (Djuric 2022). Dobson (2021) has suggested a number of measures that could be put in place to provide additional carbon pricing support for farmers. Measures that would support farmers while still incentivizing emissions reductions include lump sump rebates (similar to the CAI) or output-based rebates similar to the output-based pricing systems (OBPS) that regulate other large-emitting industries.

4.2.4 Summary

In summary, the current literature suggests that carbon taxes without a revenue recycling component are indeed regressive, placing a larger burden on low-income and rural households when revenue recycling is not incorporated into the taxation policy. However, revenue-neutral carbon pricing programs have been shown to mitigate disproportionate impacts across households of varying incomes and locales.

5.0 METHODS AND DATA

5.1. Database and Model

To estimate the cost of the federal carbon policy on rural Albertan households and assess any potential disproportionate impacts to rural residents as compared to urban residents, the study team employed the latest version (version 30.0) of the Statistics Canada Social Policy Simulation Database and Model (SPSD/M).[5] The SPSD/M is a static microsimulation model and database designed for the analysis of tax and transfer policies in Canada (Statistics Canada 2023).

The database component of the SPSD/M is a compilation of a broad range of datasets including the Canadian Income Survey (CIS), household tax returns, Employment Insurance (EI), and the Survey of Household Spending (SHS). With this database and model, users can analyse a wide variety of tax and transfer related inquiries. Indeed, the SPSD/M has been used in the past to better understand the implications of the federal carbon pricing policy as the database and model incorporate carbon pricing impacts on average annual household spending.

5.2. Approach

The federal carbon pricing policy largely impacts Albertan households in two ways:

- **Direct costs:** Direct carbon costs include the federal fuel charges applied to fossil fuels that directly emit GHGs. The specific fuel charge applied to each fossil fuel is based on the carbon content (and therefore GHG emissions) associated with each fuel in Appendix A (page 34).
- **Indirect costs:** Virtually all non-fossil-fuel goods and services have some amount of GHG emissions associated with their production process (e.g., electricity, food, retail merchandise, etc.). The federal fuel charge increases the costs of production associated with non-fossil-fuel goods and services. These costs are passed onto consumers either through higher prices or lower wages. The extent to which costs are passed on through prices or wage adjustments depends on several factors including the type of product, the extent to which consumers will adjust spending habits based on price changes, and the product's exposure to global markets. Indirect carbon costs that are passed on through high prices can also affect out-of-province customers through higher priced exports. Additionally, both direct and indirect costs of the federal fuel charge that manifest through price changes increase the amount of GST paid by households.

5 Disclaimer: This analysis is based on Statistics Canada's Social Policy Simulation Database and Model. The assumptions and calculations underlying the simulation results were prepared by Nichols Applied Management Inc. and the responsibility for the use and interpretation of these data is entirely that of the author(s).

The federal fuel charge also imposes costs on Albertan households through impacts to investment income (PBO 2023). As Canadian corporations face the burden of higher costs of production, dividend income, capital gains, and interest earnings to households will be impacted.

This report analyzes and discusses the above described costs of the federal fuel charge to Albertan households in two categories:[6]

- **Price costs:** The direct costs to households of the federal fuel charge as well as the indirect costs associated with price increases of non-fossil-fuel goods and services.
- **Non-price costs:** The indirect costs to households of the federal fuel charge associated with wage adjustments as well as impacts to investment income.

Using the SPSD/M, the study team estimated the price costs of the federal carbon pricing policy on Alberta households at various geographic levels [7], including:

- Rural areas: Includes communities with a population less than 1,000 or a population density less than 400 persons/km^2 that are located outside of Census Metropolitan Areas (CMAs) or Census Agglomerations (CAs).
- Small population centres: Includes CAs below 30,000 and population centres below 10,000 persons.
- Medium population centres: Includes CAs between 30,000 and 99,999 persons.
- Large population centres: Includes CMAs over 100,000 persons.

We recognize that the population centres described above do not allow for the precise delineation of RMA and non-RMA communities. Population sizes within RMA communities are wide-ranging, from as low as 110 people (the MD of Ranchland) to as high as 99,225 people (Strathcona County). However, only four RMA municipalities have populations over 30,000 as of the 2021 census:

- Strathcona County
- Regional Municipality of Wood Buffalo
- Rocky View County
- Parkland County

6 This categorization is comparable to the "fiscal costs" and "economic costs" described in PBO 2023.

7 Community breakdowns as described in the SPSD/M are based on the classification of "size of community" from the Canadian Income Survey (Statistics Canada 2019). While the Canadian Income Survey breaks out communities with population sizes between 100,000 499,999 and over 500,000, this report aggregates these classifications as "large urban centres" for ease of data presentation.

As such, the “rural area” and “small population centre” delineations capture almost 95% of RMA communities, as well as many non-RMA communities of roughly similar sizes. Conversely, the medium and large population centre delineations capture almost exclusively large, non-RMA communities (apart from the four municipalities listed above). Therefore, a high level comparison can be made across rural and small population centres, as well as medium and large population centres, to better understand potential disparities in the price costs of the federal carbon pricing policy between average or “typical” rural households and their urban counterparts.

The SPSD/M does not allow for the analysis of non-price costs of the federal fuel charge to rural and urban Albertan households. Instead, this report includes a separate, high level discussion of the potential distribution of these costs across urban and rural communities.

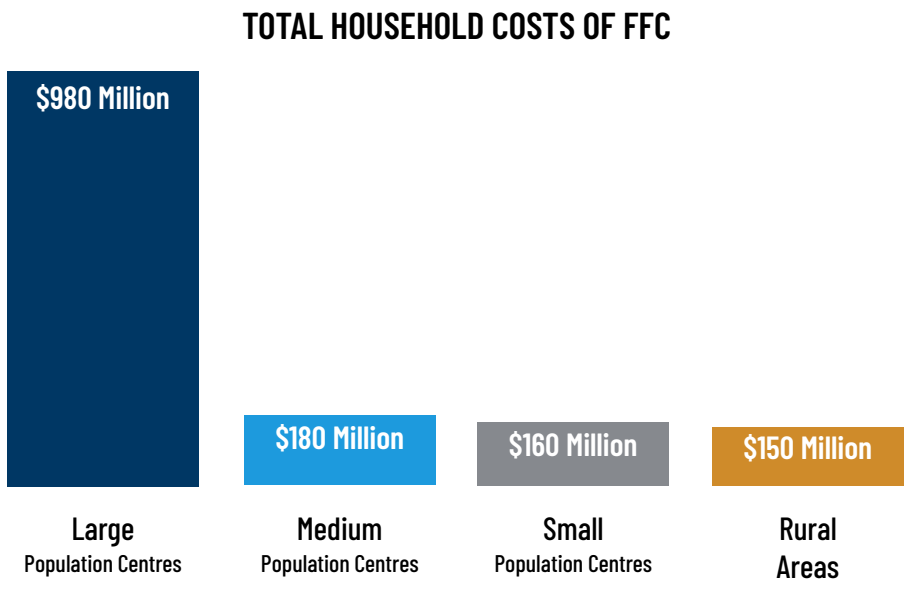
Finally, the analysis presented in this report focuses exclusively on household impacts. Impacts to non-household sectors of the economy such as exports or rural businesses (including farms) are not evaluated here but would certainly be an interesting and valuable area of future work. Furthermore, this analysis does not capture impacts to Albertan households associated with the TIER system that regulates large emitters in the province.

6.0 RESULTS

6.1. Price Costs

Price costs are defined as the direct costs to households of the federal fuel charge as well as the indirect costs associated with price increases of non-fossil-fuel goods and services. Over the course of 2023, at a federal carbon price of $65 per tonne CO_2e, it is estimated that Albertan households will spend roughly $1.44 billion on the federal fuel charge both directly and indirectly[8]. The majority (68%) of these costs are incurred by large population centres which host a relatively larger number of households as compared to less populated medium and small population centres and rural areas as seen in Figure 6-1 (page 22).

Figure 6-1 Total Price Costs of the Federal Fuel Charge to Households, Alberta, 2023

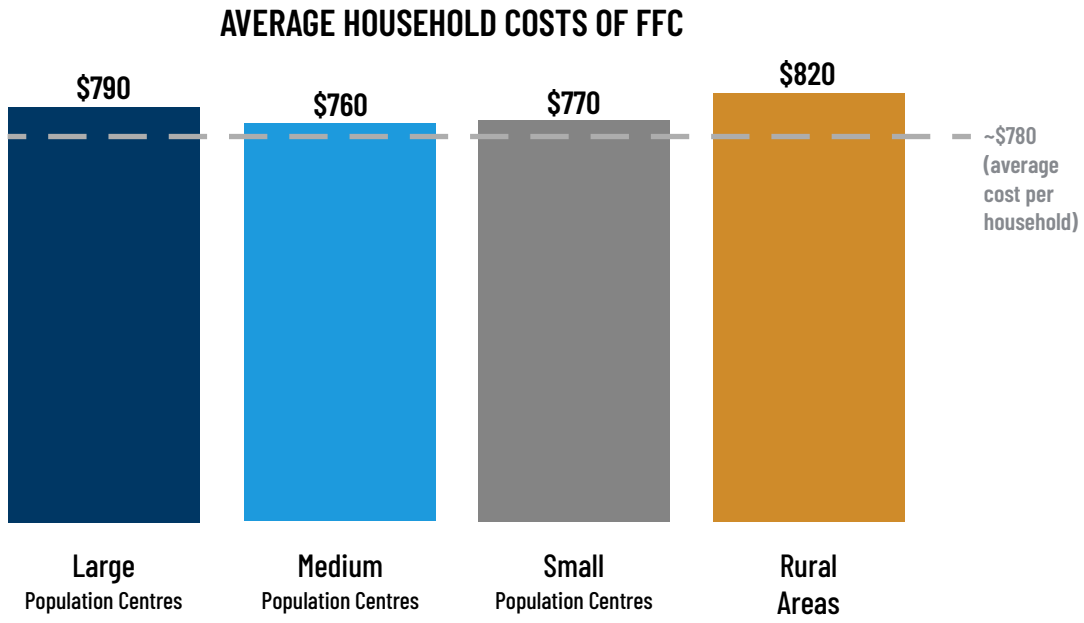


Source: Study team's calculations using SPSD/M version 30.0.

The average cost of the federal fuel charge per household in Alberta in 2023 is an estimated $790. Across the various population centres, households in rural areas appear to have the highest average costs associated with the federal fuel charge, while those in medium and small population centres have relatively lower costs (Figure 6-2 (page 23)). Indeed, households in rural areas are estimated to spend slightly more (roughly 4% more) than the average provincial household on price costs associated with the federal fuel charge in 2023. Households in medium and small population centres are estimated to spend slightly less than provincial average on the federal fuel charge on 2023 (roughly 4% and 3% less, respectively).

8 The reference to "indirect" carbon pricing costs here is with respect to price increases on non-fossil-fuel goods.

Figure 6-2 Average Price Costs of the Federal Fuel Charge to Households, Alberta, 2023



Sources: Study team's calculations using SPSD/M version 30.0.

The vast majority of federal fuel charge costs to Albertan households is a result of the direct costs on motor fuels and natural gas (roughly 80% together) as seen in Figure 6-1 (page 22). Indirect price costs associated with other major household spending categories such as electricity and food and beverage purchases are relatively small.

In terms of the average cost of the federal fuel charge for urban and rural households in 2023, households in rural areas and small population centres are estimated to spend slightly more on direct costs of the fuel charge associated with natural gas as compared to households in large and medium population centres. Fuel charge costs across other expenditure categories are relatively similar across population centres.

Table 6-1 Proportion of Price Costs of the Federal Fuel Charge to Households by Expenditure Category (%), Alberta, 2023

POPULATION CENTRE	MOTOR FUELS	NATURAL GAS	ELECTRICITY	FOOD AND BEVERAGE	OTHER
Large Population Centre	55%	24%	0.3%	3%	17%
Medium Population Centre	55%	26%	0.3%		16%
Small Population Centre	54%	27%	0.3%		16%
Rural Areas	53%	28%	0.2%		15%
Provincial Average	55%	25%	0.3%		17%

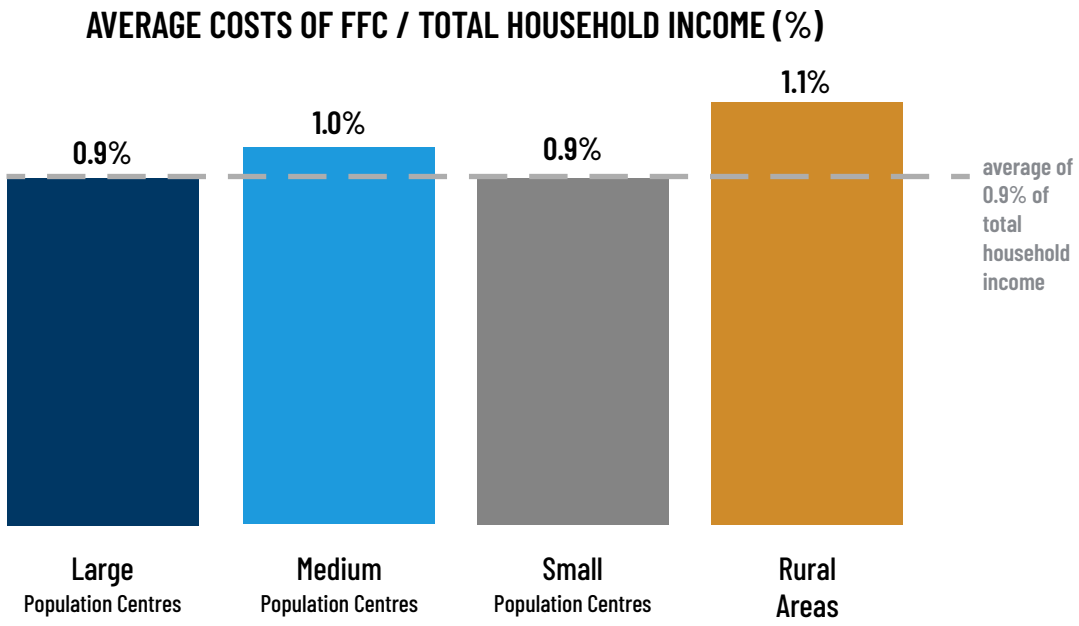
Source: Study team's calculations using SPSD/M version 30.0.

When evaluating whether or not a tax policy is "fair" across different types of households, economists typically relate the costs of the tax policy to some measure of household income or expenditures (e.g.,

Beugin 2016, PBO 2023). Accordingly, the study team analyzed the estimated cost of the federal fuel charge on households in Alberta as a proportion of household income or household expenditures. This analysis helps better contextualize whether the price costs of the federal fuel charge represent a larger proportion of household income and expenditures for rural households as compared to urban households.

On average, the price costs of the federal fuel charge represent roughly 0.9% of total household income in Alberta (Figure 6-1 (page 22)). The costs of the federal fuel charge represent a slightly larger proportion of total household income on average for households in rural areas and medium population centres compared to the provincial average (roughly 0.2 and 0.1 percentage points more, respectively).

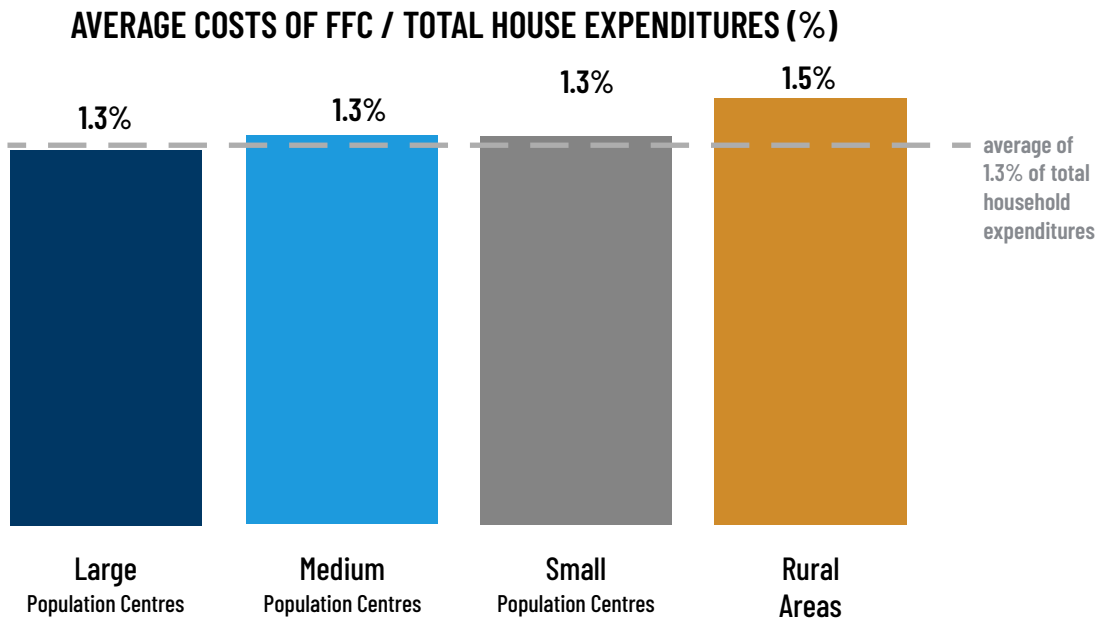
Figure 6-3 Average Price Costs of the Federal Fuel Charge as a Share of Total Household Income, Alberta, 2023



Source: Study team's calculations using SPSD/M version 30.0.

Relative to household expenditures , the price costs of the federal fuel charge represent roughly 1.3% of total household income in Alberta (Figure 6-4). The costs of the federal fuel charge represent a slightly larger proportion of total household expenditures on average for households in rural areas compared to the provincial average (roughly 0.2 percentage points more).

Figure 6-4 Average Price Costs of the Federal Fuel Charge as a Share of Total Household Expenditures, Alberta, 2023



Source: Study team's calculations using SPSD/M version 30.0.

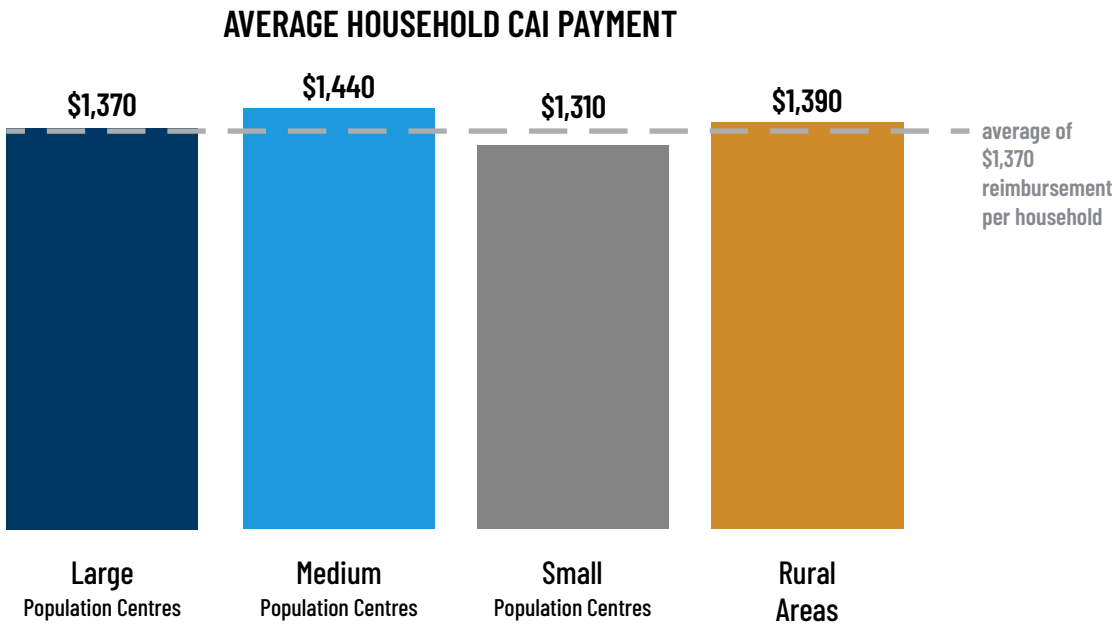
NOTE

Values are rounded to the nearest 0.1%

As discussed in Section 3.0 Policy Summary (page 11), the federal carbon pricing policy is a revenue neutral policy, where the funds collected are returned to each province. In Alberta, funds are delivered through a combination of CAI payments and other federal programming (GOC 2022a; ECCC 2022). For rural households (i.e., defined in the policy as those residing outside of a CMA), the CAI payment includes a 10% supplement — in other words, a family of four residing within a CMA could be expected to receive a CAI payment of $1,544 in Alberta in 2023, while a family of four residing outside of a CMA would receive $1,698.

In 2023, the average Alberta household can expect to be reimbursed roughly $1,370 through the CAI program. The average CAI payment to households in medium population centres is the highest in the province (an estimated $1,440 in 2023), while payments to households in small population centres appears to be the lowest ($1,310) in Figure 6-5 (page 26). The variation in the average CAI household payments across population centres described in Figure 6-5 are driven by a combination of household composition (i.e., number of adults, number of children, etc.) and whether or not a household resides within a CMA.

Figure 6-5 Average Household CAI Payment, Alberta, 2023



Source: Study team's calculations using SPSD/M version 30.0.

NOTES

Estimated CAI payments include 10% rural supplement where applicable.

Overall, the average net cost of the federal fuel charge for Albertan households in 2023 is negative (-$580). A negative net costs indicates that the average household is better off as it is receiving larger CAI payments than it is spending on price costs associated with the federal fuel charge (Table 6-2). Households in medium population centres are the best off, receiving roughly $680 more in CAI payments in 2023 than they spend on the federal fuel charge. Households in small population centres and rural areas have slightly higher net costs — in other words, they are estimated to receive more CAI payments in 2023 than they spend on price costs associated with the federal fuel charge, but not quite as much as those in medium and large population centres.

Table 6-2 Average Household Net Cost of the Federal Fuel Charge, Alberta, 2023

POPULATION CENTRE	AVERAGE HOUSEHOLD FFC COST*	AVERAGE HOUSEHOLD CAI PAYMENT	NET COST
Large Population Centre	$790	$1,370	-$580
Medium Population Centre	$760	$1,440	-$680
Small Population Centre	$770	$1,310	-$540
Rural Areas	$820	$1,390	-$570
Provincial Average	$790	$1,370	-$580

Source: Study team's calculations using SPSD/M version 30.0.

NOTE

*Price costs (i.e., direct costs of the federal fuel charge and indirect costs associated with price increases of non-fossil-fuel goods and services).

6.2. Non-Price Costs

Non-price costs are defined as the indirect costs to households of the federal fuel charge associated with wage adjustments as well as impacts to investment income. Recent work has shown that by 2030, when the carbon price reaches a maximum of $170 per tonne CO_2e, the price effects of the federal fuel charge will still leave average Albertan households in a net positive position (i.e., receiving larger CAI payments than they are paying in price costs of the fuel charge). But the broader impacts to wages and investment income will move many households into net negative position (i.e., receiving smaller CAI payments than they are paying in price and non-price costs of the fuel charge) (PBO 2023). It is important to note that this analysis assumes there is no behavioural adjustments on the part of households or other economic agents by 2030, which is highly unlikely. However, the results suggest that the non-price costs of the federal fuel charge are likely more impactful to Albertan households than the price costs discussed above. This outcome is unsurprising, given that Alberta hosts a relatively carbon-intensive economy driven primarily by the oil and gas sector. As production costs of oil and gas increase with an increasing price of carbon, assuming no emission reducing adjustments are made, there is likely to be a downward pressure on wages, an increase in unemployment, and a reduction in key components of investment income (e.g., dividend income, capital gains).

The extent to which these impacts affect rural and urban households differently in Alberta is unclear. However, the nature of the economies of rural communities in Alberta relative to the economies of large urban centres would suggest that employment impacts (e.g., reduced wages, increased unemployment) may have a larger effect on rural communities. Carbon-intensive activities like mining and oil and gas are often hosted in rural communities in Alberta. Table 6-3 (page 28) describes the proportion of the labour force participating in carbon-intensive industries including mining, quarrying, and oil and gas, as well as related support activities in RMA and non-RMA communities. The proportion of the labour force in these industries hosted in RMA communities is more than twice as large as compared to non-RMA communities (10% versus 4%). Federal fuel charge impacts imposed on households through reduced wages and increased unemployment in these industries may therefore affect rural Albertan communities in a more pronounced way as compared to urban communities with relatively more diverse assessment bases. The extent to which these non-price costs of the federal fuel charge will impact rural households as compared to urban households will depend on a number of factors including, but not limited to, economic diversification and advancements in emissions reducing technology in the fossil fuel industry.

Table 6-3 Proportion of Labour Force in Carbon-Intensive Industries, RMA and Non-RMA Communities, 2021

SECTOR	% OF LABOUR FORCE	
	RMA COMMUNITIES	NON-RMA COMMUNITIES
Mining, quarrying, and O&G extraction	6%	2%
Support activities for mining, quarrying, and O&G extraction	4%	2%
Total	**10%**	**4%**

Source: Statistics Canada 2021.

Increases to the production costs of fossil fuel industries may also impact Albertan households through their municipal tax payments. As discussed in the Part 1 report of this work, for municipalities that are heavily reliant on fossil-fuel-related assessment for tax revenue (as many rural Albertan communities are), these communities may need to shift the tax burden to other properties and encourage new economic development across other sectors. Economic diversification is likely to take place at a modest pace over a long time horizon. Oil and gas assessment is not expected to suddenly vanish or be replaced immediately. As this dynamic unfolds, there may be municipal tax implications to rural Albertan households that are greater than what households in large, diversified urban communities experience.

6.3. Study Limitation

The above described analysis provides a high level overview of the price and non-price costs of the federal fuel charge on urban and rural households in Alberta. However, it is important to note that the results provided in this work are estimates and acknowledge a number of study limitations associated with the approach.

First, data with respect to household spending used to estimate the price costs of the federal fuel charge in the SPSD/M are sourced from the Statistics Canada Survey of Household Spending (SHS). The SHS is a biennial survey that collects data from Canadian households with respect to spending habits. The sample size of SHS data available in the SPSD/M for each population centre in Alberta is provided in Table 6-4 (page 29). Overall, the SPSD/M relies on exceptionally small sample sizes across all population centres. As such, estimates of price costs associated with the federal fuel charge to households in specific population centres may not be representative of an average household in those regions.

Table 6-4 SPSD/M Household Sample Size, Alberta

POPULATION CENTRE	HOUSEHOLD SAMPLE SIZE
Large Population Centre	918
Medium Population Centre	132
Small Population Centre	152
Rural Areas	137
Provincial Total	1,339

Source: SPSD/M version 30.0.

Second, costs to Albertan households associated with increases to GST on the federal fuel charge as well as costs that are passed on as a result of the TIER program regulating large emitters are not captured in this study.

Finally, both the model and database of the SPSD/M operate within static accounting frameworks based on the 2018 structure of the economy. While the SPSD/M allows for summary and analysis of annual snapshots, it does not account for any behavioural changes or responses to taxes and transfers. Indeed, the purpose of a carbon pricing policy is to encourage behavioural changes that result in the consumption of less carbon-intensive goods and services. As technological innovation improves the availability of substitutes for carbon-intensive goods and services, a given household can improve its position in terms of the price costs of the federal fuel charge by lowering its carbon footprint.

7.0 SUMMARY AND DISCUSSION

The federal carbon policy imposes real costs on Albertan households both directly and indirectly. Overall, it appears that the price costs of the federal fuel charge affect rural and urban Albertan households relatively similarly, with no discernable disparity in terms of costs incurred. When revenue recycling is considered, the average household net cost of the federal fuel charge is negative in all population centres in Alberta — in other words, households are expected to receive larger CAI payments than they spend directly and indirectly on the federal fuel charge in 2023.

Non-price costs of the federal fuel charge, including impacts to households through wage reductions and unemployment, may have a more pronounced impact on rural households as compared to urban households, as rural communities in Alberta host a relatively larger proportion of the province's labour force in carbon-intensive industries. Furthermore, downward pressures on carbon-intensive activities such as oil and gas may, in the long run, result in an erosion of the assessment base of many rural communities that host these industries. For communities that rely heavily on oil and gas activities for non-residential assessment, there may be a larger burden placed on households for municipal tax revenue as this assessment declines.

It is important to note that the above described analysis focuses on one point in time (2023) and does not capture any behavioural changes associated with the federal fuel charge, a highly unrealistic assumption. The purpose of a carbon pricing policy is to encourage behavioural changes that result in the production and consumption of less carbon-intensive goods and services. As the carbon price continues to increase up to $170 per tonne CO_2e by 2030, consumers will undoubtedly continue to make alternative decisions when it comes to their behaviour and spending habits. For households in urban communities, it is much easier to switch to lower carbon alternatives as the carbon price increases. Public transit, infrastructure for electric vehicles, and hybrid work arrangements are all more readily available options for urban households as compared to rural households. Furthermore, the ease with which undiversified rural communities will be able to transition their assessment base away from carbon-intensive activities is unclear. Therefore, as the carbon price continues to increase, the disparity in the costs of the policy to rural and urban households in Alberta may become more pronounced.

Rural Albertan communities need to be proactive and readily engaged to adjust to the federal carbon pricing policy. Some preliminary suggestions for policy solutions that may reduce the costs of the federal fuel charge on rural Albertan households include:

- **Encouraging households to make low carbon decisions with respect to transportation and home heating.** Indeed, the largest components of the price cost of the federal fuel charge is the direct costs associated with the purchase of motor fuels and natural gas. For households in rural areas, alternative transportation options are more limited as compared to urban households. However, rural households are able to consider investing in more fuel efficient vehicles when the time comes. Furthermore, the RMA may consider lobbying for the development of electric vehicle infrastructure (e.g., charging stations) in rural areas of Alberta. A comparable program would be the installation of the SuperNet network in the province. Through the SuperNet network, the province has improved access to internet for many rural communities in Alberta. Similar support for electric vehicle infrastructure would allow rural households to transition to a low carbon transportation option more easily. When it comes to home heating, residents might consider making adjustments such as improving the seal / insulation of their homes and investing in more efficient furnaces to reduce their reliance on natural gas and improve the carbon footprint of their utility consumption.

- **Encouraging economic diversification in rural communities.** This suggestion is discussed in detail in the Part 1 report. In general, household costs incurred through impacts to wages and employment in carbon-intensive industries may be tempered through the diversification of rural assessment bases. Support for low carbon commercial and industrial activities in rural communities could lead to increased household wages and investment returns (Beugin et al. 2016). The tools available to municipalities with respect to investment attraction are limited and the timeline for successfully identifying, attracting, and subsequently taxing new industrial growth is considerable — in many cases a planning horizon in excess of several decades is advisable and the degree to which the assessment related to oil and gas can fully be replaced will vary considerably across municipality.

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APPENDIX A: FEDERAL FUEL CHARGE RATES

Table A-1 Federal Fuel Charge Rates for Alberta, Manitoba, Ontario, and Saskatchewan, 2022 – 2030

FUEL	UNIT	YEAR / TAX ($ PER CO_2e)								
		2022 $50	2023 $65	2024 $80	2025 $95	2026 $110	2027 $125	2028 $140	2029 $155	2030 $170
Aviation gasoline	litre	0.1244	0.1592	0.1959	0.2326	0.2694	0.3061	0.3428	0.3795	0.4163
Aviation turbo fuel	litre	0.1291	0.1678	0.2065	0.2453	0.2840	0.3227	0.3614	0.4001	0.4389
Butane	litre	0.0890	0.1157	0.1424	0.1691	0.1958	0.2225	0.2492	0.2759	0.3026
Ethane	litre	0.0509	0.0662	0.0815	0.0968	0.1121	0.1273	0.1426	0.1579	0.1732
Gas liquids	litre	0.0832	0.1081	0.1331	0.1581	0.1830	0.2080	0.2329	0.2579	0.2828
Gasoline	litre	0.1105	0.1431	0.1761	0.2091	0.2422	0.2752	0.3082	0.3412	0.3743
Heavy fuel oil	litre	0.1593	0.2072	0.2550	0.3028	0.3506	0.3984	0.4462	0.4941	0.5419
Kerosene	litre	0.1291	0.1678	0.2065	0.2453	0.2840	0.3227	0.3614	0.4001	0.4389
Light fuel oil (Diesel)	litre	0.1341	0.1738	0.2139	0.2540	0.2941	0.3342	0.3743	0.4144	0.4545
Methanol	litre	0.0549	0.0714	0.0878	0.1043	0.1208	0.1373	0.1537	0.1702	0.1867
Naphtha	litre	0.1127	0.1465	0.1803	0.2142	0.2480	0.2818	0.3156	0.3494	0.3832
Petroleum coke	litre	0.1919	0.2452	0.3018	0.3584	0.4149	0.4715	0.5281	0.5847	0.6413
Pentanes plus	litre	0.0890	0.1157	0.1424	0.1691	0.1958	0.2225	0.2492	0.2759	0.3026
Propane	litre	0.0774	0.1006	0.1238	0.1470	0.1703	0.1935	0.2167	0.2399	0.2631
Coke oven gas	cubic metre	0.0350	0.0455	0.0560	0.0665	0.0770	0.0875	0.0980	0.1085	0.1190
Marketable natural gas	cubic metre	0.0979	0.1239	0.1525	0.1811	0.2097	0.2383	0.2669	0.2954	0.324
Non-marketable natural gas	cubic metre	0.1293	0.1654	0.2035	0.2417	0.2799	0.3180	0.3562	0.3944	0.4325
Still gas	cubic metre	0.1350	0.1396	0.1718	0.2040	0.2362	0.2684	0.3006	0.3328	0.3650
Coke	tonne	158.99	206.68	254.38	302.07	349.77	397.46	445.16	492.86	540.55
High heat value coal	tonne	112.58	145.02	178.48	211.95	245.41	278.88	312.35	345.81	379.28
Low heat value coal	tonne	88.62	115.21	141.8	168.38	194.97	221.56	248.14	274.73	301.31
Combustible waste	tonne	99.87	129.82	159.78	189.74	219.7	249.66	279.62	309.58	339.54

Source: GOC. 2021.