

IS BRITISH COLUMBIA'S CARBON TAX
GOOD FOR HOUSEHOLD INCOME?
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Is British Columbia's Carbon Tax Good for Household Income?

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About Navius Research

Navius Research Inc. (“Navius”) is a private consulting firm with locations in both Vancouver (head office) and Toronto. Our consultants specialize in analysing government and corporate policies designed to meet environmental goals, with a focus on energy and greenhouse gas (GHG) emission policy. We assist clients with energy and climate change-related stakeholder consultation and engagement processes, and with the preparation of clear and effective communication materials related to these topics. This combination of quantitative forecasting expertise and communication and engagement capabilities allows Navius to provide a complete and integrated solution to clients working on climate change and energy planning.

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Summary

This study describes how British Columbia's carbon tax – and accompanying personal and corporate tax cuts – affect households by altering investment and economic activity across the province. Using Navius' GEEM model, we determine that the average household is better off with the carbon tax than without. A key reason is that the government uses carbon tax revenue to reduce personal and corporate income taxes, making the province a more attractive jurisdiction for investment.

How does the carbon tax affect households?

The Liberals introduced the carbon tax in 2008 to encourage a shift away from greenhouse gas intensive activities across the economy and help achieve the province's targets for emission reductions. The most obvious effect of the carbon tax is to increase the cost for energy, such as natural gas and gasoline. Households currently rely on these fuels for heating their homes and operating their vehicles, so the carbon tax imposes an additional cost on households.

But this isn't the full story – the carbon tax also has a number of effects that are less obvious. For example, households can reduce emissions by improving the efficiency of their homes or purchasing a more efficient vehicle, and by doing so reduce their exposure to the tax. These decisions have both costs and benefits – more energy efficient technologies typically have a higher initial purchase price, but they also reduce a household's energy costs.

When implementing the tax, the Liberals committed to returning revenue raised by the tax back to the economy, which has various impacts on households. First, households benefit directly from lower personal income taxes as well as through higher transfers to low-income, rural and northern-communities. Second, cuts to corporate and personal income taxes stimulate economic activity across the province and benefit households indirectly. Lastly, the tax causes the cost of some non-energy goods and services consumed by households to rise, if providing that good or service requires fossil energy.

Evaluating the impact of the carbon tax therefore requires a comprehensive assessment of the costs imposed on households, and must also account for how carbon tax revenue is subsequently recycled throughout the economy.

What are the net impacts of the carbon tax on households?

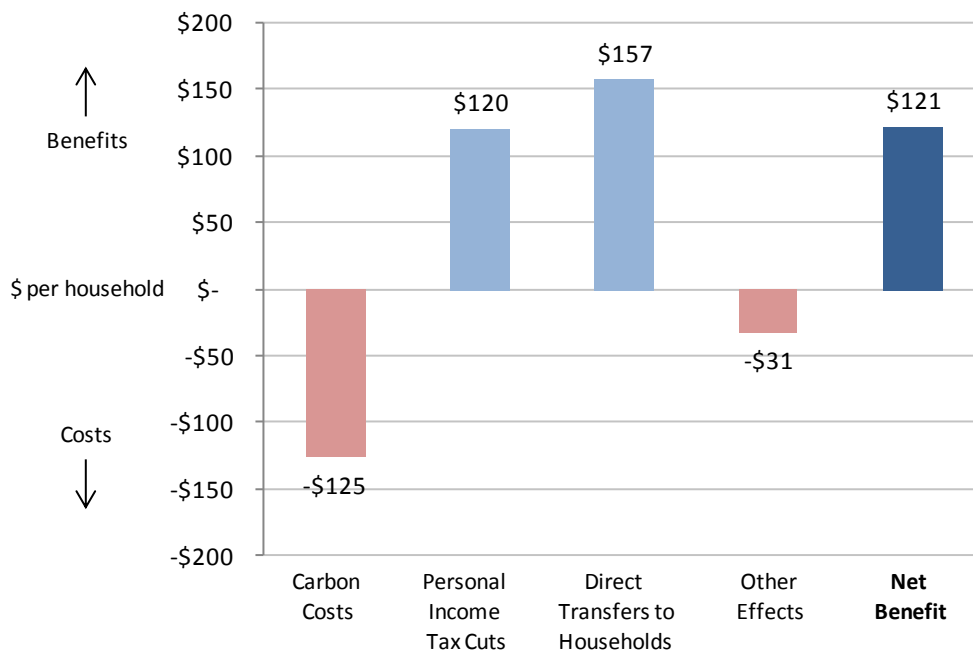
After accounting for the positive and negative effects described above, we find that some energy and emissions intensive sectors of British Columbia's economy are negatively impacted by the carbon tax, including mining and natural gas extraction. However, by using carbon tax revenue to reduce personal and corporate income taxes, the overall economy is boosted and **the average household is made better off by \$121 annually in 2020.**

Essentially, we find that the benefits of personal and corporate tax cuts outweigh the costs of the carbon tax. In particular, by lowering corporate taxes, the province is likely to become more economically competitive relative to other jurisdictions in North America. This competitiveness has a positive impact on the provincial economy and on household income.

Figure 1 summarizes the annual costs and benefits of the carbon tax for the average household in 2020, which include:

- *Carbon costs.* The most visible component of the policy is the carbon tax paid by households on fossil fuels. In 2020, households pay \$125 in carbon tax on average, primarily on gasoline for transportation and natural gas for household heating.
- *Personal income tax cuts and transfers to households.* The main benefits to households result from recycling of carbon tax revenue. Personal income tax reductions and transfers to households directly raise annual household income by \$120 and \$157, per year respectively (\$277 in total).
- *Other effects.* These effects include higher prices for non-energy commodities and services as well as changes to British Columbia’s economic activity (both positive and negative). Reductions in corporate income taxes help minimize negative economic impacts by making the province an attractive jurisdiction for investment. The net impact of these various effects is a cost of \$31 per year.

Figure 1 Annual impact of the carbon tax on the average British Columbia household in 2020



Source: Navius analysis.

Assuming the carbon tax is maintained at its current structure and level of \$30 per tonne carbon dioxide equivalent (t CO₂e).

Is it possible for the carbon tax to help the environment and the economy?

Yes. Welfare and economic activity may improve in certain specific cases where carbon tax revenue is used to reduce taxes on capital (Goulder, 1995). In particular, if capital is mobile across North America and a single jurisdiction (i.e., British Columbia) reduces corporate income tax rates, that jurisdiction becomes more attractive for investment.

Introduction

Background on British Columbia's Carbon Tax

In July 2008, British Columbia became the first jurisdiction in North America to implement a broad-based carbon tax. This tax is unique because it covers more emissions than any other carbon pricing system in North America, applying to virtually all greenhouse gas emissions from fossil fuel combustion.¹ The tax has two important objectives:

1. It encourages households and firms to reduce greenhouse gas emissions. By placing a tax on greenhouse gas emissions, households and firms have an incentive to switch to more efficient technologies (e.g. switching to a more efficient natural gas furnace) or to technologies that consume a fuel that produces fewer greenhouse gas emissions (e.g., switching from a natural gas furnace to electric heating).
2. It mitigates potential negative economic effects of a carbon tax by being revenue neutral. Carbon tax revenue is returned to British Columbians through reduced corporate and personal income taxes as well as through transfers to low-income and rural households. Reducing personal and corporate income taxes stimulates economic activity, while transfers to low-income and rural households are intended to ensure that no segment of the population is unfairly affected by the carbon tax.

How Does the Carbon Tax Affect Households?

This study examines the impact of the carbon tax on the average household in British Columbia. The carbon tax affects households in some ways that are highly visible, such as by raising the price for fossil fuels like gasoline and natural gas. However, the carbon tax also affects households in ways that are less visible – for example, the total effect of cutting corporate and personal income tax rates for households is not immediately clear. **Evaluating the impact of the carbon tax requires a comprehensive assessment of the costs imposed on households, and must also account for how carbon tax revenue is subsequently recycled throughout the economy.**

The government did communicate some of the likely impacts when it implemented the tax, including carbon tax payments and direct tax cut impacts for households (BC Ministry of Finance, 2008). Many other analyses of the tax have assessed either the environmental benefits of reducing emissions or the costs of the policy. For example, Rivers and Schaufele (2012) used historical data to quantify the decline in gasoline demand resulting from the imposition of the carbon tax. Meanwhile, the Canadian Taxpayers Federation analyzed the costs imposed on households by the carbon tax, but not the benefits from income tax cuts or transfers (CTF, 2012). Also related to households, the Canadian Centre for Policy Alternatives has conducted analyses of the relative costs and benefits of the tax, with a focus on fairness

¹ The tax applies to 70% of provincial emissions. Remaining emissions include those arising from agriculture, waste, forestry and process/fugitive sources in industry (BC Ministry of Finance, 2012a).

among households of differing income. Notably, Lee (2011) quantifies the carbon tax payments as well as the impact of other tax cuts for households in each income decile for 2010.

This study expands on these previous analyses of British Columbia's carbon tax by providing a comprehensive assessment of its impacts on households. In particular, we account for how the carbon tax - and accompanying personal and corporate tax cuts - impacts households by altering investment and economic activity across the province. The analysis explicitly represents the following ways in which the revenue neutral carbon tax affects households:

1. *Carbon costs.* The most obvious effect of the carbon tax is to raise the price for gasoline and natural gas, which are used for personal transportation and household heating. British Columbia's carbon tax currently raises the price for gasoline by 6.7¢ per litre; it also raises the price for natural gas by about \$1.5 per GJ, which leads to a roughly 19% increase in rates paid by households.² Other fossil fuels increase in price as well.
2. *Household decisions to reduce greenhouse gas emissions.* This analysis is unique from other analyses in that it accounts for how households are likely to reduce their emissions in response to the carbon tax. A central objective of the carbon tax is to encourage households and firms to reduce emissions, which minimizes their exposure to the tax. For example, if a household chooses to purchase a hybrid sport utility vehicle (SUV) as opposed to a conventional SUV, their carbon tax payments would decline by \$53 per year.³ These household decisions result in additional benefits associated with improving energy efficiency (the hybrid SUV consumes less fuel) as well as additional costs (a hybrid SUV is more costly to purchase than a conventional SUV). The authors are not aware of any other studies of the British Columbia carbon tax that account for both the costs and benefits of abatement activities undertaken by households as a result of the carbon tax.
3. *Cuts to personal and corporate income taxes, as well as greater transfers to households.* Our analysis expands on that conducted by Lee (2011) by assessing the impact of the carbon tax through 2020. The effects of the revenue neutral carbon tax vary of time as households and firms adjust to the carbon tax and tax cuts. Looking at impacts beyond the short term is important because it takes time for households and firms to respond to the carbon tax. It also takes time for the benefits from corporate and personal income tax cuts to materialize.
4. *Other economic effects.* The carbon tax has several other effects, both positive and negative, that are accounted for in our analysis. First, cuts to corporate and personal income taxes stimulate economic activity across the province. This occurs because lower corporate income tax rates improve the return on investment in British Columbia relative to other jurisdictions, incenting additional investment in the province. Likewise, cutting the personal income tax rate reduces labor costs for industry and stimulates economic activity. Second, some goods and services consumed by households have embedded carbon costs, if providing that good or service requires fossil energy. For example, although a dining room table set does not produce

² Assuming the current FortisBC rate of \$7.79/GJ in the Lower Mainland (FortisBC, 2013).

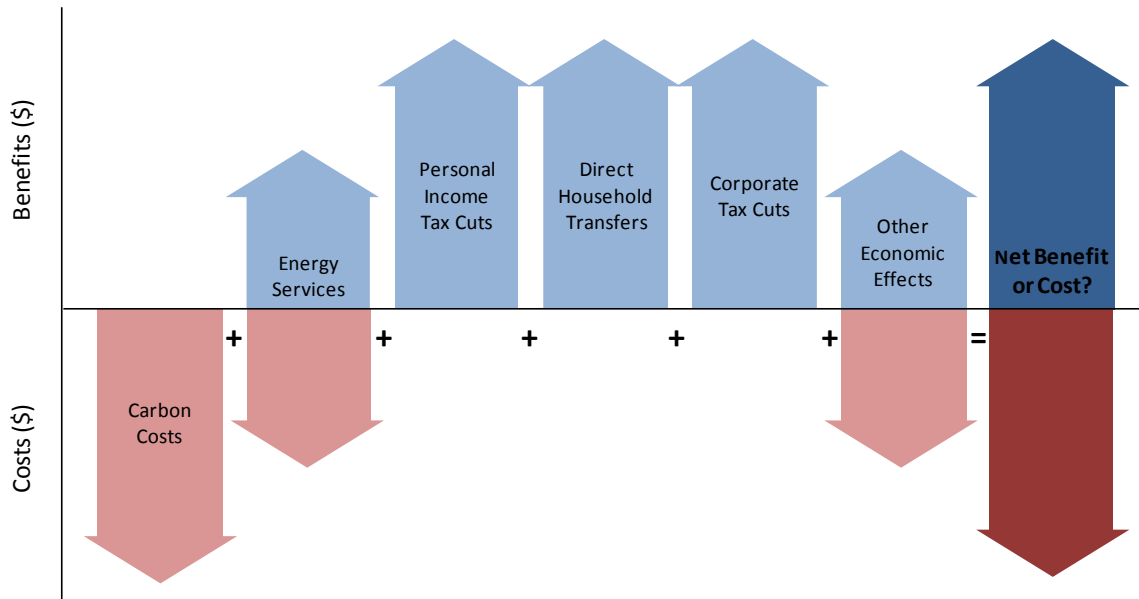
³ Based on a 2012 Toyota Highlander V6 4WD conventional transmission, relative to similar model with hybrid transmission (NRCan, 2013). Standard operating conditions assume vehicles are driven 20,000 km annually, with the conventional and hybrid vehicles emitting 4,968 and 3,174 kg CO₂, respectively.

emissions, its manufacture and transport do. The carbon tax paid by manufacturers of such a good is likely to be passed on to consumers.

Figure 2 shows the expected direction of each of the dynamics evaluated in this analysis (i.e., whether the dynamic leads to a benefit or imposes a cost on households). Some of the dynamics lead to a benefit (such as cutting personal income tax rates), while others lead to a cost (such as carbon costs). The direction of other dynamics is uncertain. For example, “other economic effects” include both positive and negative impacts, and the overall result could be positive or negative depending on how the carbon tax alters the structure of the economy.

The objective of this analysis is to assess the net effect of these dynamics on households in British Columbia. In the following sections, we describe the approach used to conduct our analysis and then present our findings.

Figure 2 Possible direction of impacts of a revenue neutral carbon tax on households



Approach to Modelling British Columbia's Carbon Tax

Overview of the GEEM Model

To analyze the impact of the carbon tax on households we use our in-house GEEM model, which simulates British Columbia's economy from 2008 to 2020. Below, we highlight the most important features of the model as they relate to this analysis.

The GEEM model accounts for:

- *Options for government taxation.* The model accounts for the majority of taxes in British Columbia and has several options for representing how carbon tax revenues can be recycled.
- *How households and firms alter their technology choices in response to different economic conditions.* We represent how households are likely to adopt low- and zero-emissions technologies to reduce their exposure to the carbon tax.
- *The major policies included in British Columbia's Climate Action Plan.* These policies include a vehicle emissions standard and strengthened energy efficiency standards for residential and commercial buildings. A comprehensive assessment of the carbon tax must include these policies because they interact with the carbon tax. For example, a vehicle emissions standard reduces emissions from passenger vehicles and therefore affects households' exposure to the carbon tax.
- *Changes to economic structure.* Households in British Columbia are further affected by how the revenue neutral carbon tax alters the province's economic structure. On one hand, the carbon tax imposes a cost on emissions-intensive industries, discouraging new investment and employment, which results in costs for households. On the other hand, cutting corporate and personal income tax rates encourages new investment and employment, and may lead to benefits for households. For example, some firms may choose to invest more in the province due to its lower tax rates.
- *Changes that occur over time.* The version of the model used for this analysis simulates British Columbia's economy from 2008 to 2020. The model explicitly accounts for inter-temporal dynamics related to the retirement and replacement of energy-consuming technologies. Specifically, the carbon tax takes time to impact firm and household investment decisions; households typically wait to replace equipment such as furnaces until they reached the end of their useful life, so the impacts of the tax are not observed immediately.

To ensure that the analysis accurately reflects current and future trends, we calibrate our model to a variety of sources. In particular, we calibrate to economic activity by sector (BC Stats, 2012), provincial and federal greenhouse gas emissions inventories (BC MoE, 2012; EC, 2012), the National Energy Board's forecast of natural gas production (NEB, 2011) and provincial and federal government accounting of revenues (Statistics Canada, 2011).

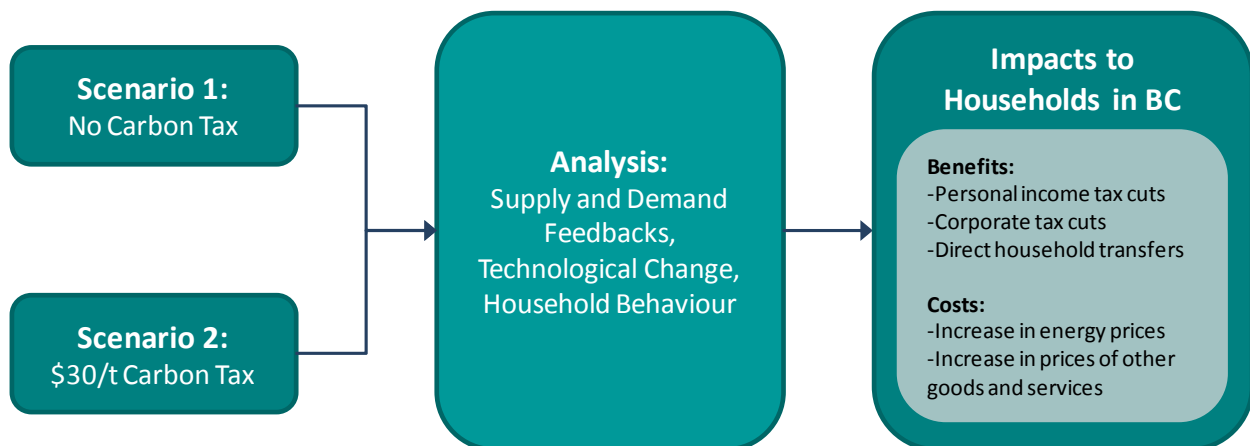
Scenarios

To evaluate the impact of the carbon tax, we construct two scenarios – one without the carbon tax and one with the carbon tax. The difference between the two scenarios represents the impact of the tax. Figure 3 shows a conceptual schematic of the study design.

The two scenarios are characterized as follows:

1. *No Carbon Tax.* The government does not implement the carbon tax, but implements the other policies under the Climate Action Plan. These policies include an emissions standard for passenger vehicles, tightened standards for residential home construction and the *Clean Energy Act* (2010), among other policies.
2. *The Carbon Tax.* The government implements the carbon tax, which rises from \$10 per tonne of carbon dioxide equivalent (CO₂e) in 2008 to \$30 per tonne of carbon dioxide equivalent (t CO₂e) by 2012 and remains constant through 2020. Revenue from the carbon tax is recycled back to the economy through cuts to personal and corporate taxes as well as through direct transfers to households. From 2012 to 2015, we assume that the shares of revenue recycled according to each of these mechanisms aligns with those forecast in Budget 2012 (BC Ministry of Finance, 2012b). For the remainder of the period, we assume that the shares are maintained at 2014/15 levels. The implication of this assumption is that 100% of revenue is returned to businesses and households in 2020 with 20% through personal income tax cuts, 26% through household transfers and 54% through corporate tax cuts.

Figure 3 Conceptualization of our analysis to determine the impacts of the carbon tax on households



The extent to which British Columbians will directly benefit from higher dividend payments is uncertain and depends on the ownership of provincial assets. For this analysis, we assume that none of the corporate tax reductions benefit British Columbians directly through higher corporate income. Instead of attempting to determine the ownership structure of all corporations operating in the province (many of which would be owned by shareholders outside the province), we make this conservative assumption that most certainly results in us under-stating economic benefits of the carbon tax (or over-estimating costs).

Sensitivity Analysis

Although the carbon tax is forecast to be 100% revenue neutral by 2013/14 according to the government's budget, it has been revenue negative since its inception. In other words, more revenue has been returned to British Columbians than has been collected. To explore the implications for households if the carbon tax were revenue negative in the future, we conduct a sensitivity analysis in which revenue over-recycling aligns with the historic average of 17%.

Another uncertainty relates to the share of revenue allocated to personal and corporate tax cuts, which has varied since the carbon tax was first implemented. In our main analysis, we assume that the share forecast in Budget 2012 for 2014/15 is maintained, with 46% of revenues allocated to households (via personal income tax cuts or direct transfers) and 54% to corporate tax cuts. However, we also conduct a sensitivity analysis showing the impact of allocating a greater share of revenue to households (68%), as occurred when the carbon tax was first implemented in 2008.

Impact of British Columbia's Carbon Tax on Households

The results of our analysis are presented below. First, we describe the amount of revenues collected through the carbon tax in 2020 and how these funds will be returned to taxpayers. Second, we summarize the financial impacts of the carbon tax for the average household in British Columbia. Lastly, we present the results of our sensitivity analysis, in which we explore alternative assumptions about revenue allocation.

Carbon Tax Revenue and Expenditures

Table 1 shows total revenues collected from the carbon tax and how they are subsequently redistributed, both historically and according to our forecast for 2020. Revenue from the carbon tax increases progressively over time. Between 2008 and 2012, this increase is largely due to rising rates for the carbon tax. After 2012, the tax is stable at \$30 per tonne and revenues continue rising due to growing greenhouse gas emissions, most notably from natural gas extraction (although emissions are lower than they would have been in absence of the tax). In 2020, we forecast carbon tax revenues approaching \$1.3 billion. This revenue is returned to taxpayers through a combination of personal income tax cuts, direct transfers to households and corporate tax cuts.

Table 1 British Columbia carbon tax revenues and expenditures (million 2010\$)

	Actual				Forecast
	2008/09	2009/10	2010/11	2011/12	2020
Carbon tax revenue	310	548	741	938	1,264
Personal income tax cuts	108	209	207	213	254
Direct household transfers^a	107	155	184	257	332
Corporate tax cuts	101	375	474	655	679
Total tax expenditures	- 7	- 191	- 124	- 188	-

^a Direct household transfers include, among others, the Low Income Climate Action Tax Credit and the Northern and Rural Homeowner Benefit. Sources: Actual data from BC Ministry of Finance (2010; 2011; 2012b). Forecast produced by Navius analysis.

Household Impacts

Our analysis shows that if the carbon tax is maintained in its current form through 2020, the average household in British Columbia is better off by \$121 per year in 2020 than if the carbon tax had not been implemented. In other words, after accounting for the costs related to the carbon tax and the subsequent redistribution of carbon tax revenue, households have greater disposable incomes. Figure 4 shows the various factors that contribute to this net benefit for households.

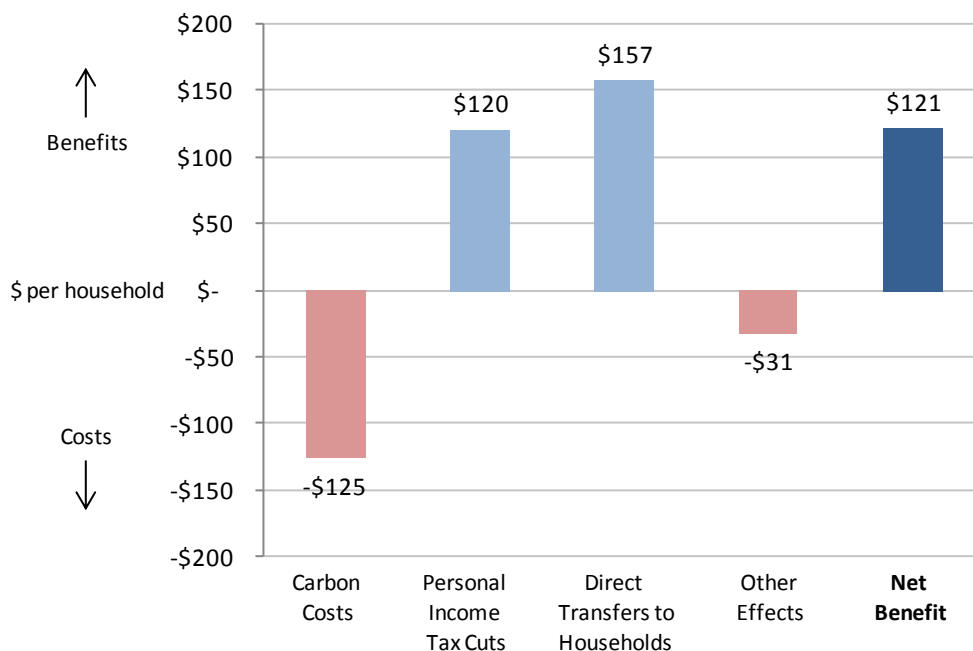
The most visible component of the policy is the carbon tax paid by households on fossil fuels. In 2020, households pay \$125 in carbon tax per year on average, primarily from purchasing gasoline for transportation and natural gas for household heating. These costs are significantly lower than they would have been in the absence of the Climate Action Plan because the carbon tax, vehicle emissions standard and strengthened efficiency standards for residential buildings all encourage or require households to adopt lower emissions technologies.

The main benefit to households results from the recycling of carbon tax revenue. Personal income tax reductions and direct transfers to households raise household income by \$120 and \$157 per year, respectively.

We estimate that the average British Columbian household is better off with the carbon tax than without because the government uses carbon tax revenue to reduce other taxes, such as those on personal and corporate income.

Other economic effects are small, and in total reduce disposable income by \$31 per year. These effects include higher prices for non-energy commodities and services as well as changes to British Columbia's economic activity and structure (e.g. changes to gross domestic product). Reductions in corporate income taxes partially offset these negative economic impacts by making the province an attractive jurisdiction for investment in North America.

Figure 4 Annual impact of the carbon tax on the average British Columbia household in 2020



Source: Navius analysis.

It is important to note that these results focus on the impact of the carbon tax on the *average* British Columbian household. A number of characteristics affect the degree to which any individual household is impacted by the tax, including household size, income, location and energy consumption habits. Determining the extent to which households are differently impacted - according to wealth, for example - is complex and needs to consider direct and indirect tax effects, existing transfer payments that may be indexed to consumer prices, available abatement options and numerous other factors.

The distributional elements of the carbon tax are an important policy concern. Nevertheless, the revenue raised by a carbon tax is more than adequate to ensure that the poorest households are not adversely affected (Rivers, 2012). British Columbia's government has attempted to address equity concerns by incorporating fairness mechanisms such as low income and rural tax credits into the tax.

Alternative Methods for Revenue Distribution

While our analysis shows that the carbon tax is likely to benefit the average household in British Columbia, this benefit depends on how much of the tax revenue is recycled back into the economy and the manner in which it is recycled. As discussed above, these characteristics of the policy are uncertain. Therefore, we conduct a sensitivity analysis in which we 1) match historic over-recycling of carbon tax revenue and 2) increase the share of revenue allocated to personal tax cuts relative to corporate tax cuts.

The benefit of the carbon tax to households depends on how much tax revenue is recycled back into personal and corporate tax cuts.

Amount of Revenue Recycling

The revenue allocation method applied in our core analysis assumes that the tax becomes revenue neutral, as forecast in Budget 2012. However, historically the government has returned more funds than it collects through the carbon tax - by 17% on average. If we assume that this level of over-recycling is maintained in the future, the average net benefit to households increases from \$121 to \$202 per year in 2020 (see Table 2). A portion of this benefits comes at a cost of lower government revenue. Less government revenue decreases resources to fund other government priorities.

Personal vs. Corporate Tax Reductions

The relative allocation of revenue to personal versus corporate tax reductions also has an impact on household benefits. In our base case, we assume that the share of revenue allocated to personal income tax reductions, corporate tax reductions and direct transfers to households aligns with those forecast for 2013/14 in Budget 2012. According to the budget forecast, about 46% of distributions will be returned to households, via both personal income tax reductions and direct household transfers. However, when the tax was first implemented about two-thirds of redistributions (68%) were returned to households. If such a proportion is achieved in the future, the average net benefit to households increases to \$169 in 2020.

The manner in which tax revenues are recycled has broader impacts on the economy beyond direct financial impacts to households. Although personal income tax cuts and transfers to households lead to more immediate and direct benefits to households, corporate tax cuts may be better at stimulating economic growth in the province. Economic growth benefits households in the long-run through higher income. Future research could assess the relative merits of changes to personal and corporate taxes in terms of maximizing long-term economic growth for British Columbia.

Table 2 Sensitivity analysis results

	Base Case	Revenue negative	Higher allocation to households (68%)
Average net benefit per household of carbon tax in 2020 (2010\$)	\$121	\$202	\$169

Source: Navius analysis.

Acknowledgements

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