The Effect of Carbon Pricing on Low-Income Households, and Its Potential Contribution to Poverty Reduction

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Sustainable Prosperity

BACKGROUND PAPER

The Effect of Carbon Pricing on Low-Income Households, and Its Potential Contribution to Poverty Reduction

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Table of Contents

Introduction

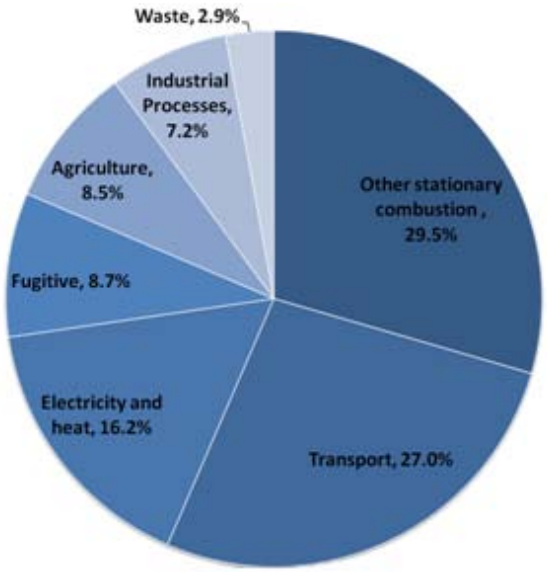
Canada will face major physical effects arising from the changing climate. Since the 1950s, Canada has experienced an average temperature rise of 1.3°C, higher than the global average of 0.78°C.[1] Canada can expect increased glacier melt, more volatile weather patterns and increasingly threatened animal and marine habitats, even from the most conservative warming predictions.[2] These intensifying climatic changes will transform the economy and drastically affect the daily lives of Canadians.

At the same time, Canadians, both individually and collectively through government action, have been slow to take action to combat climate change. Despite its original Kyoto commitment to reduce greenhouse gas emissions to 6 per cent below 1990 levels (revised in 2010 to 17 per cent below 2005 levels by 2020), Canada's greenhouse gas emissions have increased by almost 25 per cent since 1990.[3] Current government actions at the national level consist of implementing new automotive greenhouse gas (GHG) regulations, phasing out coal-fired electricity plants, and investing in clean energy, among other actions.[4] Canada's national climate change policy is highly aligned with that of the United States, and, in its current form, is unlikely to achieve the emissions reductions necessary to meet the government's targets.[5]

Canada's emissions profile reflects regional differences in resource endowments and commonalities in resource inefficiency, urban design and lifestyle. Figure 1 shows the contribution to Canada's carbon emissions from various segments of the economy – the largest contributors being stationary sources (buildings, factories, etc.), transport, and electricity and heat production.

[1] National Round Table on the Environment and the Economy. 2009. "Degrees of Change: Global Warming and the Stakes for Canada. A Summary of the Impacts of Climate Change Expected in Canada over the 21st Century". Available online at: http://www.climateprosperity.ca/eng/studies/climate-impacts/report/degrees-of-change-diagram-eng.pdf
[2] Ibid.
[3] Environment Canada. Canada's 2008 Greenhouse Gas Inventory: A Summary of Trends: 1990-2008. Available online at: http://www.ec.gc.ca.
[4] Government of Canada. November 26, 2010. "Canada's Action on Climate Change". Available at: http://www.climatechange.gc.ca/default.asp?lang=En&n=72F16A84-1
[5] National Round Table on the Environment and the Economy. 2011. "Parallel Paths: Canada-U.S. Climate Policy Choices". Available online at: http://www.climateprosperity.ca/eng/studies/canada-us/report/canada-us-report-eng.pdf

Figure 1: Sector Contribution to National GHG Inventory, 2008



Source: Environment Canada. Canada's 2008 Greenhouse Gas Inventory: A Summary of Trends: 1990-2008.

The majority of Canada's greenhouse gas emissions are from Alberta (33 per cent), Ontario (26 per cent), Quebec (11 per cent), Saskatchewan (10 per cent) and British Columbia (9 per cent).[6] The electricity and heat sector in Alberta is responsible for almost half of all emissions from electricity and heat production nationally, due to its heavy dependence on coal.[7]

The most significant changes towards decarbonising the economy need to be made at the source: the fossil fuels we use to power our lives. The electricity generation sources historically used in each province stem largely from local resource endowments. For example, Alberta is highly dependent on coal, which is not surprising given that it holds over 70 per cent of Canada's coal reserves.[8] On the other hand, the electricity grids in British Columbia and Quebec are almost carbon-free due to the hydropower resources located in these two provinces. Some provincial governments have taken steps towards transforming their established power generating mix away from carbon-intensive sources. Ontario has used the *Green Energy Act* to increase the amount of electricity generated from renewable sources, while committing to phase out coal-fired power plants.

The approach to decarbonising the Canadian economy favoured by economists and supported by many in the business and policy communities is to price carbon.[9] Pricing carbon makes carbon-intensive goods and services more expensive, thus shifting demand towards lower-carbon alternatives. A high carbon price will be necessary to achieve

[6] Environment Canada. Canada's 2008 Greenhouse Gas Inventory: A Summary of Trends: 1990-2008. Available online at: http://www.ec.gc.ca
[7] Government of Alberta. December 2008. "Launching Alberta's Energy Future. Provincial Energy Strategy". Available online at: www.energy.alberta.ca.
[8] Ibid.
[9] For details about Canadian business preferences for carbon pricing, see the February 2011 Sustainable Prosperity policy brief, "Canadian Business Preference on Carbon Pricing', available at: http://sustainableprosperity.ca/article758

significant emissions reductions. Several Canadian provinces (Alberta, British Columbia and Quebec) already have some form of carbon pricing in place, while others are actively considering it.

Governments can choose between a cap-and-trade system and a carbon tax. Both options have advantages and disadvantages, though a carbon tax has recently gained favour for its simplicity and the speed and ease of implementation compared to a cap-and-trade system. Both options generate revenues for governments: a carbon tax through tax revenues and a cap-and-trade system through the sale of permits. Key design and policy concerns include how to use the revenue from either system, and how to ensure that the policy is fair and doesn't exacerbate existing inequality.

The use of carbon revenue and how they are managed is a major policy concern. Economists favour recycling the revenue into tax cuts, because it increases economic efficiency by reducing distortionary taxes such as those on labour, which discourage more employment. However, the actual economic efficiency gains of cutting distortionary taxes are also likely overstated. Besides lowering taxes, there is also an opportunity to use carbon revenue to make a major impact on other important government priorities, such as alleviating poverty, which could be achieved through the tax system.

This background report will draw upon international examples and research to examine how climate change and federal-level carbon pricing could impact the welfare of vulnerable populations. It will describe how the federal government could mitigate these impacts through revenue use options and policy instruments.

The distributional impacts of climate policy have been examined at the regional and economic (competitiveness of different sectors) levels. This paper is focused on the impacts at the household level.

Climate Change's Effect on Vulnerable Populations

There are several ways in which climate change, and the policies to mitigate it such as carbon pricing, can impact a household's financial situation and general welfare. This section will first explore the physical impacts of climate change on vulnerable populations; then the impact of mitigation policies.

Physical Impacts

Canada will face significant physical impacts from climate change. These changes will reverberate through the economy and affect the lives of households and individuals.

Research has been conducted on how climate change will affect various economic sectors. In British Columbia (BC), a study identified the most impacted sectors as those dependent on water as a key input, including forestry and energy among others, as BC is likely to experience water shortages.[10] At the national level, research suggests that the most significant challenges will be posed by extreme weather events, including floods and storms, making agriculture and other natural resource-dependent sectors most vulnerable.[11]

Canada's economy is heavily dependent on natural resource extraction. Though natural resource sectors directly represent only 6 per cent of Canada's Gross Domestic Product[12], they also provide raw materials and key inputs for other sectors. Natural resource sectors such as forestry, agriculture and mining are vulnerable to climate change, though some more than others. For example, it can be expected that climate change will alter the growing conditions for the forestry and agricultural sectors, which, depending on the region, could increase or decrease yields. At the same time, climate change will also make some previously inaccessible natural resources, such as oil in the Arctic, easier to access. Therefore the impacts on economic sectors and employment will vary widely by region, given Canada's vast and varied geography. Employment in these sectors will fluctuate according to physical climate change effects on sector output. Low-income, especially rural populations tend to be heavily employed in natural resource sectors, making their livelihoods heavily dependent on a sector's economic strength. Table 1 shows the employment figures by province and territory, which demonstrates the significant variance in provincial and territorial economies.

[10] Olewiler, Nancy. 2009. "Climate Change: BC's Progress toward a Low-Carbon Economy". Business Council of British Columbia Outlook 2020 Project, 2009. Available at: www.bcbc.com/Documents/2020_200910_Olewiler.pdf.
[11] Natural Resources Canada. 2004. "Climate change impacts and adaptation: A Canadian Perspective". Page ix. Available at http://adaptation.nrcan.gc.ca/perspective/pdf/report_e.pdf.
[12] Industry Canada. 2009. "GDP by Sector of the Canadian Economy". Available at: http://www.ic.gc.ca/eic/site/cis-sic.nsf/eng/h_00013.html#vla2b

Table 1: Employment in Natural Resources Sectors by Province/Territory (share of total employment)

Province/Territory	Share of natural resource sector's employment[13] of total employment
Alberta	11%
British Columbia	4%
Manitoba	7%
New Brunswick	6%
Newfoundland and Labrador	9%
NWT	8%
Nova Scotia	5%
Nunavut	3%
Ontario	2%
PEI	12%
Quebec	3%
Saskatchewan	15%
Yukon	5%
Canada	**5%**

Source: Statistics Canada

Canada's changing climate will also affect its built environment – homes, buildings, factories, roads and cities. Climate change can damage these permanent structures, resulting in increased costs for occupants. Low-income groups have less disposable income available to meet this type of unexpected expense. Vulnerable populations, such as Aboriginal groups, are already two to three times more likely to live in housing in need of major repairs.[14] Climate change will only exacerbate the existing cost burden on vulnerable populations for housing maintenance and repair.

The activities that contribute to climate change, that is the burning of fossil fuels, also create air pollution. Low-income populations tend to live closer to pollution sources, such as factories or mines, owing to lower property values. Pollution has negative effects on human health, as it is a leading cause of asthma and breathing conditions. The Canadian Medical Association estimates that air pollution costs the Canadian economy in excess of eight billion dollars per year, in terms of associated sickness and deaths.[15] Policies that lead to reductions in greenhouse gas emissions will also reduce air pollution, improving health outcomes.

[13] Natural resource sectors considered as part of this calculation: agriculture, forestry, fishing and hunting, mining, and oil and gas extraction.
[14] Statistics Canada. 2008. "Aboriginal Peoples in Canada in 2006: Inuit, Métis and First Nations, 2006 Census". Available at: http://www12.statcan.ca/census-recensement/2006/as-sa/97-558/pdf/97-558-XIE2006001.pdf.

[15] Canadian Medical Association. August 2008. "No Breathing Room: National Illness Costs of Air Pollution". Available at: http://www.cma.ca/multimedia/CMA/Content_Images/Inside_cma/Office_Public_Health/ICAP/CMA_ICAP_sum_e.pdf

Policy Impacts

A carbon price will create an additional cost for companies and sectors that produce carbon-intensive goods and services. This price signal is necessary to spur the decarbonisation of the economy, by making carbon-intensive goods and services more expensive, thereby shifting demand towards lower-carbon alternatives and decreasing production in carbon-intensive sectors. Carbon is embedded in almost every product through the energy used to produce it, assuming that energy is derived from a fossil fuel source. In addition to price increases for fossil fuels, which directly affect transportation, housing and fuel expenses, the cost of embedded carbon will affect the price of most goods and services, to varying degrees. Table 2 shows the ten goods with the highest expected price increases due to a hypothetical 57€/t CO_2 carbon tax in the Netherlands. Other research confirms that the goods most affected by a carbon price are gasoline, electricity, natural gas and food.[16]

Table 2: Top ten product groups experiencing the highest price increase with a 57€/t CO_2 tax in the Netherlands (2000)

Product Group	Price Increase (%)
1. Heating and lighting	2. 101.5
3. Electricity	4. 49.4
5. Gas including solid and liquid fuels	6. 35.4
7. Gasoline and oil	8. 28.4
9. Fish	10. 11.4
11. Garden and flowers	12. 6.8
13. Vegetables	14. 5.6
15. Holidays, camp and weekend recreation	16. 5.4
17. Toys	18. 5.4
19. Butter, cheese and eggs	20. 5.2

Source: Kerkhof, Annemarie C., Moll, Henri C., Drissen, Eric and Wilting, Harry C.. January 2008. "Taxation of multiple greenhouse gases and the effects on income distribution: A case study of the Netherlands". Ecological Economics 67: 322.

From table 2, it's evident that fossil fuel prices see the largest increases (as is intended by the carbon price), while the prices of other goods rises in relation to their embedded carbon content and associated carbon costs, but by a far smaller amount. As will be explored in more depth later in the report, the input-output model (used to calculate the price increases in table 2) has inherent weaknesses in that it does not account for the behavioural changes (i.e. input substitution) that would occur as a result of the imposition of a carbon price, and that are indeed the goal of a carbon price. The model also assumes producers are able to pass on all costs, which varies depending on the demand elasticity (responsiveness to price changes) for the good.[17]

[16] Grainger, Corbett A. and Kolstad, Charles D. August 2009. "Who pays a price on carbon?" National Bureau of Economic Research Working Paper.
[17] This theory assumes that firms that produce goods with inelastic demand will pass all costs along, and those whose products face elastic demand cannot pass costs along.

The costs of compliance to companies are passed on through changes in consumer prices, stock returns, wages, and other returns to factors of production.[18] A carbon pricing policy is intended to shift behaviour away from carbon-intensive goods and fuels by raising their costs in terms of:[19]

- the way households spend their income;
- the inputs firms use to produce goods; and,
- the allocation of labour and capital between economic sectors.

Carbon pricing policies are designed to produce major economic shifts; however, policies should be designed to protect the most vulnerable populations so that these policies are not regressive.

In a cap-and-trade system with grandfathered permits, the benefits will tend to accrue to shareholders, who are more likely to belong to a high-income group, with costs being imposed on consumers.[20] Therefore, grandfathering of permits has been found to be highly regressive.[21] The elasticity of demand for the product in question will determine the extent to which carbon costs can be passed on to consumers. Companies that produce goods with inelastic demand (i.e. where price increases would not affect demand) would pass costs onto consumers through higher prices, thereby directly shifting the policy burden onto consumers.[22] On the other hand, companies whose products have elastic demand (i.e. where the quantity of product demanded does change with price) could be forced to absorb the additional carbon costs into their cost structure. To maintain competitiveness, these companies would be forced to cut costs elsewhere, which could result in lower wages, indirectly shifting the burden onto consumers. In the most carbon-intensive sectors, there could also be job losses as output decreases. Workers may have invested in developing skills relevant to a particular industry. If that industry shrinks, these workers will have more trouble finding a job in another sector, depending on skill transferability and availability of transition programs.[23] However, it is likely that the most intense impacts occur during the transition period (short- to medium-term; see Box 1) and that over time, wages and stock values would tend to return to their initial levels.[24]

[18] Grainger, Corbett A. and Kolstad, Charles D. August 2009. "Who pays a price on carbon?" National Bureau of Economic Research Working Paper.
[19] Peters, Jotham, Bataille, Chris, Rivers, Nic and Jaccard, Mark. November 2010. "Taxing Emissions, Not Income: How to Moderate the Regional Impact of Federal Environment Policy". C.D. Howe Institute Commentary.
[20] Fullerton, Don. August 2008. "Distributional Effects of Environmental and Energy Policy: An Introduction". National Bureau of Economic Research Working Paper.
[21] Blonz, Joshua, Burtraw, Dallas and Walls, Margaret A. September 2010. "Climate Policy's Uncertain Outcomes for Households: The Role of Complex Allocation Schemes in Cap and Trade". Resources for The Future.
[22] Rivers, Nic. October 2010. "Distributional incidence of climate change policy in Canada". Sustainable Prosperity.
[23] Fullerton, Don. August 2008. "Distributional Effects of Environmental and Energy Policy: An Introduction". National Bureau of Economic Research Working Paper.
[24] Congressional Budget Office. April 25, 2007. "Trade-Offs in Allocating Allowances for CO_2 Emissions". Economic and budget issue brief.

The importance of timescales

Sectors, companies and households will be most adversely affected by a price on carbon in the short term when they are unable to quickly adjust production processes and lifestyle to be less carbon-intensive. Researchers have suggested that four time scales are relevant when assessing the impacts on these groups: [25]

-The very short run, where companies cannot adjust prices and profits fall. There may be job losses but little effect on end-market prices.

-The short run, where companies can raise prices to reflect higher energy costs with a decline in sales as a result of product or import substitution. Households face higher prices and suffer welfare impacts if they are not able to make immediate shifts away from carbon-intensive goods.

-The medium run, when in addition to the changes in output prices, the mix of inputs may also change, but capital remains in place, and economy-wide effects are considered. Prices are still high, and households have likely made all the easiest lifestyle changes. Their ability to make further changes depends on the speed of introduction of substitutes into the marketplace.

-The long run, where capital may be reallocated and replaced with more energy-efficient technology. Prices are still high, but households can more easily make lifestyle adjustments and substitute away from carbon-intensive goods (e.g. there may be more options for public transit, more products available, etc.).

The cost burden associated with the policy is shifted onto the public, either through higher prices or lower wages. This is known as the distributional impact of the policy, which measures who bears its economic burden.[26] The net impact on a particular household is a function of its reliance on carbon-intensive products or employment in a carbon-intensive sector and its ability to substitute towards lower-carbon alternatives. Structural factors contribute significantly towards a household's spending pattern and ability to make substitutions with regards to carbon-intensive goods. For example, living in a suburb means increased dependence on automobile travel, due to greater distances and less access to public transit or other alternatives.

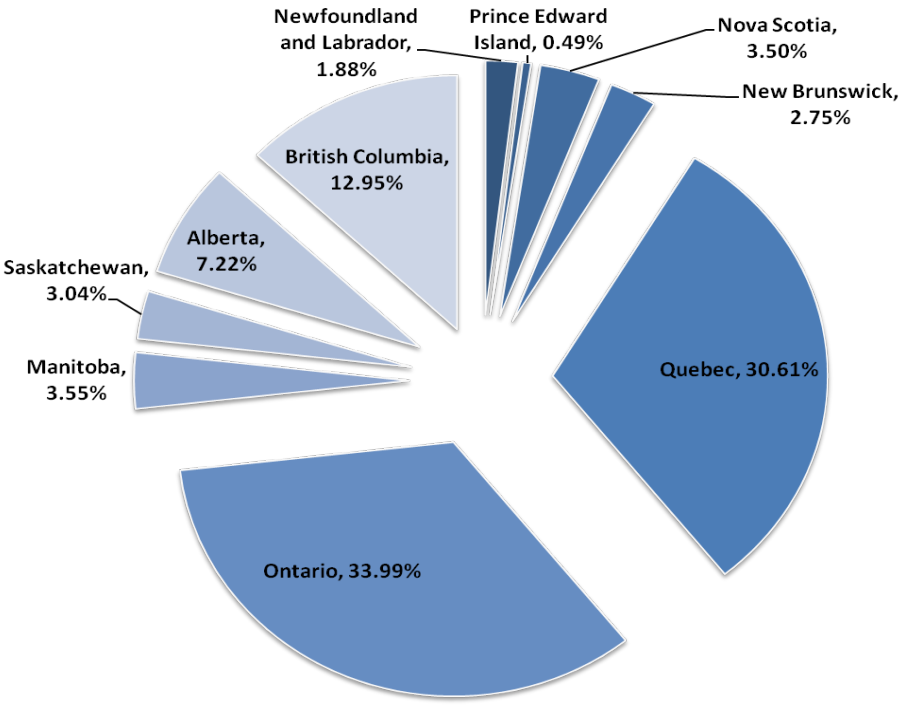
Although low-income groups in Canada will be disproportionately affected by both physical climate change and the policy responses used to combat it, Canadians overall will bear a much smaller burden globally than those in many less developed countries. Though they did not contribute to greenhouse gas emissions to anywhere near the same extent as industrialized countries, many low-income countries find themselves in geographically sensitive regions where they will face the most serious physical impacts of climate change. So while there are equity and fairness issues within the Canadian context of addressing this issue, Canadians will not face climate change ramifications that are in proportion globally to their contribution to the problem.

[25] Fischer, Carolyn and Morgenstern, Richard. November 2009. "Climate Policy and Competition: US Industry's Regulatory Dilemma". Resources for the Future. Page 5.
[26] Rivers, Nic. October 2010. "Distributional incidence of climate change policy in Canada". Sustainable Prosperity.

Identifying Vulnerable Populations[27]

This report identifies "vulnerable populations" as the lowest-income Canadians; in this section, the term refers specifically to the two (out of five) lowest income quintiles. It is important to note that not all individuals who fall into these two quintiles can be considered as living below the after-tax low-income cut-off (LICO). Over the past 30 years in Canada, the poverty rate has fluctuated between 15 and 20 per cent of the population.[28] The two lowest-income groups also include those who may be only temporarily low-income, such as students. Statistics Canada provides helpful information about the characteristics of these two income quintiles. Across the country, the distribution of the lowest two income quintiles varies significantly and mirrors the general distribution of the population, as shown in Figure 2.

Figure 2: Geographic distribution of the lowest two income groups in Canada (Provinces only)

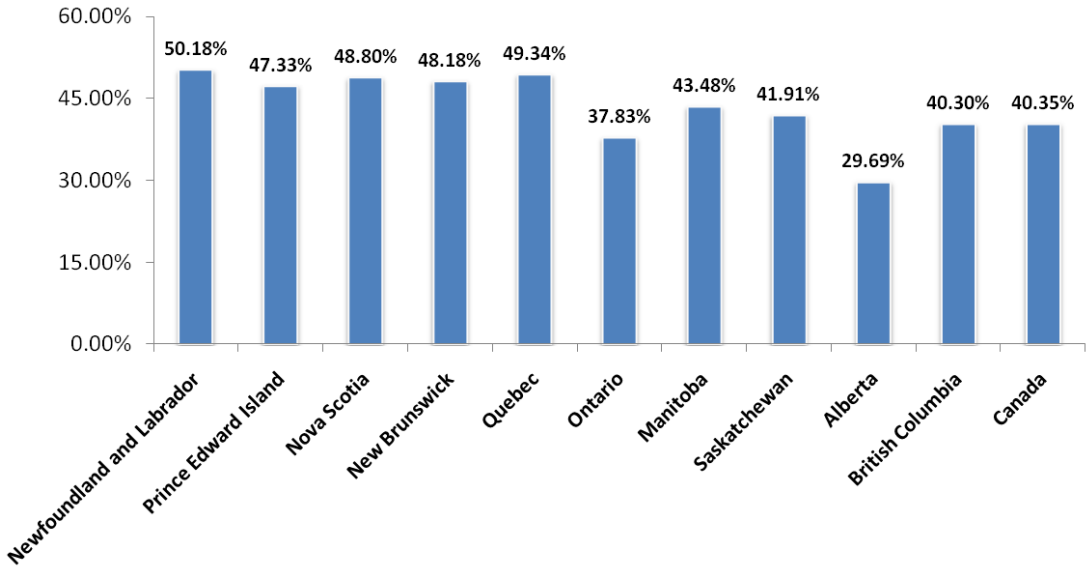


Source: Statistics Canada. 2010. Survey of household spending, 2008. Ottawa, Canada. Income Statistics Division.

By definition, 40 per cent of the population falls into the lowest income quintiles, though this varies by province, with some being above or below 40 per cent, as shown in figure 3.

[27] The analysis in this section is based on data from Statistics Canada's 2008 Survey of Household Spending. The survey did not cover the Territories.
[28] Hay, David I. 2009. "Poverty Reduction Policies and Programs: Canada". Canadian Council on Social Development.

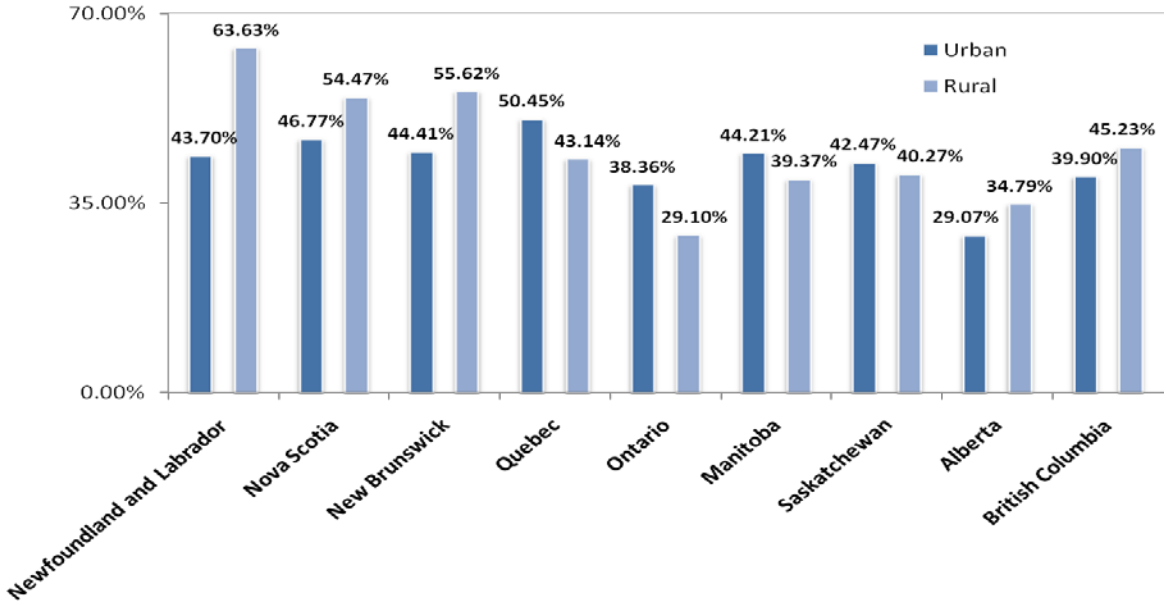
Figure 3: Percentage of the population in the two lowest income quintiles by Province



Source: Statistics Canada. 2010. Survey of household spending, 2008. Ottawa, Canada. Income Statistics Division.

Almost mirroring the total Canadian numbers (87.65 per cent), most Canadians in the two lowest income quintiles live in urban areas (87.64 per cent). However, the numbers vary significantly by province. Figure 4 shows the urban versus rural breakdown for the two lowest quintiles in nine provinces (excluding Prince Edward Island). In all provinces except Saskatchewan, Manitoba, Ontario and Quebec, the lowest-income groups are more likely to live in rural areas.

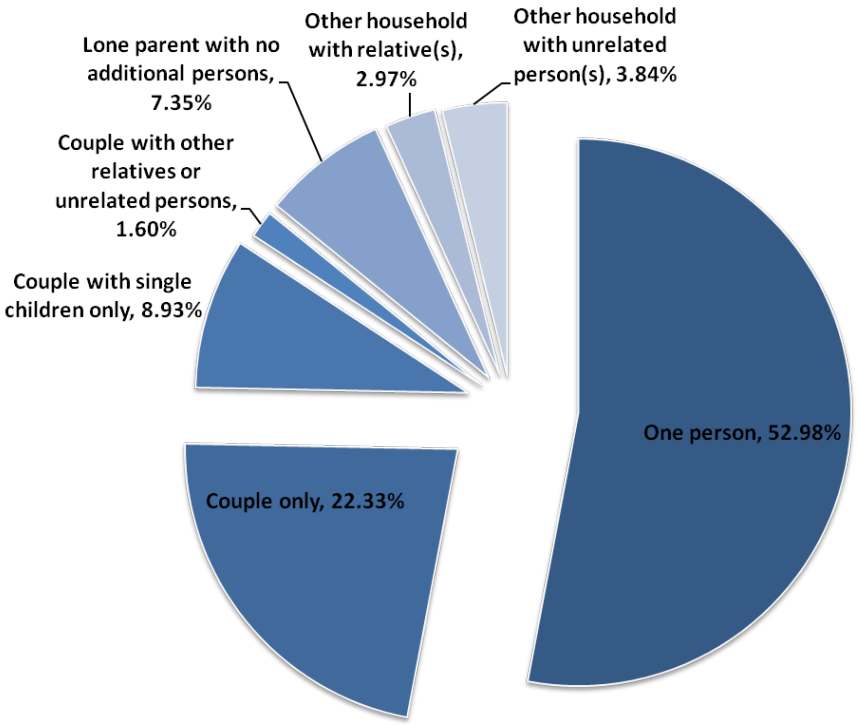
Figure 4: Urban vs. rural breakdown by province (two lowest quintiles)



Source: Statistics Canada. 2010. Survey of household spending, 2008. Ottawa, Canada. Income Statistics Division.

The real differences between these two income quintiles and the top three is in characteristics such as household size/type and level of educational attainment. About half (46.54 per cent) of those in the lowest income quintiles have a high school diploma as their highest level of education. Most in the lowest two income groups are either a single- or two-person household, as shown in Figure 5.

Figure 5: Household type of the two lowest income quintiles (Provinces only)



Source: Statistics Canada. 2010. Survey of household spending, 2008. Ottawa, Canada. Income Statistics Division.

Quantifying the Impacts

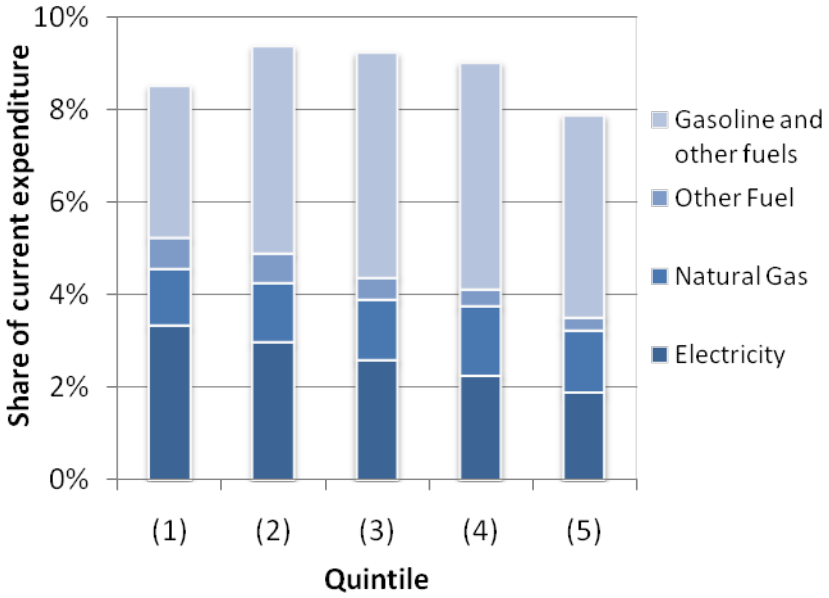
Carbon pricing disproportionately affects low-income groups because expenditures on carbon-intensive goods make up a larger share of their expenses (see Figure 6 – where column one represents the lowest income group and five the highest). The low-income cut-off point is considered to be when a household spends more than 70 per cent of its income on essentials (i.e. food, shelter, and clothing). Canadian households spend about six per cent on average of their total expenditures on fossil fuels, with the lowest quintile spending five per cent, the middle class about seven per cent, and the wealthiest also five per cent.[29]

Low-income households also tend to borrow more on a proportional basis, so their expenditures can exceed their income. Therefore, looking at expenditures can sometimes understate the actual distributional impact on low-income groups. Figure 7 shows the share of income spent on fossil fuels by quintile, from lowest to highest. It clearly shows

[29] Rivers, Nic. January 2011. "Distributional impacts of climate change policy in Canada". Working Paper.

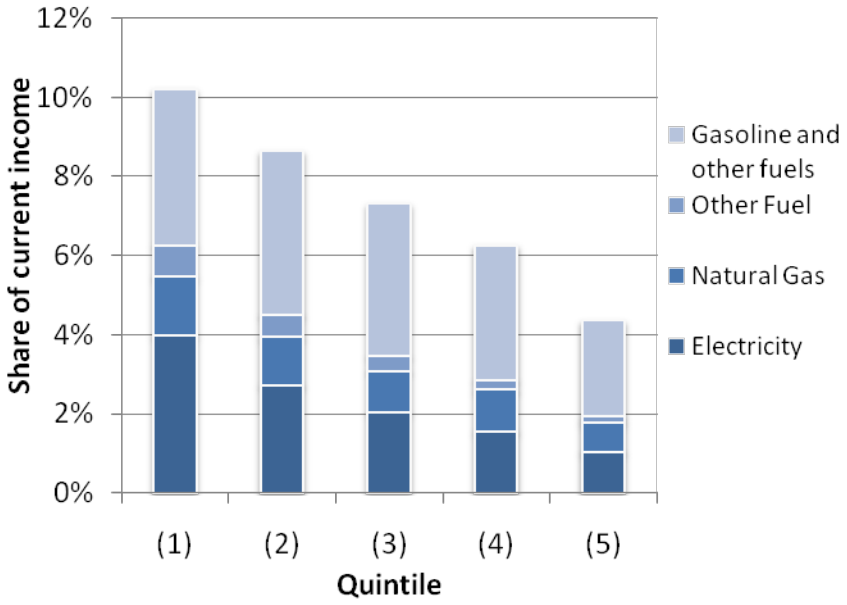
that low-income groups spent a lot more of their income on fossil fuels (more than 10 per cent for the lowest quintile) versus higher income groups (just over four per cent for the highest quintile).

Figure 6: Share of expenditures on fossil fuels by quintile



Source: Rivers, Nic. January 2011. "Distributional impacts of climate change policy in Canada". Working Paper.

Figure 7: Share of income spent on fossil fuels by quintile



Source: Rivers, Nic. January 2011. "Distributional impacts of climate change policy in Canada". Working Paper.

Low-income groups also have less ability to substitute low-carbon alternatives, and tend to have different carbon-spending patterns than higher-income groups. For example, they may spend proportionally more on home heating (perhaps because their homes are less energy efficient), but less on motor fuels because they have a lower rate of vehicle ownership.[30] Table 3 shows spending on vehicle operation by income quintile. Rural households are more heavily affected than those in urban areas, as they tend to have higher energy expenditures.[31] In addition to overall higher spending on fossil fuels, low-income groups may consume a greater amount of higher carbon-content fuels (e.g. coal) than high-income groups.[32]

Table 3: Spending on vehicle operation by income quintile (2007) – households with actual spending only

	Poorest 20%	Second 20%	Middle 20%	Fourth 20%	Richest 20%
Vehicle Operation	$2,434	$3,725	$5,054	$6,229	$8,131
Percentage of households	58%	85%	95%	97%	98%

Source: Kerstetter, Steve. September 2009. "The Affordability Gap: Spending differences between Canada's rich and poor". Canadian Centre for Policy Alternatives. Page 10. Available at: http://www.policyalternatives.ca/sites/default/files/uploads/publications/National_Office_Pubs/2009/Spending_Patterns_Low_Incomes.pdf

There are other factors besides income that may also make certain groups, such as women, Aboriginal peoples or others living in remote communities, more vulnerable to negative welfare impacts arising from carbon pricing. For example, rural and remote communities are often more dependent on fossil fuels (e.g. for travelling large distances, and often for electricity from diesel generators), with less flexibility to make substitutions (e.g. lack of public transit or electricity grid). The uneven impact of carbon pricing on different groups or communities can, without proper policy design, make carbon pricing's costs unfairly and unevenly distributed. Policy makers should be concerned about the fairness of carbon pricing, if only because the perception of unequal and unfair distributive effects will reduce political support.

[30] Speck, Stefan. 1999. "Energy and carbon taxes and their distributional implications". Energy Policy 27 (1999) 659-667.
[31] Rivers, Nic. January 2011. "Distributional impacts of climate change policy in Canada". Working Paper.
[32] Callana, Tim, Lyons, Seán, Scott, Susan, Tol, Richard S.J. and Verde, Stefano. July 2008. "The Distributional Implications of a Carbon Tax in Ireland". Economic and Social Research Institute Working Paper.

Academic literature on the regressivity of carbon pricing

Canada

Although Canada has yet to implement a carbon price at the national level, there was research conducted as early as 1994 on the distributional effects of a carbon tax. It found the tax to be moderately regressive; decreasing consumable income by about 1.2 per cent for the lowest-income group.[33]

More recently, research has been conducted by Rivers (as cited elsewhere), and researchers in British Columbia to examine the impacts of the provincial carbon tax, which was found to be regressive after 2011.[34] For the BC carbon tax to remain progressive, the low-income tax credit must be grown.[35]

British Columbia's Carbon Tax

British Columbia implemented a carbon tax in 2008. The tax itself is regressive, but "revenue neutral," as the impacts are offset by tax cuts to personal and corporate income taxes, and a Low Income Climate Action Tax Credit.[36] This "recycling" of the carbon tax's revenues has helped reduce its regressivity.[37]

International

The literature shows that, in developed countries (e.g. Denmark, Ireland, UK, US, etc.), a carbon price is regressive, unless complementary policies are introduced to reduce the impacts of the policy on low-income groups. The impacts are more regressive when calculated on a per-capita, rather than a household, basis.[38] The main driver of regressivity is the consumption and spending patterns of various income/expenditure groups.[39] In developing countries (e.g. China, Indonesia), research has shown a carbon tax to be progressive, owing to differences in carbon-intensity between urban and rural spending patterns.[40] That is, richer, urban dwellers' lifestyles are far more carbon-intensive than those of the rural population. Spending patterns in developing countries generally differ from those of developed countries; for example, there is less car ownership and less fuel used for heating (in warmer climates).[41] Rural populations are more likely to be employed in less energy- and capital-intensive sectors, such as agriculture.[42]

[33] Hamilton, Kirk (World Bank) and Cameron, Grant (Statistics Canada). 1994. "Simulating the Distributional Impacts of a Canadian Carbon Tax". Canadian Public Policy XX:4: 385-399.
[34] Lee, Marc and Sanger, Toby. October 2008. "Is BC's Carbon Tax Fair? An Impact Analysis for Different Income Levels". Canadian Centre for Policy Alternatives (BC Office). Page 5.
[35] Ibid.
[36] Ibid
[37] Ibid.
[38] Grainger, Corbett A. and Kolstad, Charles D. August 2009. "Who pays a price on carbon?" National Bureau of Economic Research Working Paper.
[39] Ibid.
[40] Brenner, Mark, Riddle, Matthew and Boyce, James K. June 2005. "A Chinese Sky Trust? Distributional Impacts of Carbon Charges and Revenue Recycling in China". University of Massachusetts.
[41] Ibid.
[42] Yusuf, Arief Anshory. 2008. "The Distributional Impact of Environmental Policy: The Case of Carbon Tax and Energy Pricing Reform in Indonesia". Economy and Environment Program for Southeast Asia.

The effect on low-income groups is less pronounced when expenditures, rather than income, are used as the basis for analysis (as Figures 6 and 7 showed). Those with low incomes tend to consume more of their income during the course of a year than those with high incomes, making a carbon price appear more regressive if measured based on annual income.[43] Low-income groups may include students, the temporarily unemployed, retirees and others with higher lifetime incomes. Current expenditures can used as a proxy for lifetime income if consumption is relatively smooth over the course of a lifetime (assuming people make spending decisions based on expected lifetime income), though this may understate the policy's regressivity by two to three times versus using annual expenditures.[44] Regressivity may also be understated due to differences in household size. Wealthier households tend to be larger than low-income households; which inflates the relative income of the poorer households.[45]

Gasoline Taxes and Regressivity

While a carbon price has been implemented in several jurisdictions, gasoline taxes are more widespread, so they provide an interesting point of comparison. Gasoline taxes are regressive, unless revenue is recycled via lump-sum payments.[46] Gasoline, carbon and other environmental taxes are inherently regressive; they can be made less regressive, or even progressive, depending on how the revenues are used.

Limitations

Although these studies provide a useful approximation of reality, they have limits that should be understood when interpreting results.

The type of economic model used (income-output, econometric or computable general equilibrium) has an impact on the proximity of the results to reality. Most previous studies used an income-output model, which has several limitations. Firstly, these studies generally do not try to estimate the flip side: for example the welfare gains in terms of improved human health and other factors, meaning that only costs and not benefits are considered.[47] Many studies are not dynamic, in that they don't reflect behavioural responses (i.e. consuming less of higher priced carbon-intensive goods).[48] They also often assume that all additional carbon costs are passed on to consumers, which is unlikely to be the case.

[43] Fullerton, Don. August 2008. "Distributional Effects of Environmental and Energy Policy: An Introduction". National Bureau of Economic Research Working Paper.
[44] Grainger, Corbett A. and Kolstad, Charles D. August 2009. "Who pays a price on carbon?" National Bureau of Economic Research Working Paper.
[45] Ibid.
[46] West, Sarah E. and Williams, Roberton C. III. 2004. "Estimates from a consumer demand system: implications for the incidence of environmental taxes". Journal of Environmental Economics and Management 47 (2004) 535–558.
[47] Fullerton, Don. August 2008. "Distributional Effects of Environmental and Energy Policy: An Introduction". National Bureau of Economic Research Working Paper.
[48] Rausch, Sebastian, Metcalf, Gilbert E., Reilly, John M. and Paltsev, Sergey. 2010. "Distributional Implications of Alternative U.S. Greenhouse Gas Control Measures," The B.E. Journal of Economic Analysis & Policy: Vol. 10: Iss. 2 (Symposium), Article 1. Available at: http://www.bepress.com/bejeap/vol10/iss2/art1.

Rivers provides a useful guide to the literature in terms of type of model used and the associated findings in Table 4. The incorporation of more dynamic features in the computable general equilibrium (CGE) suggests that the studies that use it produce results more likely to closely approximate reality, though like all models, it still has limitations. As shown in Table 5 below, the studies using the CGE tend to find carbon pricing to be less regressive than those using less dynamic models.

Table 4: Summary of literature findings on distributional impacts of environmental policies

Study	Finding
Input output model with consumer expenditure survey	
[Metcalf, 1999]; package of various environmental taxes in US	Absolute incidence: regressive; Differential incidence: neutral or progressive
[Brenner et al., 2007]; carbon tax in China	Absolute incidence: progressive; Differential incidence: highly progressive
[Dinan and Rogers, 2002]; carbon tax in US	Absolute incidence: regressive; Differential incidence: potentially progressive
[Hamilton and Cameron, 1994]; carbon tax in Canada	Absolute incidence 'moderately regressive'
[Callan et al., 2009]; carbon tax in Ireland	Absolute incidence: regressive; Differential incidence: neutral
[Lee and Sanger, 2008]; carbon tax in BC	Absolute incidence: mildly regressive; Differential incidence: potentially progressive
Econometric estimation of consumer demand system	
[Tiezzi, 2005]; carbon tax in Italy	Absolute incidence: progressive
[West and Williams, 2004]; gasoline tax in US	Absolute incidence: regressive; Differential incidence: potentially progressive (with lump sum distribution)
[West and Williams, 2004]; carbon tax in Australia	Absolute incidence: regressive
Computable general equilibrium model	
[Parry, 2004]; various environmental policies in US electricity (partial equilibrium model)	Differential incidence: highly regressive (with grandfathered permits) or mildly regressive (with lump-sum allocation to households)
[Heerden et al., 2006]; carbon tax in South Africa	Differential incidence: progressive
[Araar et al., 2008]; carbon policies in Canada (CGE model with stochastic dominance analysis)	Differential analysis: mildly regressive
[Oladosu and Rose, 2007]; carbon tax in Susquehanna River Basin	Absolute incidence: slightly progressive; Differential incidence: highly progressive (with lump-sum permits allocation to households)

Source: Rivers, Nic. October 2010. "Distributional incidence of climate change policy in Canada". Sustainable Prosperity.

How Governments Can Lessen the Regressive Impacts of Climate Policy on Vulnerable Populations

Carbon pricing, either through a carbon tax or cap-and-trade system, can generate substantial revenues for governments. Research suggests that the distributional effects of carbon pricing are determined by how governments choose to allocate revenues.[49] Table 5[50] shows the estimates that have been made for Canadian carbon revenues at the national level.

Table 5: Estimates of carbon price revenue by 2020 (2009)

Organization	Estimated annual revenue by 2020
National Roundtable for the Environment and Economy (NRTEE)	$53 billion[51] [52]
David Suzuki Foundation and the Pembina Institute	$45.5 billion[53]
David Suzuki Foundation	$50 billion[54]

Source: Various; see footnotes

Since its inception in 2008, BC's carbon tax has raised $848 million, which is projected to exceed one billion dollars annually by fiscal 2012-13.[55] Quebec's carbon tax, though more modest than BC's, still accounts for $200 million annually in public revenue.[56]

Quebec's Carbon Tax

On October 1, 2007, Quebec introduced a carbon tax for large energy users of hydrocarbons (petroleum, natural gas and coal). The tax is set at a rate of $0.8/L of gasoline and $0.9/L of diesel. The revenue will be used for projects that help the province reduce its GHG emissions, such as public transit.

The substantial revenue potentially generated by a carbon pricing policy creates a number of policy options for governments to consider, and revenue can be divided so that several

[49] Rivers, Nic. January 2011. "Distributional impacts of climate change policy in Canada". Working Paper.
[50] Sustainable Prosperity. December 2010. "Carbon Pricing, Climate Change, and Fiscal Sustainability in Canada". Available online at: http://sustainableprosperity.ca/article586
[51] NRTEE. 2009. "Achieving 2050: A Carbon Pricing Policy for Canada (Advisory Note)." Available online at: http://www.nrtee-trnee.com/eng/publications/carbon-pricing/carbon-pricing-advisory-note/carbon-pricing-advisory-note-eng.pdf.
[52] Note NRTEE published this estimate of revenue discounted to a present value at a rate of eight per cent or roughly $18 billion per year by 2020. The estimate quoted here represents the author's calculation of the *undiscounted* figure, to facilitate comparison with other estimates.
[53] Pembina Institute and David Suzuki Foundation. 2009. "Climate Leadership, Economic Prosperity." Available online at: http://pubs.pembina.org/reports/climate-leadership-report-en.pdf.
[54] David Suzuki Foundation. 2008. "Pricing Carbon: Saving Green." Available online at: http://www.davidsuzuki.org/publications/downloads/2008/Pricing_Carbon_saving_green_eng.pdf.
[55] Government of British Columbia. n.d. "Tax Cuts Funded by the Carbon Tax." Available online at: http://www.fin.gov.bc.ca/tbs/tp/climate/A2.htm.
[56] CBC News - Montreal. June 7, 2007. "Quebec to collect nation's 1st carbon tax." Available online at: http://www.cbc.ca/canada/montreal/story/2007/06/07/carbon-tax.html.

options are implemented simultaneously. The following uses of revenue have been proposed in various jurisdictions that are currently, or are considering, pricing carbon: [57]

- **Revenue recycling** - Governments have the option to use revenues generated by a carbon pricing policy to recycle the revenues through a number of measures. The one most preferred by economists is to use the revenues to reduce other taxes. This policy is widely understood to be the most economically effective one, in that it reduces taxes that are considered growth-retarding relative to a consumption-based tax or fee (which describes a carbon price). The ability to use carbon-based revenues to actually decrease taxes on corporate and personal income also makes this policy option a particularly attractive one, from a political perspective. Moreover, as recent research has shown, this use also allows for design options that would address regional concerns over distributional impacts of a carbon-pricing policy.[58]
- **Deficit reduction** - Generating general government revenues which can be used to reduce the deficit and borrowing needs, thereby reducing the tax burden on future generations. A number of U.S. states participating in the Regional Greenhouse Gas Initiative (RGGI) have already taken proceeds from the auctioning of emission allowances for use in general government revenues. Also, the U.K. government recently announced, as part of its austerity measures, that it would be "clawing back" the carbon levy that corporations have been paying as part of their Carbon Reduction Commitments[59] (the expected proceeds for government will be GBP 1 billion annually).
- **Public investment**: Increased fiscal space provided by a carbon pricing policy would allow governments to increase their investments in public goods relating to mitigation of climate change (e.g. by providing R&D incentives or investing in a "smart grid," building retrofits or public transit) and adaptation. These kinds of investments, of course, would need to be weighed against the investment incentive provided by a carbon price itself. But the two factors arguing in favour of such investment would be: (1) the very nature of public-good type investments, where private investment will not happen, or not happen in the absence of some degree of public investment; and (2) the small incentive created by the low carbon price that would likely characterize any carbon pricing policy in its early stages (to ensure political and business community acceptance), would not be large enough to catalyze much investment on its own.
- **Addressing distributional issues:** Because carbon pricing, and its effect on energy prices, is likely to be regressive, governments could choose to allocate some of the carbon policy revenues to help offset that effect.
- **Reducing Poverty:** Government could also put carbon revenue towards a more significant poverty-reduction program. Poverty can exacerbate environmental issues (and vice-versa); for example, low-income groups may be more dependent on natural resources, and more prone to over-harvesting to help meet basic needs.

[57] Ellerman, Denny. November 2009. "Allocation in Air Emissions Markets." Center for Energy and Environmental Policy Research.
[58] Peters, Jotham, Bataille, Chris, Rivers, Nic and Jaccard, Mark. November 2010. "Taxing Emissions, Not Income: How to Moderate the Regional Impact of Federal Environment Policy." C.D. Howe Institute, Available online at: http://www.cdhowe.org/pdf/Commentary_314.pdf.
[59] For more details, see the UK Department of Energy and Climate Change: http://www.decc.gov.uk/en/content/cms/what_we_do/lc_uk/crc/crc.aspx

Poverty Reduction

Carbon revenues have the potential to provide governments with a large new source of revenue. Research has identified the "poverty gap," i.e. the amount of money it would take to raise the incomes of low-income groups above Statistic Canada's after-tax low-income cut-off (LICO). At least some carbon revenues can be directed towards filling the $5.7 billion poverty gap that exists in Canada. In Canada, more than three million people are living below LICO.[60] Though there are other ways to reduce poverty, such as tax cuts, these are of limited value to low-income groups, some of whom do not pay income taxes.

The carbon tax shift proposed by the Liberal Party during the 2008 federal election proposed to target a portion of carbon revenues towards poverty reduction. The specific measures included job retraining, cuts in personal income taxes for low-income families, income supplements for low-income workers and pensioners, and tax credits for families and rural residents.[61]

There is a vast literature on the social benefits of reducing poverty, such as better health outcomes. Although a fulsome discussion of these benefits is outside the scope of this paper, it should be emphasized that these greater societal, as well as individual, benefits increase the merits of using at least some portion of carbon revenues towards poverty alleviation.

Recent research by Rivers suggests that using carbon revenues to reduce social inequality will cost 1.2 per cent of gross domestic product (GDP) to reduce the Gini index (a measure of inequality)[62] by one per cent.[63]

When deciding among options (or combination of options), there are a variety of factors for governments to consider, including environmental effectiveness, economic efficiency, distributional impacts (equity), and administrative and political feasibility.[64] Perhaps the strongest argument in favour of using at least some portion of carbon revenues to reduce distributional issues is that it is necessary to sustain long-term political support of carbon pricing. This option would also increase the fairness of the policy, which is an oft-cited concern of policy makers. Vulnerable groups should not be made to disproportionately bear the costs of a policy. Just as governments consider the competitiveness and carbon leakage impacts of carbon pricing on sectors of the economy, households, particularly those with low incomes, need support in adjusting to a carbon price. Poverty reduction is another worthy use of carbon revenue as significant progress can be made with a relatively small investment, and in addition to individual benefit, there are many wider societal advantages of alleviating poverty.

[60] Yalnizyan, Armine. August 2010. "The problem of poverty post-recessions". Canadian Centre for Policy Alternatives. Page 3.Available at: http://www.policyalternatives.ca/sites/default/files/uploads/publications/reports/docs/Poverty%20Post%20Recession.pdf
[61] Liberal Party of Canada. 2008. "The Green Shift: Building a Canadian Economy for the 21st Century."
[62] A frequently used measure of income distribution is the Gini coefficient. This parameter can take on values between 0 and 100, with 0 indicating that wealth is evenly distributed throughout the population, such that each individual holds an identical share of total wealth, and 100 indicating that a single individual holds all wealth.
[63] Rivers, Nic. 2011. "Distributional incidence of climate change policy in Canada". Working paper.
[64] For a thorough discussion of these criteria, see NRTEE, *Achieving 2050: A Carbon Pricing Policy for Canada (Technical Report)*, 2009. Available online at: http://www.nrtee-trnee.com/eng/publications/carbon-pricing/carbon-pricing-tech/carbon-pricing-tech-backgrounder-eng.pdf.

Reducing Impacts on Vulnerable Populations

Policy options

Table 6 shows a summary of the major existing income-support programs in Canada. Any option that refunds carbon revenue back to Canadians will have to examine the income-support programs already in place, so they can be leveraged for efficient delivery. Beneficiaries of the existing programs must apply (at least once if not every year), and most benefits are made by cheque or direct deposit. There are a variety of options that governments could implement to increase the fairness and progressivity of a carbon price, by building off these existing programs, which are shown in table 7. The tax reform and income support policy instruments, in terms of lump sum payments and refundable tax credits or tax cuts, can also be employed to distribute carbon revenue to low-income groups as part of a poverty reduction program.

Table 6: Major existing income support programs in Canada (national level)

Program	Eligibility	Delivery
Seniors		
Old Age Security and Guaranteed Income Supplement	Canadians over 65 (with various residency categories). Those who earn less than $38,112 per year will receive the Guaranteed Income Supplement.	Paid by cheque or direct deposit at the end of each month.
Canada Pension Plan	Canadians 65 years old or between 60 and 64 years old who earn less than $934.17 per month.	Paid by cheque or direct deposit at the end of each month.
Working Families		
Canada Child Tax Benefit	Families with children under age 18.	Paid by cheque or direct deposit on the 20th day of each month.
Working Income Tax Benefit	Low-income individuals and families who are already in the workforce. Net income must be below $16,770 (single) or $25,854 (families).	Paid by cheque or direct deposit in instalments on fixed dates four times per year (5th day of each quarter).
Universal Child Care Benefit	Families already receiving the Canada Child Tax Benefit will automatically receive the Universal Child Care Benefit. Families get a payment for each child under the age of six to help cover the cost of child care.	Paid by cheque or direct deposit of $100 monthly payment on the 20th day of each month (taxable).
GST/HST credit	Canadians 19 years of age or older, have (or previously had) a spouse or common-law partner, or be (or previously was) a parent and live (or previously lived) with their child. Net income must be below $40,126 (single, no child) or $42,506 (couple, no child). Higher cut offs for singles and families with children.	Must apply every year. Paid by cheque or direct deposit in January, April, July and October (generally the fifth day of the month).

Source: Service Canada (www.servicecanada.gc.ca) and Canada revenue Agency (http://www.cra-arc.gc.ca)

Table 7: Options available to government to reduce the regressivity of carbon prices

Category	Option	Pros	Cons
Tax Reform	• Reduce distortionary taxes (i.e. payroll, income and corporate).	• Economists tend to view this as the most economically efficient option.	• Doesn't reduce regressivity (i.e. doesn't fully offset price increases).[65] • Increases the level of inequality in society.[66]
	• Tax credit (refundable or not).	• Relatively easy to administer and deliver. • Has been used successfully in jurisdictions with a carbon tax (e.g. BC).	• Forgoes opportunity to reduce distortionary taxes.
Income support	• Provide a lump sum carbon rebate.	• Preserves the incentive to reduce emissions.[67] • Found to be the most effective approach to reducing regressivity.[68] • Increases the level of equality in society.[69]	• Forgoes opportunity to reduce distortionary taxes.
Subsidies	• Fund building energy efficiency improvements.[70] • Transitional assistance for those working in affected sectors.[71] • Subsidized public transit.[72]	• Funds are targeted to address specific issues, including structural issues such as lack of access to public transit in city suburbs.	• Forgoes opportunity to reduce distortionary taxes. • Doesn't reduce regressivity (i.e. doesn't fully offset price increases).
Other assistance	• Help lines[73] • Education		

Source: Various, see footnotes

Researchers have modeled the different options available to governments looking to offset the regressivity of carbon pricing. In the Canadian context, Rivers found that lump sum

[65] Blonz, Joshua, Burtraw, Dallas and Walls, Margaret A. September 2010. "Climate Policy's Uncertain Outcomes for Households: The Role of Complex Allocation Schemes in Cap and Trade". Resources for The Future.
[66] Rivers, Nic. 2011. "Distributional incidence of climate change policy in Canada". Working paper.
[67] Callana, Tim, Lyons, Seán, Scott, Susan, Tol, Richard S.J. and Verde, Stefano. July 2008. "The Distributional Implications of a Carbon Tax in Ireland". Economic and Social Research Institute Working Paper.
[68] Blonz, Joshua, Burtraw, Dallas and Walls, Margaret A. September 2010. "Climate Policy's Uncertain Outcomes for Households: The Role of Complex Allocation Schemes in Cap and Trade". Resources for The Future.
[69] Rivers, Nic. 2011. "Distributional incidence of climate change policy in Canada". Working paper.
[70] Feng, Kuishuang, Hubacek, Klaus, Guan, Dabo, Contestabile, Monica, Minx, Jan and Barrett, John. 2010. "Distributional Effects of Climate Change Taxation: The Case of the UK". Environ. Sci. Technol. 2010, 44, 3670–3676.
[71] Brenner, Mark, Riddle, Matthew and Boyce, James K. June 2005. "A Chinese Sky Trust? Distributional Impacts of Carbon Charges and Revenue Recycling in China". University of Massachusetts.
[72] Bräannlund, Runar and Nordström, Jonas. 2004. "Carbon tax simulations using a household demand model". European Economic Review 48 (2004) 211 – 233.
[73] Callana, Tim, Lyons, Seán, Scott, Susan, Tol, Richard S.J. and Verde, Stefano. July 2008. "The Distributional Implications of a Carbon Tax in Ireland". Economic and Social Research Institute Working Paper.

payments, versus reductions in personal income taxes, are more effective in mitigating the regressive impacts of a carbon pricing policy.[74]

European countries have used at least some of their carbon tax revenues to reduce personal income taxes, which has shown to be ineffective in reducing the tax's regressivity. Denmark implemented a CO_2 tax in 1992/1993, with separate schemes for industry and households. Low-income households are compensated through lowered income taxes and supplemental child-support payments.[75] This approach has not reduced the tax's regressivity, though other options to increase the tax's progressivity have not been explored because their cost is seen to be too high.[76] Sweden, which introduced its carbon tax in 1991, reduced income taxes to attempt to reduce the tax's regressivity, though data shows that it has not been effective in doing so.[77] It also introduced a public transit subsidy, which decreased the price of transit by almost 30 per cent.[78] The Netherlands, which undertook a series of energy tax reforms between 1988 and 2002, has used the revenues raised from these taxes to lower personal income taxes, and subsidize household energy-efficiency investments. [79]

When choosing options, policy makers must consider how the targeted recipients already interact with the government. Participation rates in existing government income-support programs or tax credits can demonstrate the delivery mechanism with the highest potential uptake rate. For example, tax cuts do not benefit low-income groups because they pay little in income taxes.[80] But tax credits can offer an income-support solution even to those not paying taxes.

The redistribution option chosen also has an impact on regional distributional impacts. The C.D. Howe Institute recently looked at the regional impacts of the choice of carbon revenue redistribution method. It found that when the revenue is used to cut federal business and personal income taxes, there is a transfer of income from Alberta and Saskatchewan to the rest of Canada, but no transfers occur when revenues are used to cut provincial income taxes.[81]

Design considerations

Policy makers must pay careful attention to design issues and unintended consequences, even after they have selected what seems to be the appropriate instrument. Policy-makers

[74] Rivers, Nic. 2011. "Distributional incidence of climate change policy in Canada". Working paper.
[75] Wier, Mette, Birr-Pedersen, Katja, Klinge, Jacobsen, Henrik and Klok, Jacob. 2005. "Are CO_2 taxes regressive? Evidence from the Danish experience". Ecological Economics 52 (2005) 239– 251.
[76] Ibid.
[77] Miller, John. 2010. "Levelling the Carbon Playing Field: A Ralwsian Take on Carbon Taxation and Climate Justice." Indiana University Bloomington. Working Paper.
[78] Bräannlund, Runar and Nordström, Jonas. 2004. "Carbon tax simulations using a household demand model". European Economic Review 48 (2004) 211 – 233.
[79] Vollebergh, Herman R.J. 2008. "Lessons from the polder: Energy tax design in The Netherlands from a climate change perspective". Ecological Economics 64 (2008): 660-672.
[80] Rivers, Nic. 2011. "Distributional incidence of climate change policy in Canada". Working paper.
[81] Peters, Jotham, Bataille, Chris, Rivers, Nic and Jaccard, Mark. November 2010. "Taxing Emissions, Not Income: How to Moderate the Regional Impact of Federal Environment Policy". C.D. Howe Institute Commentary.

must consider the issues highlighted in Table 8 in order to ensure the policy option chosen has the intended effect.

Table 8: Design issues to consider

Consideration	Options	Implications
Eligibility	Determined by income and/or participation in existing government income support programs.	Eligibility can be based on income being below a certain threshold, and/or recipients can be automatically enrolled if they participate in another existing income support program. If eligibility is based on income, then recipients will have to apply in order to receive the benefit. The government wants the highest possible participation rates, so needs to figure out the best way to ensure those eligible can receive their payments.
Calculation of payment	Fixed lump sum or percentage of income	Must decide whether the refund is the same for everyone or differentiated by income. Income can fluctuate from year to year.
Timing of payment	Lump sum or instalments	Low-income groups may require the payment each month for expenses as opposed to the end of the year or quarterly.
Geography	Rural or urban differentiation	Rural households are generally more carbon-intensive than urban ones (and have lesser access to alternatives); however, unless the government distinguishes between them, compensation for rural households could be unequal.[82]
Size of household	Payment sized according to household size	Household size will have an impact on how far the refund will go towards offsetting increased carbon costs. Larger households in low-income groups will need more support.
Identification of beneficiaries	Differentiation within the low income group	Compensation should be focused on those in the low- income group who have less chance of increasing their incomes over the long run (i.e. not those with temporary low incomes such as students).[83]

Source: Various; see footnotes

Implementation considerations

While considering adopting a carbon pricing policy, policy makers should consider consulting low-income and other vulnerable communities early in the development process. This direct engagement will enable policy makers to better understand the concerns of these communities, and enable them to design more effective policies that minimize the negative impacts on these groups.[84]

[82] Callana, Tim, Lyons, Seán, Scott, Susan, Tol, Richard S.J. and Verde, Stefano. July 2008. "The Distributional Implications of a Carbon Tax in Ireland". Economic and Social Research Institute Working Paper.
[83] Wier, Mette, Birr-Pedersen, Katja, Klinge, Jacobsen, Henrik and Klok, Jacob. 2005. "Are CO_2 taxes regressive? Evidence from the Danish experience". Ecological Economics 52 (2005) 239– 251.
[84] Sustainable Prosperity. Forthcoming 2011. "Fairness and Carbon Pricing".

Conclusion

Canadian policy-makers should regard carbon pricing as the best option to achieve significant carbon emissions reductions while setting Canada on the path towards a low-carbon economy. At the same time, careful policy design is necessary to ensure that vulnerable populations are not disproportionately affected by such a policy.

There are trade-offs between equality and economic efficiency when it comes to choosing how to allocate revenues from a carbon price. The fact is that the most economically efficient policies tend to exacerbate income inequality.[85] It is government's responsibility to ensure the fairness and equality of its policies, suggesting that at least a portion of carbon revenues should be directed towards reducing the negative financial impacts of the policy on low-income and vulnerable groups. And, if real poverty reduction is an objective of government, future carbon revenues potentially offer a source of revenue to provide low-income Canadians additional income support.

[85] Rivers, Nic. 2011. "Distributional incidence of climate change policy in Canada". Working paper.

Glossary

Carbon Allowance, Credit or Permit[86]
Any tradable certificate or permit representing the right to emit one tonne of carbon or carbon dioxide equivalent (tCO_2e).

Income Quintiles[87]
A method to measure the average (mean) household income of residents, ranking them from poorest to wealthiest, and then grouping them into five income quintiles (one being poorest and five being wealthiest), each quintile containing approximately 20 per cent of the population. The income quintile measure is derived from Statistics Canada Census data by aggregating household income to the dissemination area (note: As of 2001 Census data, dissemination area replaces enumeration area as a basic unit for dissemination) and then ranking neighbourhoods by income quintile. Income quintiles are available for both urban and rural populations. Income quintiles are often used as a proxy measure of socio-economic status.

Progressive[88]
A progressive tax is a tax by which the tax rate increases as the taxable base amount increases. Progressive taxes attempt to reduce the tax incidence of people with a lower ability to pay, as they shift the incidence increasingly to those with a higher ability to pay.

Regressive[89]
"Regressive" describes a distribution effect on income or expenditure, referring to the way the rate progresses from high to low, where the average tax rate exceeds the marginal tax rate. In terms of individual income and wealth, a regressive tax imposes a greater burden (relative to resources) on the poor than on the rich — there is an inverse relationship between the tax rate and the taxpayer's ability to pay as measured by assets, consumption, or income.

[86] Wikipedia. See: http://en.wikipedia.org/wiki/Carbon_credit
[87] University of Manitoba. 2007. "Glossary: Income Quintiles". See: http://mchp-appserv.cpe.umanitoba.ca/viewDefinition.php?definitionID=102882
[88] Wikipedia. See: http://en.wikipedia.org/wiki/Progressive_tax
[89] Wikipedia. See: http://en.wikipedia.org/wiki/Regressive_tax