

УДК 338.2

**Политика ценообразования на выбросы углерода:
Конкретное изучение налога на углеродосодержащие выбросы
в Британской Колумбии**

Петропавлова Е.И.

epetropa@sfu.ca

Университет Саймон Фрейзер (Бёрнеби, Британская Колумбия, Канада),

Петропавлова Г.П., petropavlova@mail.ru

Санкт-Петербургский государственный
университет низкотемпературных и пищевых технологий

В Британской Колумбии налоговая политика в области углеродосодержащих выбросов играет очень важную роль при рассмотрении последствий климатических изменений, так как она стимулирует общественное движение и способствует росту понимания общественностью важности снижения концентраций парникового эффекта в атмосфере путем «расплаты» за выбросы.

Ключевые слова: выбросы тепличных газов, налог на углеродосодержащие выбросы, изменение климата, воздействие на окружающую среду, экономическая эффективность, возможность управления, политическая осуществимость, справедливость (налогового обложения).

**Carbon Pricing Policy: A Case Study of British Columbia's
Carbon Tax**

Petropavlova E.I., epetropa@sfu.ca

Simon Fraser University (Burnaby, British Columbia, Canada),

Petropavlova G.P., petropavlova@mail.ru

Saint-Petersburg State University of Refrigeration & Food Engineering

British Columbia's carbon tax policy plays a critical role in addressing climate change effects, as it encourages a social movement and develops a public under-

standing of the importance to reduce GHG concentrations in the atmosphere by 'paying the price' on emissions.

Keywords: greenhouse gas emissions; carbon tax; climate change; environmental effectiveness, economic efficiency, administrative feasibility, political feasibility, equity.

The 2007 report of the Intergovernmental Panel on Climate Change (IPCC) states that the world's average temperature rises abnormally due to human activities, particularly combustion of fossil fuels and changes in land use. These activities cause higher concentration of greenhouse gases in the atmosphere and can lead to various severe effects on the earth if no action is undertaken (IPCC, 2007(b)). Several regions of the province of British Columbia (B.C.) have already been warming at a rate more than twice the global average rate, primarily due to their location in the northern hemisphere (B.C. Government, 2008(c)). On July 1st, 2008 the B.C. government introduced a carbon tax policy in response to the dangerous effects of climate change.

Increases in global temperatures are primarily caused by combustion of fossil fuels and changes in land use, all of which produce greater amounts of greenhouse gases (GHGs), particularly, carbon dioxide, methane, and nitrous oxide (IPCC, 2007(b)). Over the past 150 years, the atmospheric concentrations of carbon dioxide grew from fairly constant 280 parts per million (ppm) to more than 380 ppm (IPCC, 2007(b)). Our current concentrations of carbon dioxide within the atmosphere represent the highest record for the last 650,000 years (IPCC, 2007(b)). In other words, climate change is obvious and has the potential to dramatically change the life on the earth.

The Climate Action Plan, implemented in British Columbia in 2008, states that the province could be exposed to the greatest dramatic effects of climate change due to its location in the northern hemisphere (B.C. Government, 2008(c)). Numerous regions of B.C. have already been warming at a rate more than twice the world's average rate (B.C. Government, 2008(c)). The current effects of climate change in B.C.

include the following: water shortages, growing pressure on fisheries and forestry, increasing risk of reduced resources and land losses, higher insurance and adaptation costs, and significant potential for economic and social shifts (B.C. Government, 2008(c)). The Lower Mainland has the greatest concentration of GHGs in B.C. because of the considerable traffic congestion and the widest usage of natural gas per household for heating in the province (B.C. Government, 2008(c)). The Climate Action Plan exemplifies the B.C. government's recognition of the need to mitigate severe impacts of global warming by providing a set of wide-range climate actions which are necessary to "make the province more efficient, competitive, and productive while reducing greenhouse gases" (CBC News, 2008). The plan is designed to achieve earlier legislated commitments of the Greenhouse Gas Reduction Targets Act (B.C. Government, 2008(c)). The Act aimed to reduce the province's greenhouse gas emissions by 33% by 2020 and by at least 80% by 2050 relative to 2007 levels, as well as to turn B.C.'s public sector to carbon neutral levels in 2010 (B.C. Government, 2007). One of the most important components of the Climate Action Plan is putting a price on carbon through revenue-neutral carbon tax (B.C. Government, 2008(c)). This part of the plan was implemented on July 1st, 2008 when the B.C. government introduced the first of its kind in North America, and the world's first broad-based revenue-neutral tax on greenhouse emissions from combustion of fossil fuels. This action of the provincial government is in line with the IPCC's suggestion in the 4th Assessment - Synthesis Report, which states that "an effective carbon-price signal could realize significant mitigation potential in all sectors" (IPCC, 2007(a), p. 18).

The Ministry of Finance of B.C. (2010(e)) defines carbon tax as "a tax based on greenhouse gas emissions generated from burning fossil fuels". Carbon tax is imposed on the purchase and use of fossil fuels in the province of British Columbia and is not applied to the purchase of goods (e.g. vehicles) that generate carbon emissions (Ministry of Finance, 2010(c)). Individuals and businesses that use fossil fuels for transportation, heating and cooling of buildings, and industrial processes are required to pay the carbon tax (B.C. Government, 2008(c)). Carbon tax represents a price sig-

nal that should lead to lower emissions through a market response in the provincial economy (Ministry of Finance, 2010(e)). The implementation of the carbon tax in B.C. is meant to offer an incentive to individuals and businesses to decrease their emissions by minimizing fuel consumption, improving fuel efficiency, and utilizing environmentally friendly technologies and fuels (Ministry of Finance, 2010(e)).

Five fundamental principles determine the B.C.'s carbon tax design (B.C. Government, 2008(c)). The first principle is revenue-neutrality, which implies that all revenues obtained from the carbon tax are recycled in the provincial economy through tax reductions (B.C. Government, 2008(c)). For the purpose of accountability, the government of B.C. is legally bound to compose and publish an annual public plan, which explains how all carbon tax revenues are reimbursed to taxpayers through reductions in personal and business taxes (i.e. low-income tax credit, personal income taxes, general corporate income tax, and small business corporate income tax) (Ministry of Finance, 2010(d)). According to the B.C. Budget and Fiscal Plan published in 2010, carbon tax revenues for 2008/2009 and 2009/2010 were \$848 million, which is slightly lower than original planned estimates. However, more than \$1,042 million were returned to taxpayers through tax cuts, hence, residents of British Columbia earned over \$194 million due to the introduction of the revenue-neutral carbon tax (Ministry of Finance, 2010(d)). Presently, British Columbians, who earn up to \$118,000 per year, have the lowest provincial income tax rates in Canada (Ministry of Finance, 2010(d)). Corporate income tax in B.C. has been already cut by almost 40%, and small business corporate income tax is expected to be reduced to zero by 2012 (Ministry of Environment, 2010). The Budget and Fiscal Plan for 2010/2011 to 2012/2013 illustrates that tax reductions are expected to exceed carbon tax revenues every year from 2010 to 2013, which signifies that British Columbians will have very competitive tax rates in Canada (Ministry of Finance, 2010(a)). It is also planned that the province of British Columbia will have one of the lowest corporate taxes among G7 countries by 2012 (Ministry of Environment, 2010). These tax cuts are intended to provide various benefits in the province, in particular, to increase personal savings,

create more jobs, attract investment in the economy of B.C., and improve the province's position among its trading partners (Ministry of Finance, 2010(d)). Carbon tax revenues are not used for funding of governmental projects, including any emissions reduction programs (B.C. Government, 2008(c)).

The second principle that underlies the carbon tax design in B.C. is the broadest possible coverage (given existing data, technological, and measurement limitations) of the tax (B.C. Government, 2008(c)). The B.C.'s carbon tax is applied to all fossil fuel emissions listed in Environment Canada's National Inventory Report (i.e. from the purchase and use of gasoline, diesel, propane, coal, natural gas, tires if used as fuel, and others) excluding only those emissions that are not from burning fossil fuels (B.C. Government, 2008(c)). Therefore, the carbon tax covers 77% of total GHG emissions in B.C.; the remaining 23% of unaddressed emissions are from non-energy agricultural uses and waste (10%), fugitive currently immeasurable emissions (9%), and non-combustion industrial process emissions (4%) (Ministry of Finance, 2010(c)). B.C.'s Carbon Tax Act (Chapter 40) provides a full list of fuel types and combustibles that are subject to the carbon tax (Schedule 1 and Schedule 2 of tax rates) and categorizes all possible exemptions from payment of tax and security (i.e. for fuel in certain types of containers, feedstock, non-energy uses of fuel, interjurisdictional passenger and cargo flights, interjurisdictional air services flights, cruise ships, non-coasting trade, visiting forces, and security exemption) (B.C. Government, 2008(a)).

The third principle of the operational mechanism of B.C.'s carbon tax is a low initial tax rate of \$10 per tonne of carbon emissions in 2008, which rises gradually by \$5 a year and reaches \$30 in 2012, until the proposed tax rates are scheduled (B.C. Government, 2008(c)). The low initial tax rate, and the five year phase-in approach of rate increases, will provide individuals, families, and businesses with the time and opportunity to alter (reduce) their fuel consumption, and to make effective decisions about their future purchasing behavior (B.C. Government, 2008(c)). Therefore, gradual rises in the carbon tax rates introduce certainty and transparency of price signals

on carbon emissions for individuals and businesses (Climate Action for the 21st Century, 2010). Due to the fact that different fossil fuels emit various amounts of greenhouse gases in combustion processes, the Carbon Tax Act (Chapter 40) translates tax rates per tonne of carbon dioxide equivalent to the tax rates for each type of fuel and other combustibles per unit of tax (e.g. cent/litre, cent/cubic metre, dollar/tonne) in each of the five years of the tax schedule (B.C. Government, 2008(a)). Table 1 provides an example of selected carbon tax rates by fuel type for the period from 2008 to 2010.

Table 1 demonstrates that, for example, at a current tax rate of \$20 per tonne of CO₂ (effective July 1st, 2010) the carbon tax rate for a litre of gasoline is 4.45¢, while the rate for a litre of propane is 3.08 ¢. In 2012 the tax rate for gasoline will be 6.67¢/L, and the rate for propane will be 4.62 ¢/L. The rate for gasoline on a per litre basis is lower than the rate for diesel or jet fuel because of the lower carbon content of gasoline relative to diesel or jet fuel (Ministry of Finance, 2010(b)). Consequently, different carbon concentrations in different types of fuel determine the rate of the carbon tax.

Table 1. Selected carbon tax rates by fuel type from 2008 to 2010
(B.C. Government, 2008(a))

Type of fuel	Rate of tax for the year starting July 1, 2008	Rate of tax for the period starting July 1, 2009 and ending Dec 31, 2009	Rate of tax for the period starting Jan 1, 2010 and ending June 30, 2010	Rate of tax for the year starting July 1, 2010	Rate of tax for the year starting July 1, 2011	Rate of tax for the year starting July 1, 2012
Gasoline	2.34 ¢/L	3.51 ¢/L	3.33 ¢/L	4.45 ¢/L	5.56 ¢/L	6.67 ¢/L
Light Fuel Oil (Diesel)	2.69 ¢/L	4.04 ¢/L	3.84 ¢/L	5.11 ¢/L	6.39 ¢/L	7.67 ¢/L
Jet Fuel	2.61 ¢/L	3.92 ¢/L	3.92 ¢/L	5.22 ¢/L	6.53 ¢/L	7.83 ¢/L
Propane	1.54 ¢/L	2.31 ¢/L	2.31 ¢/L	3.08 ¢/L	3.85 ¢/L	4.62 ¢/L
Natural Gas	1.90 ¢/m ³	2.85 ¢/m ³	2.85 ¢/m ³	3.80 ¢/m ³	4.75 ¢/m ³	5.70 ¢/m ³
High Heat Value Coal	20.77 \$/tonne	31.16 \$/tonne	31.16 \$/tonne	41.54 \$/tonne	51.93 \$/tonne	62.31 \$/tonne
Low Heat Value Coal	17.77 \$/tonne	26.66 \$/tonne	26.66 \$/tonne	35.54 \$/tonne	44.43 \$/tonne	53.31 \$/tonne

The fourth principle, upon which the B.C.'s carbon tax is based, calls for the protection of low-income individuals and families through a refundable low-income climate action tax credit which indicates a compensation for the tax, and is adjusted

based on provincial inflation (B.C. Government, 2008(c)). This low-income climate action tax credit represents one of the significant elements of the individual and business income tax reductions provided as part of the revenue neutrality principle of the carbon tax (Ministry of Finance, 2010 (d)). Residents of British Columbia, whose incomes are less than \$30,722 for individuals, and \$35,843 for families, receive a quarterly climate action tax credit of \$115.50 for each adult, and \$34.50 for each child on a regular basis along with the B.C. HST credit (Ministry of Environment, 2010). For this purpose, the government of B.C. claims that most low-income British Columbians are better off after the implementation of the carbon tax (B.C. Government, 2008(c)). Moreover, all B.C. residents were given a one-time \$100 Climate Action Dividend in June 2008 before the carbon tax came into force. This dividend was distributed to British Columbians to aid them in implementing lifestyle changes related to the consumption of fossil fuels (Ministry of Small Business and Revenue, 2008).

The final principle of the carbon tax states that while being one of the major components in meeting B.C.'s emissions reduction targets, the tax is not designed to reach these targets on its own, thus, it will be integrated with other climate actions and measures (B.C. Government, 2008(c)). For the purpose of equity, and avoidance of double taxation, the carbon tax is designed to complement any future provincial and regional cap and trade schemes (e.g. B.C. will participate in cap and trade system as part of the Western Climate Initiative starting in January 2012) or national carbon pricing systems (Ministry of Environment, 2010).

Due to the fact that carbon tax is a consumption tax, which is payable by all individuals, businesses, and visitors to B.C. at the time of retail purchase, or use of fossil fuels in the province, mechanisms of the tax collection and remittance are very similar to those of the existing Motor Fuel Tax Act (Ministry of Small Business and Revenue, 2008). This allows for simpler administration procedures; in particular, the carbon tax is imposed and collected at the wholesale level in an almost identical way that motor fuel taxes are imposed and collected today in the province (natural gas tax is the only exception as it is collected at the retail level) (Ministry of Finance,

2010(b)). Figure 1 demonstrates an administrative procedure for the collection of security and tax on sales of fossil fuels.

According to Figure 1, fuel sellers, who are collectors, receive security from deputy collectors or wholesalers on fuel sales to them, equal to the tax payable on the final retail sale to consumers (B.C. Government, 2008(a)). Collectors must remit this security to the government on or before the 15th day of each month after the reporting period in which the fuel is first sold in B.C (B.C. Government, 2008(b)). Deputy collectors (wholesalers) are reimbursed for the amount they pay to collectors by receiving security from the retail dealers equal to the tax payable on the final retail sale to consumers (B.C. Government, 2008(a)). Retailers, in turn, collect the carbon tax on direct retail sales of fuel to consumers (B.C. Government, 2008(a)). This mechanism of security and tax collection helps to decrease the number of companies that are required to file a tax return and remit security to the government (Ministry of Small Business and Revenue, 2008).

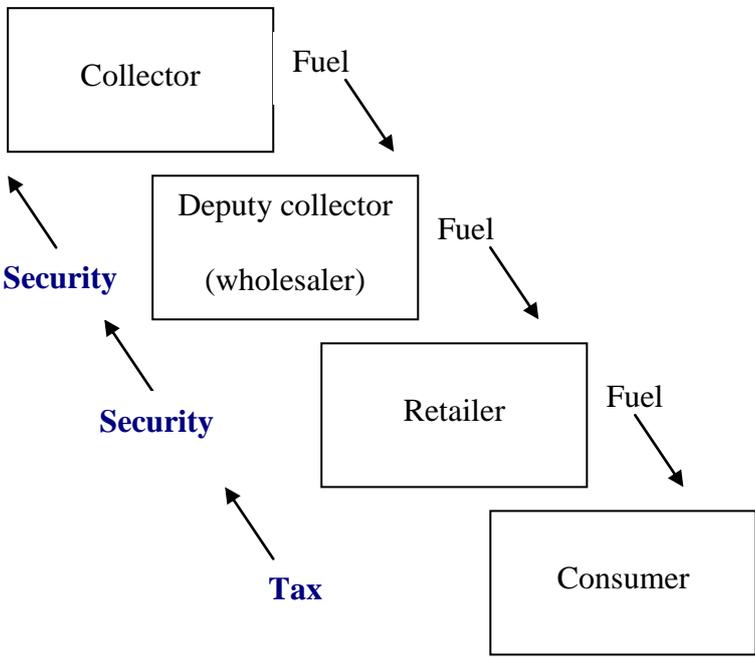


Figure 1. Mechanism of collection of security and carbon tax on fuel sales (simplified version from Ministry of Small Business and Revenue, 2008)

Other administrative procedures, such as refunds, inspections and audits, assessments of tax or security, penalties for non-remitting tax and security, refunds, appeals, recovery of amounts owing, and offences, have very similar nature to the provisions outlined in the Motor Fuel Tax Act, and managed with less administrative costs (Ministry of Small Business and Revenue, 2008).

Although the B.C.'s carbon tax was introduced only two years ago and no comprehensive and definite estimates have been made to assess the impacts of the policy, the preliminary results suggest that the carbon tax has not caused any harm to the provincial economy, and provided positive expectations about future environmental effects (Elgie et al., 2010).

In regards to the economic benefits, in 2009, economic growth in the province was greater than Canada's total economic growth (Elgie et al., 2010). However, carbon tax policy benefits for the entire economy of B.C. were insignificant due to the fact that low-income climate action tax credits and income tax cuts exceeded obtained carbon tax revenues for 2008 and 2009 in total (Elgie et al., 2010). Despite the negligible nature of economic benefits, B.C. stays competitive with other jurisdictions, attracts new investment, and keeps its unemployment rates below Canada's national average (Ministry of Finance, 2010(c)).

Due to the fact that the current rates of the carbon tax are still relatively low and few studies have been conducted to identify the B.C.'s emissions reductions since the tax implementation, it is difficult to assess by how much GHG emissions have been lowered in the province. However, environmental results of the carbon tax policy are anticipated to be optimistic according to several estimates (Elgie et al., 2010). An independent consulting company, MK Jaccard and Associates, believes that the B.C.'s carbon tax on its own, without any other greenhouse gas reduction policies and actions, can lead to emissions reductions in 2020 by up to three million tonnes of carbon dioxide equivalent annually (B.C. Government, 2008(c)). This amount of GHG emissions is produced by approximately 787,000 cars per year (B.C. Government, 2008(c)). There are many examples of how the carbon tax has already provided an

incentive for individuals and organizations to alter their fuel consumption behavior. For instance, with the new carbon tax policy, UBC has a \$42-million incentive to decrease its consumption of fossil fuels (Ministry of Environment, 2010). UBC has begun replacing its natural gas boilers with new energy efficient ones which will reduce UBC's fossil fuel consumption and energy costs, while lowering GHG emissions by 58,000 tonnes per year (Ministry of Environment, 2010).

In order to assess the carbon tax policy in British Columbia, the following criteria are used: environmental effectiveness, economic efficiency, administrative feasibility, political feasibility, and equity (Jaccard, 2006).

At present, it is difficult to evaluate accurately the environmental effectiveness of the carbon tax in B.C. because of the lack of emissions reduction data (i.e. Environment Canada has not released greenhouse gas emissions data for 2009). The major issue with B.C.'s carbon tax, as with any other emissions tax, is uncertainty about the aggregate GHG emissions quantity that will be determined by the market response to the tax. However, it is expected that even if B.C.'s carbon tax does not grow higher than its 2012 rate of \$30 per tonne of CO₂, B.C.'s greenhouse gas emissions will be reduced by more than eight percent to achieve the required reductions of 33 percent below 2007 levels by 2020 (Pembina Institute, 2008). This implies that the carbon tax has a significant potential to reduce GHG emissions if its rate continues to grow annually after 2012. Substantial environmental improvements can be achieved if the carbon tax policy is combined with other emissions reduction tools (e.g. future cap and trade scheme, technology standards). At the present time, it can be assumed that the carbon tax has not altered GHG emissions dramatically due to its low initial rates. Additionally, the environmental effectiveness of the B.C.'s carbon tax is limited by the existing distributional mechanism of tax revenues. In particular, carbon tax revenues are 100% recycled or returned to taxpayers in the form of income tax reductions and are not redirected to fund any fuel efficient and low-carbon technologies, carbon capture and storage projects, or fuel efficiency research. Moreover, B.C.'s carbon tax covers only 77% of total GHG emissions in the province and does not apply to GHG

emissions from non-combustion sources (e.g. CO₂ vented from natural gas processing facilities, organic wastes in landfills, methane leaking from pipelines) (Horne et al., 2010). The Pembina Institute claims it is possible to measure most of the emissions from non-combustion sources, and that the carbon tax should be imposed on these sources (Horne et al., 2010). Therefore, it can be concluded that current environmental effectiveness of the carbon tax policy is minimal.

B.C.'s carbon tax, as an emissions tax, is paid by individuals and businesses based on the amount of GHG emissions they produce when purchasing and using a particular fuel. Thus, established tax-rate on carbon emissions provides certainty about economic benefits, and the carbon tax can be considered as *economically efficient*. The B.C. government does not require companies and individuals to use any specific fuel efficient technologies, alter fuel consumption behavior in a particular way, nor restrict activities that generate GHG emissions. In theory, according to the equi-marginal principle, the total cost to society of obtaining an environmental improvement is minimized if each individual or business behaves rationally (i.e. in its own self-interests) by decreasing emissions only to the point where any additional emissions reductions are more expensive than paying the tax (Jaccard, 2006). For this purpose, the Climate Action Plan states that the carbon tax policy provides an incentive to use fuel efficient technologies and reduce fuel consumption (B.C. Government, 2008(c)). However, it is necessary to understand that it is difficult to change the latter, consumption habits, with the carbon tax. For instance, driving habits cannot be altered significantly due to the fact that the demand for gasoline or diesel is relatively inelastic; thus, the low price increase caused by the carbon tax does not generally affect fuel consumption. Nevertheless, the major problem is not in the availability of fossil fuels, hence, not in the necessity to reduce our fuel consumption. GHG emissions are the main aspect addressed by B.C.'s carbon tax, and they can be reduced by switching to fuels with lower carbon content, more efficient vehicles and technologies, implementing carbon capture and storage, even if individuals and businesses continue to use the same or greater amounts of fuel and energy. As outlined in the

Climate Action Plan, the main idea of starting with the low tax rate and gradually increasing it is to provide a price signal, and offer time for individuals and industries to switch to low carbon fuels and fuel efficient technologies (B.C. Government, 2008(c)). The economic efficiency of B.C.'s carbon tax can also be justified by the fact that the revenue-recycling mechanism (i.e. income tax reductions) provides an opportunity to augment economy-wide factor supplies, such as labour or capital supplies. This is known as the first order efficiency gain of the revenue-recycling effect (Goulder et al., 2008). In particular, B.C. taxpayers have already received over \$200 million worth of net income tax reductions, which accounts for the increase in the economy-wide factor supplies (Ministry of Finance, 2010(d)). This increase should create new jobs and attract investments in the economy of B.C. Finally, in order to evaluate the economic efficiency of the carbon tax policy more accurately, it is necessary to address the carbon leakage effect of the carbon tax policy in B.C. This effect refers to the influence of B.C.'s carbon tax policy on the emissions in other countries (e.g. United States) and sectors that are not subject to the same carbon tax policy (Barker et al., 2007). It is essential to investigate whether the carbon leakage effect exists in B.C. (i.e. whether B.C. businesses choose to re-allocate their industrial facilities to non-regulated provinces and countries to reduce compliance costs), and how it may influence industrial competitiveness and economic growth in the province.

The administrative feasibility of B.C.'s carbon tax policy can be defined as high. As it was previously described, administrative procedures of the carbon tax collection and remittance, as well as refunds, inspections and audits, assessments of tax or security, penalties for failure to remit tax or security, and others, mirror the provisions presented in the Motor Fuel Tax Act (Ministry of Small Business and Revenue, 2008). Additionally, the number of businesses filing the carbon tax return is minimized because the government collects security only at the wholesale level (Ministry of Small Business and Revenue, 2008). Based on this evidence, administrative costs to the government, as well as compliance costs to the companies that collect the car-

bon tax on behalf of the government, can be considered as minimal. However, administrative feasibility of the carbon tax policy can be challenged when new information on either greater or lower GHG emissions data is released, and the tax rates need to be altered according to the new data. In this case, adjustment of the carbon tax rate in the legislation may take some time and may require extra costs.

Emissions taxes usually perform poorly against the criterion of *political feasibility* (Jaccard, 2006). B.C.'s carbon tax represents an interesting case; it was introduced aggressively without requiring and addressing public opinion and by abolishing political debates (Peltier, 2008). B.C.'s government implemented the tax unilaterally by the majority party (Peltier, 2008). Results of an Angus Reid Strategies poll, which was conducted quickly after the implementation of the tax, revealed that the public was evenly divided on Premier Gordon Campbell's scheme of taxing consumers for the purchase and use of fossil fuels, expressing a very high interest in an alternative proposal of the New Democratic Party of Canada (NDP) to tax polluters at the source (Skelton, 2008). In particular, 82% of participants of the poll believed that a system where the polluter pays the principle should be implemented by the government (Skelton, 2008). Therefore, while the majority of people preferred taxing big industrial producers, 50% of the poll's participants actually supported Campbell's carbon tax (Skelton, 2008). It can be assumed that the other 50% of respondents perceived the carbon tax with suspicion, due to information gaps (i.e. lack of information/clarity) regarding the principles of the carbon tax policy. Therefore, public acceptance and political feasibility were not as big of an issue as one might have predicted.

Equity concerns are addressed by providing ongoing quarterly side compensations to low-income individuals and families (i.e. low-income climate action tax credits). Initially in 2008, when the carbon tax was newly implemented, low-income households were given about one-third of the revenues from the carbon tax recycling, and the rest of the revenues were assigned to individual and corporate income tax reductions (Ministry of Finance, 2010(a)). Thus, individuals and families with low-

incomes were better off, as low-income tax credits were greater than the carbon tax paid (Lee, 2010). Unfortunately, in 2009, the 50% rise in the carbon tax rate (i.e. from \$10 to \$15 per tonne of CO₂) eliminated the gain, as the low-income tax credit scarcely grew from \$100 to \$105 per adult (Ministry of Finance, 2010(a)). This year, the increase in low-income tax credits relative to the increase in the carbon tax rate, is disproportionate, meaning that the bottom 40% of households in the low-income category will experience an annual loss of \$30 (Lee, 2010). In other words, since 2010, low-income individuals and families started to lose the adequate protection promised by the government in the Climate Action Plan. It is also critical to consider how financially difficult it may be for low-income households, compared to wealthier households, to switch to more efficient technologies and low-carbon fuels (especially for heating), in terms of the required capital investment. In regards to the distribution of revenues in the form of income tax cuts between individuals and businesses, the picture has also changed from the early implementation of the carbon tax. In 2008, individuals received roughly two-thirds of the carbon tax refunds, with the remainder third of the refund allocated to businesses (Ministry of Finance, 2010(a)). In 2010, it is planned that personal income tax cuts will account for \$211 million, while corporate income tax cuts will equal \$412 million, which is more than half of the planned \$796 million of carbon tax revenues (Ministry of Finance, 2010(a)). Consequently, businesses are much better off than individuals in 2010, although the carbon tax is ultimately passed on to the consumers. Moreover, this year businesses receive a significant part of the carbon tax revenues in addition to future savings from the Harmonized Sales Tax (HST). Individuals, in turn, will experience lower carbon tax refunds and are required to incur the extra cost of the HST. Furthermore, it is unknown how fairly/equitably the carbon tax is received by businesses. In a paper by Lee (2008), he stressed that companies can pass the cost of carbon tax to consumers in the form of increased prices, to employees in the form of lower wages, or can hide the costs in lower profits. Therefore, the distribution of carbon tax revenues between individuals, businesses, and low-income households should be balanced effectively so that the in-

creasing carbon tax rates do not severely impact different stakeholders. Finally, there is concern regarding the inequitable application of the carbon tax to industrial emitters. For example, industrial producers that currently emit non-combustion GHGs that are not covered by the carbon tax policy are not subjected to the tax.

Overall, the carbon tax policy appears to be promising in terms of the potential for emissions reductions, efficient in regards to economic benefits in B.C., and feasible in terms of the ease and costs of administrative procedures. Distributional impacts are one of the major concerns that should be acknowledged in the design of carbon tax policy.

Based on the analysis provided for the carbon tax policy in B.C., it is possible to conclude that the carbon tax facilitates an important social movement that involves raising public awareness of the importance for reducing greenhouse gases in the atmosphere. Additionally, B.C.'s carbon tax may establish a new psychological habit of paying for public 'bads', such as pollution.

Conclusion

Climate change is an obvious problem and British Columbia has been already experiencing its detrimental effects, including water shortages, increasing risks of natural resource and land losses, and growing insurance and adaptation costs (B.C. Government, 2008(c)). The B.C. government recognizes the need to mitigate the dangerous consequences of climate change by undertaking different climate actions. One of these actions is the carbon tax policy that was introduced in B.C. in July of 2008. The carbon tax is applied to the purchase and use of fossil fuels in the province and represents a price signal that is expected to motivate individuals and businesses to lower their emissions by switching to low-carbon fuels, employing more efficient technologies, and changing fuel consumption behaviors. B.C.'s carbon tax is based on the principles of revenue neutrality, broad coverage, low initial and gradually rising rates, protection of low-income families, and ease of integration with other cli-

mate action tools. Administration of the carbon tax is simplified due to the fact that collection and remittance procedures of the carbon tax are similar to the provisions of the existing Motor Fuel Tax Act. The carbon tax policy is promising with regards to its potential to reduce emissions, efficient in terms of economic benefits, and feasible in terms of administrative procedures. However, the policy faces some equity concerns, such as imbalanced distribution of the carbon tax compensations between individuals, businesses, and low-income households, as well as incomprehensive coverage of GHG emissions. Nevertheless, B.C.'s carbon tax policy plays a critical role in addressing climate change effects, as it encourages a social movement and develops a public understanding of the importance to reduce GHG concentrations in the atmosphere by 'paying the price' on emissions.

In order to achieve significant reductions of greenhouse gas emissions, it is important to continue utilizing the carbon tax after 2012, and it is vital to eliminate existing weaknesses of the carbon tax policy.

References

1. Barker, T., Bashmakov, I. (2007) *11.7.2 Carbon leakage. In (book chapter): Mitigation from a cross-sectoral perspective. In (book): Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (B. Metz et al. Eds.), Cambridge, U.K., and New York, N.Y., U.S.A: Cambridge University Press.
2. B.C. Government, (2007). *Greenhouse Gas Reduction Targets Act [SBC 2007] Chapter 42*, Victoria: B.C. Government Publications.
3. B.C. Government, (2008(a)). *Carbon Tax Act [SBC 2008] Chapter 40*, Victoria: B.C. Government Publications.
4. B.C. Government, (2008(b)). *Carbon Tax Act. Carbon Tax Regulation [includes amendments up to B.C. Reg. 106/2010, July 1, 2010]*, Victoria: B.C. Government Publications.

5. B.C. Government, (2008(c)). *Climate Action Plan*, Victoria: B.C. Government Publications.
6. CBC News (2008) *B.C. premier unveils fine print of climate action plan*, [Online], Available: <http://www.cbc.ca/canada/british-columbia/story/2008/06/26/bc-climate-action-plan.html> [7 Dec 2010].
7. Elgie, S., Rivers, N., and Olewiler, N. (2010) 'B.C.'s carbon tax is looking like a winner', *The Ottawa Citizen*, 27 July, p. 11.
8. Goulder, L. Parry, I. (2008) 'Instrument Choice in Environmental Policy', *Resources for the Future*, April, pp. 1-30.
9. Horne, M., MacNab J. (2010) 'Putting a Price on Climate Pollution', *The Pembina Institute Publications*, October, pp. 1-4.
10. IPCC (2007(a)) *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. *IPCC, Geneva, Switzerland*, 104 pp.
11. IPCC (2007(b)) *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. *Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA*, 996 pp.
12. Jaccard, M. (2006) *Sustainable Fossil Fuels. The Unusual Suspect in the Quest for Clean and Enduring Energy*, New York: Cambridge University Press.
13. Lee, M. (2008) *Who pays the carbon tax?*, [Online], Available: <http://www.progressive-economics.ca/2008/02/21/who-pays-the-carbon-tax/> [3 Dec 2010].
14. Lee, M. (2010) *BC's carbon tax turns two*, [Online], Available: <http://www.policynote.ca/bcs-carbon-tax-turns-two/> [3 Dec 2010].

- 15.Los, F. (2010) *Pembina's ideas for improving B.C.'s carbon tax*, [Online], Available:
- 16.http://thegreenpages.ca/portal/bc/2010/01/pembinas_ideas_for_improving_b.html [4 Dec 2010].
- 17.Ministry of Environment, (2010). *Climate Action for the 21st Century*, Victoria: B.C. Government Publications.
- 18.Ministry of Finance, (2010(a)). *Budget and Fiscal Plan 2010/2011-2012/2013*, Victoria: B.C. Government Publications.
- 19.Ministry of Finance (2010(b)) *How the Carbon Tax Works*, [Online], Available: <http://www.fin.gov.bc.ca/tbs/tp/climate/A4.htm> [5 Dec 2010].
- 20.Ministry of Finance (2010(c)) *Myths and Facts about the Carbon Tax*, [Online], Available: <http://www.fin.gov.bc.ca/tbs/tp/climate/A6.htm> [5 Dec 2010].
- 21.Ministry of Finance (2010(d)) *Tax Cuts Funded by the Carbon Tax*, [Online], Available: <http://www.fin.gov.bc.ca/tbs/tp/climate/A2.htm> [5 Dec 2010].
- 22.Ministry of Finance (2010(e)) *What is a Carbon Tax?*, [Online], Available: <http://www.fin.gov.bc.ca/tbs/tp/climate/A1.htm> [5 Dec 2010].
- 23.Ministry of Small Business and Revenue, (2008). *British Columbia Carbon Tax: Notice*, Victoria: B.C. Government Publications.
- 24.Peltier, R. (2008) 'Oh Canada! B.C. ratifies North America's first carbon tax', *Power*, vol. 152 (8), August, pp. 76-78.
- 25.Pembina Institute (2008) 'Reality Check: The B.C. Carbon Tax: Myths and Realities', *The Pembina Institute Publications*, June, pp. 1-5.
- 26.Skelton, C. (2008) 'B.C. prefers NDP's Carbon tax plan', *The Vancouver Sun*, June, p.1.