IMPLEMENTING THE WESTERN CLIMATE INITIATIVE: A DEEPER LOOK AT THE SHORT-TERM IMPACTS IN BC

by

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Abstract

The Western Climate Initiative cap and trade mechanism is an important piece of British Columbia's plan to reduce greenhouse gas emissions by 33% from 2007 levels by 2020, but it may impose a significant burden on certain industries of the economy. I follow a two-step analysis to first, better understand the impact of the cap over the short-term and to second, identify what options are available to the government to reduce the costs of transitioning without compromising environmental goals.

I found that a number of industries covered by the cap are emissions intensive and trade exposed, and are vulnerable to emissions pricing schemes. While this is cause for concern, BC has the discretion to adopt specific design features within the WCI cap and trade that can smooth transition related costs. Careful design of the allocation and revenue-recycling feature can reduce distributional impacts and facilitate the transition to low-carbon.

Keywords: Climate Change, Cap and Trade, Western Climate Initiative, Adjustment Costs

Executive Summary

In 2007, British Columbia took bold steps towards addressing the province's greenhouse gas emissions when it introduced a broad suite of climate policies (the BC Climate Action Plan). The impact of the province's policies will, if successful, shift the province to a low-carbon trajectory of growth. As necessary as the process is, the process of adjusting to that trajectory imposes costs on industry and individuals.

As yet, British Columbia has not developed a comprehensive policy response to offset the total adjustment costs of the Climate Action Plan – specifically as it concerns adjustment costs for industry and labour. The carbon tax component of the Climate Action Plan includes a revenue-recycling mechanism that offsets the compliance costs of the tax, but there has been no public announcement by the government related to the impacts on BC industry and workers on the incoming Western Climate Initiative (WCI) cap and trade policy.

The apparent gap in the current analysis of the cap and trade suggests that the province may need to increase its preparation to address with the short-term costs of adjusting to the cap and trade scheme. The intent of this paper is to address the gap, identify the impacts of the cap and trade scheme over the short-term and identify what options are available to the British Columbia that can reduce the costs of transitioning without compromising environmental goals.

In exploring the nature of the short-term costs related to adjusting to cap and trade, I assess the vulnerability of the industries that will be covered by the incoming cap and trade system. I then identify the impacts of the various cap-related design features that can mitigate short-term costs and analyze specific features of the cap that the province can design to reduce the burden of transitioning. British Columbia has discretion over the how emissions permits are allocated under the system and how revenue generated from the allocation mechanism may be distributed.

The three key findings in this paper are that:

- Some industries in BC (specifically pulp and paper, coal manufacturing, mining and smelting operations, cement production) will struggle to cope with adjustment costs and are therefore vulnerable to the cap and trade regime – the outcome may be negative output and employment effects;
- Labour in those sectors will likely incur significant costs because of they are relatively immobile and that these industries tend to be concentrated in rural regions where individuals have fewer employment opportunities – particularly at comparable salary to previous employment; and
- There are a number of uncertainties over the exact nature of those costs – it is extremely difficult to quantify the impacts.

In assessing the province's options for mitigating cap and trade related adjustment costs, I found that there is no pure optimal solution for designing BC-specific cap and trade design features. The simplest and likely most effective policy is to implement a full auction. This type of policy is relatively simple to administer and provides policy-makers with the flexibility to address observed outcomes through the development of revenue-recycling options.

Administratively, 100% auctioning of permits is much simpler than any other allocation option as it avoids the need to develop mechanisms for grandfathering emissions permits, which is essentially a mechanism for transferring rents. Despite the

advantages to full auctioning, its implementation is likely to be politically contentious; however, the related contentions could likely be reduced by developing revenue-recycling responses and timing the implementation of the recycling programs to coincide with the timing of the cap.

Going forward, I identified important next steps for the province as it proceeds in developing the specifics of the WCI cap and trade mechanism. The steps include efforts to:

- Identify the quantitative impacts of the cap;
- Identify the level of assistance provided by grandfathering permits and each of the revenue-recycling options;
- Assess various auction design options; and
- Assess and understand the impacts and interactions between the WCI set design features (offset, banking and baseline levels) on adjustment costs.

It is also important to monitor the impacts of the current recession, the interaction of the cap and the carbon tax on competitiveness of BC industries, and developments in the United States respecting recent proposals for a nationwide cap and trade scheme.

Dedication

I would like to dedicate this work to my family. My Dad, who taught me to be inquisitive, my Mum, who taught me compassion, and who together, along with my brothers, have supported me along my winding journey.

I would also like to thank my new family. Sarah, my wonderful fiancée, whose support is crucial, and her parents, who have supported us both and provided us with a place to relax, recoup and rejuvenate throughout my time in the program.

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Glossary

BCBC	British Columbia Business Council
CAP	British Columbia Climate Action Plan
CUSFTA	Canada-U.S. Free Trade Agreement
EITE	Emissions Intensive Trade Exposed
EU ETS	European Union Emissions Trading Scheme
GHG	Greenhouse Gas Emissions
NAICS	North American Industry Classification Standards
RGGI	Regional Greenhouse Gas Initiative
WCI	Western Climate Initiative

1: Introduction

In 2007 British Columbia adopted a broad suite of climate policies aimed at reducing greenhouse gas (GHG) emissions. The set of BC climate policies, entitled the Climate Action Plan (CAP), includes a broad set of targeted regulations, standards and funding initiatives and emissions pricing policies (British Columbia Climate Action Plan, 2007). The core of the Climate Action Plan is comprised of two emissions pricing mechanisms – a carbon tax and a cap and trade system. The carbon tax was implemented in the summer of 2008 and covers emissions from carbon-based fuels. The cap and trade mechanism is still under development and is scheduled to be implemented on January 1, 2012. Adjusting to the conditions imposed by the CAP may be costly in certain instances, but is important if BC is to reduce its emissions to meet legislated targets[1] and contribute to the global effort to combat climate change.

As yet, British Columbia has not developed a comprehensive policy response to offset the total adjustment costs of the CAP – specifically as it concerns adjustment costs by industry and labour. The carbon tax component includes a revenue-recycling mechanism that offsets the compliance costs of the tax,[2] but there has been no public announcement by the government related to the impacts on BC industry and workers on the incoming WCI cap and trade policy.

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[1] British Columbia legislated GHG targets that require the province to reduce emissions by 33% of 2007 levels by 2020.

[2] There are arguments over the efficacy and equity of the recycling mechanism (Lee, 2008); however, further investigation of the specific impacts of the revenue-recycling mechanism is beyond the scope of this study.

1.1 Implications of adopting the WCI cap and trade

British Columbia's cap and trade framework is being developed in conjunction with the Western Climate Initiative (WCI) – a group of 7 U.S. states and 4 Canadian provinces. The specifics of the cap and trade program have yet to be defined and there are many decisions facing BC, many of which will influence the costs of complying with the program. The cap will cover emissions from industrial sources, referred to as large final emitters (LFEs)[3] and depending on the vulnerability of covered industries, there is the potential for negative output and employment effects (Babiker and Eckaus, 2008).

Under the WCI cap, LFE's will face a number of short-term costs associated with adjusting to the conditions of cap and trade frameworks. Covered entities will incur costs from: i) having to purchase emissions permits through an auction or the trading scheme; ii) investing in carbon abatement, which may require retiring capital stocks before the scheduled retirement; iii) a potential loss of competitiveness of their goods relative to goods that are produced in jurisdictions that do not face an emissions price or cap; and iv) navigating the framework and ensuring that they are in compliance with the rules of the framework, which will include the costs of monitoring emissions and paying for the expertise required to participate in the market for purchasing and trading emissions. The extent of any slowdown or drop in employment from the WCI is dependent on the characteristics of covered firms. If there is an increase in unemployment, there will be an additional layer of costs that will be incurred by workers displaced as a result of the cap. Depending upon the characteristics of the labour that is displaced, the level of worker-related costs could be significant.

[3] LFEs are yet to be defined, but the threshold is 25,0000 MT CO_2-e, above which a firm will be considered an LFE.

Going forward, it is important to identify the welfare losses associated with adopting the cap and trade framework and whether BC can effectively reduce the associated losses without impeding the goal of shifting to a lower carbon economy. In this paper, I present a comprehensive analysis of the implications of adopting the WCI cap and trade, and identify the trade-offs associated with adopting specific design features.

1.2 Characterization of the shift to low carbon

The imposition of carbon constraints is designed to shift the economy on to a low-carbon pathway. In substance, the shift to low-carbon is akin to a structural transition. This distinction is important in that it provides a historical basis for analysis, which can inform the policy response. In general, structural economic transitions are never win-win across an entire economy. They create new conditions that inevitably favour certain industries over others, but are pursued because the aggregate net benefits outweigh the costs. The challenge with transitions has been to maximize the net benefits of the transition while lessening the impacts on the 'losers'.

Evidence from historical structural transitions reveals that the public is resistant to the upheaval they cause. This is particularly evident amongst those most likely to be affected, but is shared by society at large. Workers in industries that are likely to be adversely impacted suffer from increased anxiety from wage and employment insecurity. Scheve and Slaughter (2001) showed that the willingness to pay to keep a job in America was over twice as high as the value added by the job itself. Their findings suggest that individuals place an endowment effect to employment and that they need to feel that they are being adequately compensated for losing what they have.

The job related anxiety and insecurity tied to pending transitions is well founded. In general, policies designed to effect structural economic change impose short-term adjustment costs as firms and individuals adapt to new conditions. Previous large-scale transitions burdened certain industries more than others, disrupting peoples' livelihoods (Warde, 2007).

Trade liberalization is an example of a recent structural transition. Analysis on the implementation of related policies provides evidence on the impact of structural transitions. Separate WTO and OECD studies concluded that:

1. The impacts of liberalized trade policy are unevenly distributed across an economy and that the impacts are dependent on specific characteristics of industry (Bacchatta and Jansen, 2003); and
2. The workers of industries that struggle to adjust are more likely to be displaced and bear significant adjustment costs (OECD, 2005).

Their findings suggest a need to assess the impacts of transitions at a disaggregated level. Aggregate impacts – even over the short-term – may result in net benefits, but hide the individual firm and worker costs.

In this context, transition-smoothing policies serve an important economic and political function. From an economic perspective, they compensate those working in declining industries to reduce the social and private costs of adjustment. From the political perspective, they soften opposition to the transition and galvanize support for decisions that yield net benefits over the long run.

1.3 Impact of transition to low-carbon for BC industry

The level of climate policy related adjustment costs for individuals and firms is not well understood in BC. Modeling estimates on the net costs of emissions pricing in

Canada and BC, are relatively low, even when measured at the industrial level (MKJA, 2007); however, the results do not capture short-term or distributional impacts.[4] The model used in BC is also argued by some to incorporate key assumptions that likely underestimate the economic costs of emissions pricing, particularly over the short-term (Mintz, 2009).[5] From a policy perspective, implementation of climate policy requires a complete understanding of distributional impacts and a measure of the short-term costs. Otherwise its implementation may cause significant adverse impacts to certain segments of the economy and may even endanger public support for the types of policies required to reduce GHG emissions.

1.4 Impact of the current recession

It would be inappropriate to omit the impact of the current recession, as it will impact the implementation of climate policy in a number of ways. I take the impact of the crisis into account; however, much of the data used predates the recession and does not accurately reflect current operating conditions. Despite the negative impact, the analysis is written with the assumption that the global economic situation will recover by 2012 (the intended start date for the WCI cap and trade). If the assumption turns out to be incorrect, it is likely that the adjustment costs of the cap and trade scheme on industry will be intensified, largely because industry will be unable to access the capital required to invest in reducing emissions.

[4] General equilibrium models – such as the one used in BC – are effective at portraying the long run impacts of specific policies, but they assume perfect markets and that actors can adjust instantaneously, thereby underestimating the short run costs (Canes, 2005).

[5] The modeling applied to both the Canadian and British Columbian economy do not account for endogenous price increases in capital stocks and for the impact of the adoption of climate policies in other jurisdictions.

1.5 Policy problem

There is a forward looking policy problem facing British Columbia as it goes about developing the cap and trade regime. As noted, there is a gap in the current analysis and the short-term costs of adjusting to the cap and trade scheme are not well understood, particularly as it relates to BC. The intent of this paper is to better understand the impact of the cap over the short-term and to second, identify what options are available to the government to reduce the costs of transitioning without compromising environmental goals.

In exploring the nature of the short-term costs related to adjusting to cap and trade, I assess the vulnerability of the industries that will be covered by the incoming cap and trade system. I then identify the impacts of the various cap-related design features that can mitigate short-term costs and analyze specific features of the cap that the province can design to reduce the burden of transitioning. I also look to previous structural economic transitions to assess the viability of adopting policy responses similar to what was implemented at that time.

2: Methodology

The methodology employed is a two-step process and is similar to what is being followed in Australia as their government moves to implement a nationwide cap and trade scheme. Figure 1 outlines the pathway used to ensure that the implementation of their cap does not unduly burden certain industries of the economy.

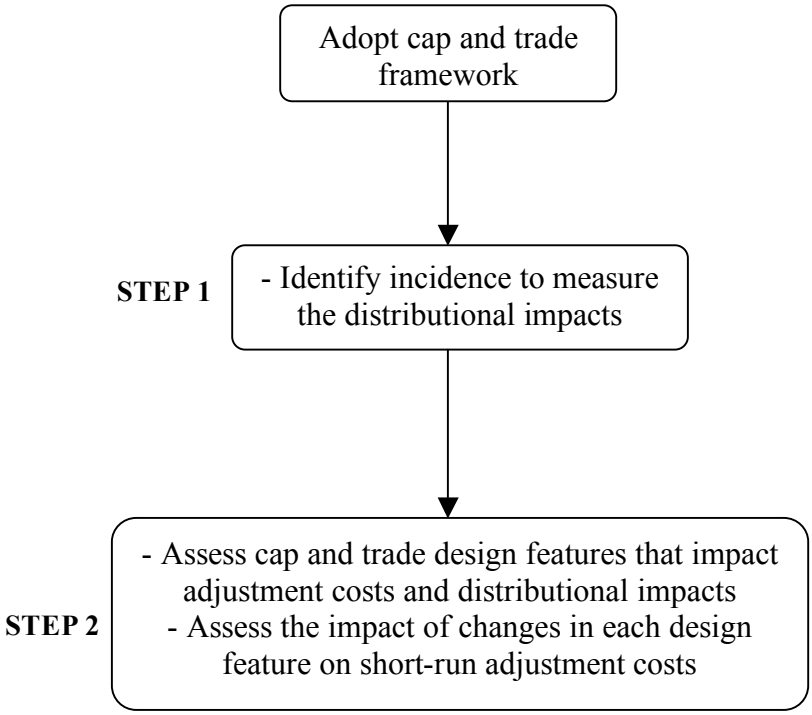

Figure 1: Decision tree used to approach the implementation of cap and trade schemes.

The first step in this analysis is to survey industries of the BC economy covered by the WCI cap and trade to determine the industrial impacts. The labour market characteristics of vulnerable industries are also analyzed to better understand the impacts on displaced workers and how rapidly vulnerable workers will be able to adapt to new conditions. The second step involves a cross-unit case analysis. Two cases present

different models of GHG cap and trade systems and two present policy responses to historical structural economic transitions. Each case provides input on how British Columbia can help mitigate the short-term adjustment impacts of the WCI cap and trade.

2.1 Rationale for selecting cap and trade cases

The two cap and trade cases are the Regional Greenhouse Gas Initiative (RGGI) and the EU Emissions Trading System (ETS). Each case incorporates different design features to address adjustment costs, but share commonalities at a higher level with each other and the proposed WCI model. Most notably they both regulate multiple, independent jurisdictions under a common framework.

2.2 Rationale for selecting structural transition cases

The implementation of the Canada-U.S. Free Trade Agreement (CUSFTA) and German reunification provide clear examples of structural economic transitions. In each case, government implemented specific policies to smooth the impact of transitioning. The Canadian reaction to the signing of the CUSFTA was relatively muted compared to the German response to reunification. Between the two responses, I am able to assess the impact of a broad range of transitional policies.

3: Measuring the vulnerability of industries in BC to cap and trade

In this chapter I look at the structure of industries of the BC economy that will be covered by the WCI cap and trade, and assess whether these industries are likely to be vulnerable to short-term adjustment costs. Industries that are vulnerable are more likely to experience negative output and employment effects, meaning that labour in those industries will bear a significant burden of adjustment.

During the first compliance phase of the WCI – beginning in 2012 and ending in 2015 – emissions from large stationary sources emitting over 25,000 tonnes CO_2-e are covered. This includes combustion at industrial and commercial facilities, industrial process emissions (incl. oil and gas process emissions) and electricity generation (incl. emissions generated from sources outside the WCI jurisdiction) (WCI, 2008).

The province is currently developing regulations regarding emissions reporting and verification to meet WCI guidelines. At the 25,000 tonne level the catchment is estimated to be 80-100 entities, though the exact list of covered entities is currently unknown (Finlayson, 2008). Without knowing the exact list, it is impossible to evaluate the precise impacts; however Environment Canada data on LFEs can be used to get a sense of the types of industries that will be covered by the cap.

Environment Canada lists entities that emit 100,000 tonnes CO_2-e or more. There are 41 such industries in BC. Of the 41 entities listed, 14 operations are gas plants or related operations (transmission, pipelines), 11 operate in the pulp and paper industry, 8

in the metals/materials industry (5 coal mining and manufacturing operations), 5 are cement or lime producers and 2 are refineries. Each of these industries is assessed in greater detail to determine their vulnerability to an emissions price. While this assessment does not analyze all entities covered by the cap, it provides insight into the types of operations that will be affected.

3.1 Economic theory on the impact of cap and trade schemes

The proposed WCI framework is a standard cap and trade scheme. Under the plan, a new type of property rights will be created. The new rights consist of the right to emit a certain amount of GHGs. If a firm cannot reduce their emissions to their allowable level or plan to expand production (leading to an increase in emissions), then that firm will have to secure additional permits through trade, purchase greater permits during auction periods or purchase offsets.

In theory, the benefit to this type of policy is that it establishes a cap on the total level of emissions and ensures that emissions will be reduced in line with the cap; however, there is a significant question over the role of offsets and whether it simply allows for a continued increase in absolute emissions. It is certainly possible that per firm emissions could increase, although the question over whether there is a net increase or decrease in emissions over the entire jurisdiction is unclear. Still, cap and trade mechanisms are, in theory, a cost-effective way to reduce emissions, as each firm covered by the cap faces the same emissions price. While the plan is cost-effective and should lead to overall reductions in emissions, there are distributional impacts that need to be considered. Each firm covered by the cap will face a different burden, as they have different market characteristics.

Firms with relatively high marginal emission abatement cost (MAC) will face a higher cost of complying with a cap and trade program than firms with a relatively low cost of abatement (*see Figure 2*). In theory, under a cap and trade framework each firm will reduce their emissions if the costs of reducing emissions are less than the price of the emissions permit. It is cost-effective because all firms, regardless of their emissions abatement costs, face the same emissions price ($X), assuming the market in permits operates efficiently (without distortions).

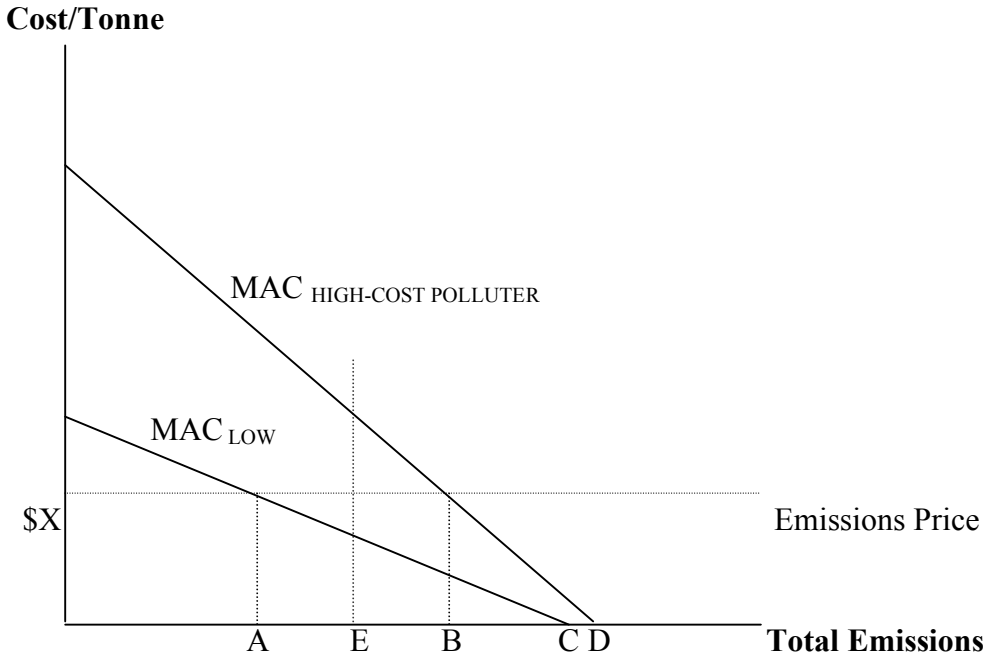

Figure 2: Impact of an emissions price on firms with different costs of abatement.

A low-cost polluter that begins with a total emissions level of 'C' will reduce emissions to point A where the marginal cost of reducing emissions (as given by the MAC_{LOW}) equals the permit price on the market ($X). The high-cost polluter will reduce emissions from point D to point B. If each firm must achieve a target of E, then the high-cost emitter will buy permits and the low-cost firm will sell its excess permits. If both firms were initially 'endowed' with E permits, then the low-cost polluter will earn rents

from its permits (the area above its MAC curve and below the market price of permits), while the high cost polluter will face incremental costs compared to the situation without a cap and trade system.

As noted, while each firm faces different costs to abating emissions, they each face the same emissions price and the policy is therefore cost-effective. Despite the cost-effectiveness, clearly entities facing a high-cost to abate emissions will incur significantly more costs to comply with the policy. Adding a political component to the analysis, there is likely to be resistance where the private costs of compliance are high (Olewiler and Field, 2005).

In most cap and trade cases, the focus of the political resistance is on the allocation mechanism. Governments are faced with the decision of whether to grandfather allowances or auction them to covered entities. No matter what is decided upon, there will always be differences in the level of costs incurred by firms; however, the mechanism employed can significantly increase the private costs of compliance (Olewiler and Field, 2005). There may be no need to be concerned over the private costs of compliance, especially when considering the overall policy package and how any auction generated revenue is redistributed (explored in detail in Chapter 8), but it is important to recognize that changes in design features can significantly alter compliance costs.

One additional benefit to cap and trade schemes is its impact on research and development (*see Figure 3*). The introduction of a trading scheme adds additional incentives to firms to adopt new technologies. Shifting to lower carbon technologies and processes will reduce the slope of a firm's MAC curve. A firm that can shift to a 'newer',

less steep MAC curve will lessen their need for emissions permits and may provide them with surplus emissions permits that can be either sold immediately in the market or banked for future use. Either way, a firm that was able to implement cost saving, emission reduction technology will benefit by the cap and trade framework. In Figure 3, the shaded area represents the revenue the firm would get from reducing their emissions from B to A, and selling their now excess permits at the market price. The costs would be the incremental abatement costs incurred by moving from B to A (represented on the graph by the area 'E'). Clearly, the revenue generated by the surplus permits is greater than the abatement costs (incremental rents to a firm shifting MAC curves is represented by the area 'D').

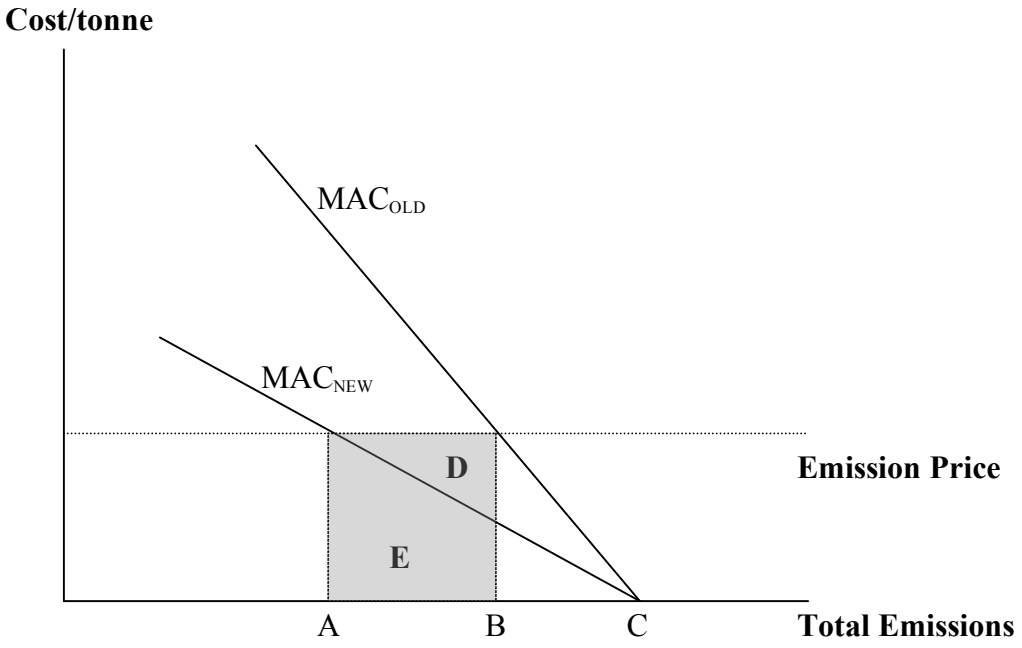

Figure 3: Benefits to R&D from cap and trade.

In theory, cap and trade systems are attractive because they are cost-effective and put a hard cap whatever pollutant is being targeted. In practice, the impact of the policy is tied to the characteristics of the entities that are covered by the cap and depending upon

those characteristics, the policy may be somewhat less attractive. It is important to recognize that many of the entities covered under operate in different markets and compete with different producers in different jurisdictions. These differences explain whether or not the private costs of compliance will be passed through to consumers or will be borne by labour and shareholders.

3.2 Determinants of industrial vulnerability to emissions pricing

Whether or not individual industries covered by the WCI cap and trade are vulnerable is a question of whether firms operating in those industries are able to shift the burden of the emissions price forwards to consumers. If firms are unable to pass through the costs in the form of higher prices for their goods, then the burden will be borne by labour (in the form of reduced wages or higher unemployment) or capital (reduced returns to shareholders). Understanding where the incidence of a policy that leads to a price for carbon emissions falls is a fundamental question to policy-makers, who need to adjust their policy responses accordingly.

While the incidence of an emissions price is dependent on a number of factors, it is clear that it will cause firms' production costs to increase. The question of who ultimately pays the added production costs and other cap-related adjustment costs is determined by the characteristics of a given market. General theory on the impact of commodity taxes[6] holds that the incidence is determined by elasticities of supply and demand. If demand is inelastic then the tax is shifted forwards (to consumers), while if supply is inelastic the tax is shifted backwards (onto labour or shareholders) (Rosen, 2005). Most often the incidence is somewhat diffuse; some percentage will be shifted

[6] An emissions price acts similarly to a commodity tax.

forwards, while the rest is shifted backwards. Recent studies on incidence stress the need to focus on relative price impacts and the intertemporal effects, and note that incidence likely changes over time (Fullerton and Metcalf, 2001). In the context of climate policy, relative price impacts (potentially harmful to BC industry if they compete with jurisdictions that do not face the tax) and intertemporal effects (the length of time it takes firms to substitute to more efficient processes) are important to consider.

On the supply side the key consideration is a firm's ability to reduce emissions by input substitution. Firms with limited prospects for adopting clean technology or to switch fuel inputs have a relatively inelastic supply, particularly over the short-term and may bear a higher percentage of the increased costs of production. Some firms may have higher 'sunk' capital costs at the time that the emissions price is imposed and switching technologies at that time may be prohibitively expensive (Australia Green Paper, 2008). Input substitution for emissions intensive firms may be more difficult than for other firms. Research suggests that emissions intensive industries tend employ the best available technology as it significantly impacts their energy costs (Sorrell et al., 2004). This may mean that further reductions will be more difficult to achieve in the short-term.

The demand for carbon-intensive domestic products helps determine the incidence of the carbon policy. The key consideration is whether or not consumers are able to avoid paying the added costs by substituting products from other jurisdictions for those produced in BC. This is referred to as leakage and findings suggest that a drop in output is likely in industries whose products that are traded on the world market and whose competitors do not face an emissions price (Fitz Gerald et al., 2008). If BC

consumers can opt for foreign produced goods, then firms will not be able to shift the costs forward and the incidence will fall on labour and capital.

Literature reviews on the incidence of emissions pricing show it to be a function of emissions intensity and price-setting power (Morgenstern et al., 2007; McKinsey & Company, 2006; Fitz Gerald et al., 2007; Ho et al., 2008; Australia Green Paper, 2008). Focusing on the short-term impacts of the emissions price and incorporating the supply side component, the incidence is dependent on firms' ability to substitute factors of production – adopting new technology or switching fuels (Hourcade et al., 2007; Australian Green Paper, 2008). Ultimately, firms that are emissions intensive, have fewer opportunities to fuel switch or adopt new technologies and are price takers are likely to shift the burden of the emissions price to labour (wage reductions or layoffs) or capital (declining returns to shareholders and reduced ability to raise financing for future operations).

Accordingly, the industrial analysis of the BC economy focuses on the emissions intensity, availability of low carbon technological opportunities and price setting power. The results of the industrial analysis are used to get a better understanding on who ultimately bears the burden of the emissions price and where compensatory policies should be directed.

3.3 Industrial analysis

Industries are analyzed based on NAICS[7] aggregations with the exception of coal manufacturing and refineries; two industries that are aggregated at the 4-digit NAICS

[7] North American Industry Classification Standards

level, but exhibit different market characteristics in BC. The Australian government recently developed a Carbon Reduction Scheme Green Paper (2008) that proposed criteria to identify which industries are emissions intensive, trade exposed (EITE). These criteria are adapted to fit this analysis. Each industry surveyed is ranked on its emissions intensity, opportunity for fuel switching or adopting new technologies and price-setting power. Individual industrial performance against each variable is rated low, medium or high.

Emissions intensities are ranked relative to the national average emissions intensity in Canada (0.75 ktCO_2-e/$mn GDP) and Australian standards on emissions intensities. The Australian government set an emissions intensity of 1.5 ktCO_2-e/$mn GDP as the threshold above which a firm is considered emissions intensive (Australia Green Paper, 2008). In this study, a ranking of 'high' indicates that it is above the threshold of 1.5 kt CO_2-e/$mn GDP. Medium is the Canadian average.

Emissions intensity values are calculated from 2005 NRCAN data. Provincial data, disaggregated at the industrial level were unavailable. Despite the limitations of using national data, NRCAN excludes electricity from its emissions data. This is particularly important in the BC context, where the majority of electricity is generated through renewable sources.

Price-setting power is assessed and ranked low, medium or high based on analysis of exposure to trade and market analysis. There are a number of ways to measure the ability to pass along costs. Using price elasticities or examining the correlation between BC prices and global prices would likely provide the most robust results, but such data is unavailable and complex to calculate. In its Green Paper (2008), the Australian

government did not believe that they could effectively use price elasticities or regressions on domestic and global prices to measure price-setting power. As a proxy, they used trade shares to assess the ability to pass through costs, arguing that firms exposed to trade are more likely to be price takers on the international market (Australia Green Paper, 2008). Accordingly, international competition and trade sensitivity are used to assess whether firms are able to pass through costs to consumers. I rely on secondary data and, where available Industry Canada values on trade intensity, to assess price-setting power.

Opportunities for fuel switching and adopting technologies are assessed by a review of company literature. It is difficult to ascertain the prospects for technological prospects with any real accuracy, largely because of the uncertainties associated with measuring the rate of innovation, deployment and diffusion of new technologies (Jaccard, 2006). I rely largely on secondary data from industry groups or particular stakeholders to rank technological opportunities. The same ranking system used to rank the other variables – low, medium and high – is employed. Key indicators that suggest difficulty to adapt over the short-term include:

- The life span of capital stock – longer life span, more difficult to adjust;
- Where a firm is in its capital stock turnover cycle;
- Capacity to attract required financing; and
- Emissions intensity.

3.3.1 Pulp and paper industry

The pulp and paper industry in BC is currently under duress. The current global recession has negatively impacted the industry in a significant way, although the industry has struggled over the past 20 years. Recent data shows that the decline in global pulp

and paper demand is outstripping production cuts (Dow Jones, 2008) and that net revenues are down significantly from this time last year (Pulp and Paper website, 2008).

Beyond the challenges associated with the current recession, the industry is facing increased competition. Global competitors have been much more successful at upgrading facilities and have become much more competitive. A government task force noted that increased competition from emerging markets has resulted in over supply and depressed prices (BC Task Force on Forest Renewal, 2006). Specifically, German and Swedish plants have recently completed significant technological overhauls and are now far more efficient than Canadian plants (Pöyry Consulting Report, 2008). Canadian producers – particularly those in BC – have cost advantages reflecting the relative price difference in timber; however, the technological gains by European producers has altered the playing field and the cost per unit output is now lower in Europe than in BC (Pöyry Consulting Report, 2008). Long-term industry forecasts see a continued increase in competition from emerging markets.

3.3.1.1 Emissions intensity

The pulp and paper industry is somewhat emissions intensive. In 2005, the intensity of Canadian paper manufacturers was 1.165 ktCO_2-e/$mn GDP and 0.975 kt CO_2-e/$mn GDP for pulp manufacturers. This figure is higher than the average level of intensity for all industry in Canada, but remains beneath the 'high' threshold value established for Australian industry.

3.3.1.2 Opportunities for fuel switching and adopting new technologies

There are opportunities for adopting new technologies to reduce emissions in the industry. Several European facilities have implemented new technologies and cut emissions. Mercer (a large pulp manufacturer) recently retooled both of their German plants, significantly reducing emissions and generating energy onsite through cogeneration to fulfil all operational needs (Mercer President's Report, 2007).[8] One of their plants, completed in 2004 at a cost of $1bn, is one of the cleanest and most efficient plants in the world (BC Task Force on Forest Renewal, 2006).

Canadian plants on the other hand are aging. In North America, nearly 50% of recovery boilers – the largest capital item in pulp mills – are older than 30 years of age and many BC mills have not maintained high levels of reinvestment (BC Task Force on Forest Renewal). Access to capital to finance the retrofitting and retooling of plants is a key barrier. Although capital stocks are nearing retirement at many plants, firms have been unable to secure financing (BC Task Force on Forest Renewal). One of the challenges in securing financing over the recent past is that the annual rate of return on capital employed has averaged 4% in BC over the past 20 years, well below the 12% considered the minimum required to realize opportunities for growth over the long-term (PWC Report on the Economic Impact of the BC Pulp and Paper Industry, 2007).

Despite the opportunity for retooling, the BC pulp and paper association is arguing for concessions that could be interpreted to reflect fears within the industry that they are unable to attract the financing required to achieve further reductions or are unable to pass through all of the costs of the allowances. They are pushing to receive

[8] Mercer's plant produces excess energy that is sold into the German power grid.

credit for early emissions reductions. They cite that emissions reductions over the past 15 years (now down to 600kt below 1990 levels) should be credited in some way as BC implements the cap and trade (BC Pulp and Paper WCI Climate Submission, 2007).

3.3.1.3 Industry competitiveness and price-setting power

Pulp and paper products from Canada are exported into the world market. Industry Canada measures for export intensity (domestic exports/manufacturing shipments) was 103.05% for pulp mills and 86.75% for paper mills. The degree to which the BC paper industry competes on the world market and the level of competition from emerging markets – notably Brazil – restrict the industry's ability to pass through the costs of allowances on to consumers. British Columbia remains one of the largest producers of pulp in the world and produce approximately 24% of world supply; however, the market is competitive and no one company is able to fully pass on cost increases on to consumers (Pöyry Consulting Report, 2008).

In a report commissioned by the EU, McKinsey & Company (2006) estimated that while certain types of processing within the industry will be more able than others to pass costs on, a \$10/t CO_2-e price would result in a 5-10% increase in net costs (McKinsey & Company, 2006). Data from a Canfor Pulp Income Fund shareholder report highlight some of the market characteristics specific to BC. Canfor – a major player in the BC and world market –cited that the pulp industry operates in highly competitive markets and that they are not always able to increase price in response to increases in raw material costs, suggesting that the incidence of an emissions price is likely to be diffuse (2008). It can be assumed that these same limitations exist across entities.

3.3.1.4 Vulnerability of the pulp and paper industry

Based on the assumption that BC will see net cost increases, the pulp and paper industry faces significant challenges over the short-term. Many firms in the industry posted net losses in 2007 (Canfor, 2008). Industry Canada estimates that the annual growth rate of costs over the past ten years has averaged 0.4% per year, a figure that the industry is currently unable to cope with. Given the struggles in the industry, a similar increase in net costs for BC producers to the amount predicted in Europe (5-10%) could be crippling to the industry.

The performance of the pulp and paper industry against the determinants of vulnerability to emissions pricing of is summarized in Table 1.

Table 1: Summary of the vulnerability of the pulp and paper industry.

Emissions Intensity	New Tech opportunities	Price-setting ability	Vulnerability
Medium/High	Low (over short-term)	Low/Med	High

3.3.2 Mining and materials industry

Results from the mining, metals and materials manufacturing industries– defined as including mining, smelting, coal manufacturing, aluminium production and cement manufacturing – are analyzed in this section. Many British Columbia mining and smelting operations and all aluminium and cement producers were classified by Environment Canada as LFEs and will be subject to the WCI cap and trade.

Prior to the current recession, the mining and materials industry had experienced strong results in 2006 and 2007. Commodity prices began to drop in 2007, but remained

high and net revenues for the industry were still considered to be very strong (PWC BC Mining Industry Survey, 2008). If the economy continues to contract, firms in this industry may struggle to finance investments in new, more efficient technologies and processes.

3.3.2.1 Emissions intensity

The mining industry was the largest emitter of absolute emissions in Canada in 2005. Emissions intensities vary by type of mining activity, but remain high relative to other industries. In general, extraction is not very emissions intensive. Emissions intensities for 2005 ranged from 0.245 kt CO_2-e/$mnGDP for copper mining, 0.275 kt CO_2-e/$mnGDP for non-metal mining[9]. Processing tends to be much more emissions intensive, although aluminium production tends to be much less emission intensive than other forms of processing due its high use of hydro.[10]. Cement production is the most emissions intensive process studied and emits 6.46 kt CO_2-e/$mnGDP. Non-ferrous smelting (including zinc smelting) emitted 1.057 kt CO_2-e/$mnGDP, while coal processing was roughly 0.823 kt CO_2-e/$mnGDP.

The data on emissions intensities likely underestimate the actual emissions intensity. The NRCAN data on emissions excludes emissions derived from electricity use by the industry. It is unclear how much of an effect this will have on the emissions intensities studied in the industry and the effect will differ across entities.

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[9] Most of the emissions associated with mining extraction are indirect (sourced from transportation) and are already covered by the carbon tax.

[10] Alcan-Rio Tinto operations in Kitimat generate their own hydro electricity near their site and this covers 95% of their total electricity needs. Aluminium production in BC has drastically reduced emissions intensity over the past five years.

3.3.2.2 Opportunities for fuel switching and adopting new technologies

The mining and materials industry has been active in stimulating the development and deployment of low carbon technologies. Many operations rely on hydroelectric power and have constructed facilities near their operations to provide for their electricity needs.[11] Energy is a large share of total costs for the industry as a whole and high energy costs has provided firms with a strong incentive to reduce energy consumption. Over the period of 1990-2003 firms made significant reductions in emissions intensities, declining 3.5% and 43.4% respectively for the mining and non-ferrous smelting industries in Canada (MAC, 2004). Whether this indicates that the industry has maxed out all short-term gains is unclear.

British Columbia's reliance on hydro for electricity needs suggests that further reductions over the short-term may be more difficult. In the BC mining and materials industry the emissions from electricity usage are far lower than in neighbouring jurisdictions – 51 kg/MWh in BC compared to 859 and 874 kg/MWh in Alberta and Saskatchewan (MAC Action Plan for Reducing Greenhouse Gases, 2004). Still, aluminium producers Alcan/Rio Tinto argue that there are significant opportunities to reduce emissions in the near term. Electricity at their Kitimat plant is currently sourced from hydro and natural gas and they are forecasting improvements in natural gas efficiency in the near term. Additionally, they recently committed over $550mn to modernizing plant operations; a move they argue will reduce emissions by 40% annually (Rio Tinto, 2008).

[11] In addition to the Alcan-Rio Tinto operation, Teck's zinc smelter in Trail and their Elk Valley coal operations all run on hydro produced near site.

Cement manufacturers have opportunities to reduce emissions through fuel switching and adopting new technologies. Energy costs make 38% of total costs to the industry in Canada and in a letter to the WCI the Canadian Cement Association (CCA) noted that switching to renewable fuels could reduce emissions (CCA, 2008). At present the industry relies on fossil fuels to generate the heat required to produce cement.

3.3.2.3 Industry competitiveness and price-setting power

Each of the mining and materials industries surveyed is exposed to global trade. The level of the exposure to trade will limit the extent to which mining and materials firms are able to pass the costs of allowances to consumers.

Prices in the mining and materials industry are vulnerable to external market conditions and the current economic conditions highlight that volatility. Commodity prices have dropped across the board in response to the global recession and individual firms in BC do not have sufficient market power to set prices. While the specific ability of each firm to shift allowance costs forward is differentiated across industries, each entity's exposure to global markets indicates that labour and shareholders bear some of the costs.

Aluminium producers face a slightly different scenario than other entities considered in this industry. While the industry is exposed to trade – the export intensity of 87% in 2007, more than double the industry average for Canadian manufacturing[12] – there is a coordinated attempt amongst international producers to develop a global

[12] Based on data from Industry Canada.

approach to emissions reductions.[13] Alcan Rio Tinto is a part of the association and would likely benefit somewhat by having the majority of their competition invest in reducing emissions.

Cement producers also differ from the rest of the industry. Trade sensitivity may be a larger concern for BC producers due to growing competition from India and China – two industries that have relatively lax environmental standards. The emissions and energy intensiveness, coupled with lax environmental standards in competing jurisdictions could intensify the impact of a Canadian emissions price. While Canadian cement producers export approximately 40% of their product, over the past 5 years, the Canadian share of the U.S. import market has dropped by 8% as the U.S. has shifted to lower costs producers in Asia (CCA, 2008). The Canadian Cement Association (2008) argues that this drop is due largely to higher production costs among Canadian producers. Another challenge facing BC cement producers is competition from Alberta. They are unlikely to impose an emissions price at the same time BC does. Given that cement production is relatively mobile – it is not dependent on geography specific rents – there could be higher rates of leakage out of BC.

3.3.2.4 Vulnerability of the mining and materials industry

The vulnerability of mining and materials industries is not uniform. A recent study on the impact of a \$10/ton CO_2 price in the US forecasted that energy intensive firms in the mining and materials industry would be likely the hardest hit any industry (Ho et al., 2008); however, it is likely that entities in BC who source electricity from

[13] Being coordinated the International Aluminium Institute (IAI) represents 80% of global production and is attempting to pull together aluminium producers to reduce the industries emissions – currently estimated to be 1% of global emissions (IAI, 2008).

renewables will be better off than competitors that also face an emissions price. A good example of this is in the Aluminium industry as aluminium productive is electricity intensive and BC production is heavily reliant on hydro electricity. The EU and the US forecast increases in net costs with a limited percentage (none in the EU) of the added costs being able to be passed through (McKinsey & Company, 2006; Ho et al., 2008) largely because they are reliant on carbon intensive sources of electricity. British Columbia's reliance on hydro would benefit their producers relative to American and European producers. The extent to which BC gains relative to global producers – particularly the US and the EU – is dependent on coverage, specifically how much of world production will be covered by an emissions price.

The vulnerability of coal manufacturing is difficult to assess. Result from the study in the U.S. used industry statistics at the 4-digit NAICS code, which aggregates coal manufacturing with petroleum refining. This level of aggregation makes it difficult to draw firm conclusions on the precise results of each activity. The results of the analysis on the 3241 NAICS code – refining and coal manufacturing – in the U.S. found that there is likely to be a 2-3% drop in output over the short-term and that full recovery is unlikely (Ho et al., 2008).

Cement production is likely to be vulnerable to an emissions price. In the EU, McKinsey & Company (2006) found that the industry would incur significant cost increases. Industries operating in trade-exposed regions were not assumed to be able to pass through costs and were determined to be vulnerable to the emissions price.

Table 2: Summary of the vulnerability of the mining and materials industry.

Industry	Emissions Intensity	New Tech Opportunities	Price-Setting Ability	Vulnerability
Coal	High	Medium	Low	High
Metals	Medium	Medium	Low	High
Cement	High	Medium	Low	High
Aluminium	High	Medium to High	Medium – depends on level of coordinated action	Medium

3.3.3 Refineries

There are two petroleum refineries that operate in BC – a Chevron plant in Burnaby and a Huskey plant in Prince George. Both were classified as LFE's by Environment Canada and will be covered by the WCI cap. While there is no data available on the emissions intensity of each plant, aggregate data shows that refineries in Canada are emissions intensive. Excluding electricity, refineries in Canada emitted over 10 kt CO_2-e/$mn GDP in 2005. There may be opportunities to reduce emissions through improved technologies.

Despite high emissions intensities and high absolute levels of emissions, it is unlikely that an increase in costs will be borne by producers over the short-term. While the demand for refined petroleum products (RPP) in British Columbia exceeds domestic supply and the province relies on Alberta to meet demand (BC Progress Board Report, 2005), levels of supply across Western Canada are exceedingly tight (National Energy Board, 2008). While the current recession will impact demand, there are still capacity constraints in the North American market. Small disruptions in supply result in significant increases in price and Canadian refineries – including those in Edmonton –

operate at or near full capacity[14] (NRCAN energy markets report, 2008). The lack of additional capacity in North American supply regions[15] will likely inhibit British Columbian consumers from switching producers.

Another factor that virtually eliminates competitiveness impacts facing BC refineries is that the WCI is recommending that the point of regulation for fuels produced outside of Partner jurisdictions be covered at distribution facilities. Distributors are likely able to shift that cost on to consumers and eliminate the advantage of switching to RPPs from Alberta.

Results in the U.S. context by Ho et al. (2008) forecasted a drop in output; however, as noted above their analysis aggregated data from petroleum refining and coal manufacturing. Each activity was separated out for this analysis because the market characteristics differ substantially in BC – most notably BC's supply deficit in the RPP market. In McKinsey & Company's (2006) report determined that European refineries would be able to pass along the most of the costs. Refineries are more likely to struggle over the medium- to long-term if consumers are able to shift to low carbon fuels.

3.3.4 Natural gas plants

There are a number of different natural gas operations that are classified as LFEs, from extraction to distribution and combustion. The Burrard Thermal Power plant is classified as an LFE, but is not analyzed in depth as the BC Energy Plan states that its use will largely be phased out by 2014 (BC Energy Plan, 2008). Natural gas distributors (such as Terasen Gas Ltd.) will be able to pass through 100% of the costs to consumers

[14] Figures from 2005 showed that Canadian refineries operated at an average level of 92% of full capacity.
[15] Canada has four supply regions – Western Canada, Ontario, Québec, and Atlantic Canada – and only Atlantic Canada has surplus production.

over the short- to medium-term because it is a regulated utility that simply flows through product to final consumers (McKinsey & Company, 2006; Ho et al., 2008). Existing purchase contracts may slow the passing through of costs for a short while, depending on the length of the contract.

Entities involved with natural gas extraction may also be able to pass through the majority of their costs. At present, the majority of emissions are from fugitive sources and there are technological opportunities on the horizon to reduce those types of emissions (Canadian Association of Petroleum Producers, 2009). Also on the technological front, there is a possibility of adopting large-scale carbon capture and storage (CCS) techniques in the future. The Fort Nelson Gas Plant is currently investing over $3bn with support from the province to explore the viability for implementing CCS.

The natural gas market is favourable for BC operations. Much of BC's natural gas is transported to the American Pacific Northwest and demand for natural gas is expected to be strong over the short- to medium-term as firms in the northwest states all fall under the WCI cap (Pacific Northwest Gas, 2008). Pipeline infrastructure connects BC through to California and ensures that BC is able to have continued access to the US market over the short-term. Also, there is a lot of potential for increased extraction in BC and the province appears committed to ensuring continued growth in the industry (BC Throne Speech, 2009).

Apart from Alberta, BC's direct competition for the U.S. market is from states that are either partner or observer states in the WCI and will be under pressure to reduce emissions. While Alberta is a major exporter of natural gas, the WCI regulation on fuels sourced from outside Partner jurisdictions will increase the cost of Albertan natural gas

market that enters the WCI. The WCI regulation is a *de facto* border tax adjustment and will reduce any competitive advantage gained by Alberta producers that are not subject to an emissions price.

In short, natural gas producers are not likely to be vulnerable to an emissions price. Results from Ho et al. (2008) in the U.S. confirm the expectation that the natural gas market is not vulnerable to an emissions price and found that producers would be able to pass through all of the costs of an emissions price to consumers. In the BC context, a 2004 overview and assessment of the natural gas market in BC concluded that the costs of natural gas extraction are largely passed through to consumers in the retail market (National Energy Board Report on the BC Natural Gas Market, 2004).

3.4 Impact on labour in vulnerable industries

The outcome of a particular industry's inability to adapt may be a loss of jobs. Modeling results of the impact of a $10/t emissions price in the U.S. showed that a drop in employment over the short-term is an expected consequence of a drop in output in affected industries and the negative employment effects are in most instances proportional to the drop in output (Ho, et al., 2008). Negative employment effects could be offset by increases in other industries (Olewiler, 2008); however, it is important to consider that workers that shift to new industries usually suffer a decline in earnings over both the short- and long-term (Kletzer, 1997). The expected earnings decline of displaced workers suggests that even if other industries absorb the majority of the displaced workers, there will still be policy implications and a role for government to facilitate workers to transition to new employment.

The survey of BC industries highlights that a number of the entities covered by the cap are likely to be vulnerable to an emissions price. The inability of metals, cement, coal and pulp and paper manufacturers to pass through the costs emissions allowances to consumers will likely result in a drop in output, returns to shareholders and employment. There is likely a negative feedback effect respecting output and employment. As entities become less profitable, it becomes more difficult to attract capital, which in turn leads to further reductions in output and employment.

Geographically, each of the vulnerable entities operates in rural BC. Accordingly, the survey of labour market characteristics focuses on the composition of labour in rural BC and the specific characteristics rural workers.

3.4.1 Determinants of labour vulnerability

The level of employment effects in vulnerable industries is related to labour market characteristics – specifically whether or not labour can adjust to new conditions over the short-term. Rigidities in the labour markets make it challenging for displaced workers to find new forms of employment and the adjustment period can be protracted. Sticky wages and limitations on labour mobility due from education and geographic constraints may make labour more vulnerable to structural adjustments in the economy.

Wage rigidities tend to exaggerate the drop in output and employment in affected industries. In the rural, low skill labour market (the industry most vulnerable to higher displacement costs) wage rigidities may induce struggling entities to mitigate the impact of an emissions price through layoffs – particularly if they are limited in their ability to

seek wage concessions from their labour force (for example, a unionized labour force with a current collective agreement).

Geographic barriers and skills specificity impose rigidities on labour mobility. Displaced workers living in rural regions and holding limited skill sets may be forced to move much longer distances than their urban counterparts to seek reemployment. The characterization of labour specificity is determined by the percentage of labour that does not leave a challenged industry when demand has fallen in that industry (Babiker and Eckaus, 2008). It is difficult to measure this empirically; however, I assume regional dependence on limited, low-skill (or non-transferable specific-skill) industries and the regional level of post-secondary education amongst the labour can be used as a proxy for labour specificity. BC Stats data on the economic make-up of specific regions in BC is used as evidence of high or low levels of labour specificity.

Determining the appropriate policy response to smoothing transition related costs for labour requires an understanding of the level of the costs. Adjustment costs for displaced workers are a function of age, education – including skills specificity – and mobility. In general, older, less mobile and less educated workers are likely to spend more time seeking new employment than younger, more educated ones (Kletzer, 1997; Fallick, 1993). In monetary terms, the costs to displaced workers arise from the following:

- Lost wages while spent looking for re-employment;
- Earnings from new employment tend to be lower than what they were in the previous employment;
- Lost value on human capital as firm or industry specific skills learned from previous education or employment are no longer usable;
- Retraining costs; and

- Relocation costs in the event that the worker must move to find reemployment.

Source: Kletzer, 1997.

Less tangible costs may arise if individuals are forced to move away from family or friends.

3.4.2 Degree of skills specificity in labour in BC

Virtually all of the rural regions of BC are highly dependent on natural resources and workers living in those regions are not likely to be highly mobile due to the relatively low levels of education.[16] Of the eight economic regions in BC, only the Lower Mainland derives less than 10% of its GDP from forestry (incl. pulp and paper manufacturing) and mining. Five of the regions are more dependent on forestry and mining than any other industry, and in those regions those two industries comprise at least 26% of their economic base. The Lower Mainland is the only region where greater than 20% of its population has attained a university degree. The lack of formal education indicates that workers have developed skills specific to their industry. It is more challenging for individuals that hold highly specific skills adjust to different types of employment without the benefit of receiving some form of retraining.

3.4.3 Mobility of the rural BC labour force

Migration is considered to be a requirement for a flexible labour market, but there are a number of documented constraints on labour mobility. Individuals that have lived in the same place for an extended period of time develop ties to local networks and people

[16] All of the statistics relating to the regional economic make-up and labour composition are from the BC Stats website.

and are strongly committed those established networks (Fischer and Malmberg, 2001). These local networks develop into *location-specific insider advantages* that are treated as sunk costs in the event that someone has to leave (Fischer et al., 1998). Labour market policies have largely been unsuccessful at eliminating these constraints and reduce the capacity of labour markets to adjust smoothly (Fischer and Malmberg, 2001).

Measurements of willingness to accept underemployment are an indicator of labour mobility rigidities amongst workers. Studies also show that in rural regions of Canada displaced worked are 30% are more likely to accept underemployment than their urban counterparts (Vera-Toscano et al., 2004). There is also a strong link between rural regions in Canada and underemployment of workers that are displaced from the resource industry (Vera-Toscano et al., 2004). While there is no data disaggregated at the provincial level, there is no reason to believe that rural BC differs substantially from other rural regions of Canada.

The current market conditions are also likely to further reduce the mobility of displaced workers from rural regions. The value of homes in some single-resource towns that have experienced (or will experience as a result of the emissions price) a decline has depreciated in step with the decline of their local industry. Declining home equity further limits the capacity of people living in rural regions from moving and likely further increases the likelihood that they are willing to accept underemployment.

3.4.4 Summary of labour market characteristics

The high level of dependency on employment in the resource industry, the low levels of university education and peoples' preferences to not moving suggest that BC,

particularly rural BC, will incur high transition costs. The rigidities associated with labour mobility create barriers to the economic reorganization and adjustment that is the intent of climate policy. This suggests that if pulp and mining operations slow in the short run as they adapt to carbon constraints, BC will suffer not only from the resultant drop in output, but also from the associated increase in un- and underemployment.

4: Cross-unit case analysis

In this chapter I summarize the design features of the recommended WCI cap and trade mechanism, RGGI and the EU ETS. I also examine two cases where a country has made a major structural transition; the Canada-US Free Trade Agreement and German reunification to see what lessons can be learned about adjustment costs and means of addressing these costs.

While there are innumerable ways to design the rules of a cap and trade scheme, I focus on the high-level features that impact upon both emissions reductions and the level of adjustment costs. The key components are:

- The appropriate baseline level of emissions (the cap) and degree of flexibility allowable to readjust the cap in response to external conditions, emissions accounting errors, etc. and the rate at which the cap decreases over time;
- Whether to allocate emissions permits freely (grandfathering) or to auction all or some of the permits;
- Whether to allow firms to offset GHG emissions in a regulated offset market (examples of permitted offsets could include afforestation, soil sequestration);
- Whether to allow firms to bank unused allowances; and
- How to use the revenue generated by the sale of emissions allowances.

Table 3 (p. 47) summarizes the design specifications of the key components of each cap and trade case.

British Columbia has full discretion over the allocation and revenue-recycling mechanisms under the current design specifications of the WCI. While BC may not be able to adjust other design features independently of other Partner jurisdictions, it is important to understand impact of these features on adjustment costs. As the

implementation of cap and trade schemes of this scope is relatively new, it is important to be able to monitor key aspects of the program and be able to understand how best to adjust to mitigate unanticipated or underestimated events. Accordingly, all features of the cap that influence adjustment costs – including those that are not independently controlled by BC – are reviewed.

4.1 WCI cap and trade

The WCI cap and trade system is set to come into effect in 2012. The mechanism is a core component of the goal to reduce the emissions of WCI partners by 15% below 2005 levels by 2020. (2008). There are eleven Partners in the WCI - seven states and four provinces.[17]

The initial cap for the year 2012 will be set based on emissions actual emissions data from included industries in 2010. The emissions data reported by each source must receive third-party verification to comply with WCI rules. The cap is regional and each Partner is allocated emissions allowances based on their regional cap. Upon implementation, the cap and trade mechanism will enter into the first of three compliance periods culminating in 2020. The compliance periods are due 2012 through 2014, 2015 through 2017 and 2018 through 2020. Prior to the start of each compliance period, each jurisdiction will allocate allowances, a minimum amount of which must be auctioned.

The regional cap is adjusted downward until 2020 to a level that ensures, when considered in conjunction with other policy instruments, that the WCI meets their goal of reducing emissions by 15% of 2005 levels. The rate at which the cap adjusts downwards

[17] Arizona, British Columbia, California, Montana, New Mexico, Ontario, Oregon, Québec, Utah and Washington are all Partners in the WCI. There are also some Observer members.

over time is not yet specified; however, BC will not likely have full discretion regarding the rate. It will be determined through negotiation with each other partner jurisdiction.

The WCI framework sets the parameters within which each Partner must operate. It mandates that the six most common GHGs must be covered.[18] Emissions from electricity and large final emitters (LFE) are covered during the first compliance period (2012-2014), while emissions from transportation and residential and commercial fuel use are covered at the beginning of the second compliance period.

4.1.1 Auction rules

The WCI model provides for flexibility with regards to the method of allocating emissions allowances. Each jurisdiction must auction 10% of the allowances at the start of the program, but may auction up to 100%. By 2020 a minimum of 25% of allowances must be auctioned.

Each jurisdiction must set a reserve price for the first 5% of allowances auctioned. The rationale is that a reserve price will manage the risk of having inadvertently set the cap too high. If allowances are not purchased at or above the reserve price, a portion of the allowances will be retired. Any allowances that are unsold in the auction may be auctioned in later compliance periods or retained and used at the discretion of the Partner jurisdiction.

[18] The six greenhouse gases are CO_2, CH_4, N_2O, HFCs (hydrofluorocarbons), PFCs (perfluorocarbons), and SF_6.

4.1.2 Banking and borrowing of allowances

Any covered entity that purchases or otherwise obtains an allowance may bank that allowance for later use. The WCI will set a limit on the number of allowances that may be held by an entity at any one time, which could restrict the capacity of an entity to bank allowances. No entity will be able to borrow allowances from future compliance periods.

4.1.3 Offsets

Entities may purchase 'emissions offsets' in lieu of directly reducing their emissions. It is not clear whether there is a limit on the amount of offsets an individual entity may be able to purchase. Each Partner is limited to no more than 49% of the total emission reductions over the period from 2012-2020 and they must establish criteria to ensure that all offset projects result in a GHG reduction, removal or avoidance that is real, surplus/additional, verifiable and permanent. While there is no defined list of what project types will be permitted, Partners have identified three areas of priority,

- Agriculture (soil sequestration and manure management);
- Forestry (afforestation/reforestation, forest management, forest preservation/conservation, forest products); and
- Waste management (landfill gas and wastewater management).

4.1.4 Revenue-recycling mechanism

Partners have nearly full discretion over how they allocate revenue raised from the auction of allowances. The WCI design report (2008) provides some guidance mandating that 1% of the value of allowances must be invested into an energy efficiency fund. The remaining 99% may be apportioned at each Partner's discretion, but are

encouraged to increase technology funding or reduce the burden of the emissions price for consumers and firms (WCI, 2008).

4.2 Regional Greenhouse Gas Initiative (RGGI)

RGGI is a CO_2 cap and trade mechanism that covers CO_2 emissions from power producers in 10 New England states – Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont (RGGI website, 2008). The cap is set at 2008 emissions levels and decreases over time until meeting the goal of a 10% reduction in emissions by 2019 over the initial cap levels.

The cap applies only to power producers and employs a 'phased approach' – meaning that the reductions in the cap are initially modest. The argument behind this approach is that covered entities require predictable market signals and greater regulatory certainty (RGGI website, 2008). There is no reduction in the cap until 2015 at which point the cap decreases by 2.5% per year until 2019.

As with the WCI recommendations, the RGGI allows for each jurisdiction to act independently of one another in certain regards. They set broad parameters under which each entity and jurisdiction must operate, but also allow for each jurisdiction to tailor design features specific to their needs.

4.2.1 Allocation rules

The framework requires each jurisdiction commit a minimum of 25% of the value of total allowances towards 'consumer benefits' and funding energy efficiency programs, but does not require jurisdictions to auction allowances. Despite the flexibility, the RGGI directive has a similar effect to having a minimum auction level of 25% of total

allocations given that an auction is the most logical way in which to raise the revenue required to meet the established requirements. Regardless of the scheme's flexibility, each state auctioned well over the 25% minimum and some approached an auction of 100% of the allowances during the first two compliance periods.

There are a number of different auction mechanisms that were explored by the RGGI team. Differences in the type of auction employed can influence the allowance price and there is extensive literature regarding auction mechanisms (Holt et al., 2007). The RGGI auction was designed on the basis of the following criteria:

- Low administrative costs, low transaction costs for bidders;
- Perceived as fair, transparent, and understandable to participants and the public;
- Economically efficient ─ gets allowances to those who value them the most;
- Avoiding collusive behavior by bidders and providing good signals about market prices;
- Helping to minimize price volatility;
- Raising reasonable revenues from the sale of a valuable public asset; and
- Compatible with existing electricity and energy markets.

Source: Holt et al., 2007.

Certain states set aside a number of allowances. Acceptable set-asides were not uniformly implemented in each state and were intended to recognize voluntary emissions reductions or to reduce the burden on certain industries that may struggle to pass through the costs of allowances (Environment Northeast report, 2008).[19]

[19] Acceptable set-asides were for: implementation of voluntary clean energy (all states but DE); firms in long-term purchase contracts (CT, MD & NY); combined heat and power facilities (CT, ME & NJ); and industrial emitters (i.e. refinery) (MD & DE).

4.2.2 Banking or borrowing of allowances

Entities may bank an unlimited number of allowances. There is also no limit on the number of allowances that may be held by an entity; however, there is a limit on the number of banked allowances a jurisdiction may use in a given year. Each jurisdiction can cover a maximum of 10% of their cap with banked allowances (Holt et al., 2007). If a region had banked 15% of the next year's total allowances, firms in that jurisdiction would only be able to use two-thirds of their banked allowances.

4.2.3 Offsets

Offset projects are permitted to cover a portion of emissions during any compliance period. The initial limit for entities is set at a maximum of 3.3% of total emissions, though this is dependent on the price of an allowance. If the average regional spot price for CO_2 emissions increases above a specified threshold ($7.00 during the initial compliance period) then entities will be granted greater leeway with respect to offsets. Specifically they will be able to:

- Offset allowances to projects located anywhere in North America;
- Offset allowances will be awarded on the basis of one allowance for each CO_2-e ton of certified reduction; and
- The percentage of offsets that an entity may use to cover emissions rises from 3.3% to 5%.

If the threshold price is triggered twice in a 12-month period then the offset program will be expanded again to include international projects and allow for up to 20% of emissions to be covered by offsets.

Offsets must be able to certifiably show that the projects consist of actions that are real, surplus, verifiable, permanent and enforceable. At present, the following projects are

permitted; landfill gas capture and combustion; sulphur hexafluoride capture and recycling; afforestation; methane capture from farming operations; and projects to reduce fugitive emissions from natural gas transmission and distribution. The measurement and verification protocols, though not defined in the RGGI agreement, must be consistent across jurisdictions. There is flexibility to add projects to the list of eligible offset projects provided that it is approved by each jurisdiction.

The offset framework builds in a preference for projects located within the participating states. Those located in signatory states are credited one allowance for each CO_2-e ton of certified reduction, while those located elsewhere in the United States are credited one allowance for every two CO_2-e tons of certified reduction.

4.2.4 Revenue-recycling mechanism

The memorandum of understanding (MOU) (2007) signed by each state participating in the RGGI stipulates that a minimum of 25% of the value of the allowances must to invested into programs that will provide benefits to consumers and that support strategic energy efficiency technologies. While the specific mechanisms for each state vary, they include: energy efficiency programs; low-income weatherization; low-income heating assistance; and clean energy research and development (Environment Northeast report, 2008).

4.3 EU Emissions trading system (ETS)

The EU ETS is applied to all 27 Member states and covers heavy industries, such as electricity generation, iron and steel, mineral processing plants (including cement

manufacturing), and pulp and paper (EU ETS website, 2008). These industries comprise roughly 50% of regional GHG emissions (Ellerman and Joskow, 2008).

There are three compliance phases for the ETS. The first phase was considered a trial period and ran from 2005-2007. The second phase coincides with the first compliance period of the Kyoto Protocol and runs from 2008-2012. The final phase is due to run from 2013-2020. The European Council recently declared an emissions target of 20% below 1990 levels by 2020 (Ellerman and Joskow, 2008). The ETS is intended to play a large role in achieving that goal. Specifically, the ETS has set the 2020 cap at 21% lower than verified 2005 emissions from ETS sources. To meet that goal, the cap is set to decline by 1.74% annually over the third compliance period (Ellerman and Joskow, 2008).

4.3.1 Auction rules

The ETS limits the number of allowances to be auctioned. During the first phase member states were allowed to auction up to 5% of allowances and 10% for the second phase. The percentage of allowances to be auctioned during the third phase has yet to be determined. It is likely that a much higher percentage will be auctioned, though the ETS may differentiate across industries. Presently the power generation industry is slated to have to bid on 100% of allowances, while other industries may continue to receive a portion of their allowances for free (Ellerman and Joskow, 2008). Competitiveness and the likelihood of inducing carbon leakage[20] are the two key criteria that will be used to

[20] Carbon leakage occurs when GHG emitting processes shift from a region where emissions are priced or regulated to a region without pricing or regulation. In the context of climate change, leakage reduces the overall effectiveness of a given policy as global emissions are not reduced. They are merely shifted from one jurisdiction to another.

determine which industries will continue to receive grandfathered permits (Ellerman and Joskow, 2008).

4.3.2 Banking or borrowing of allowances

There is no restriction on banking or borrowing of allowances within any of the phases. The first phase was considered a trial run and the ETS effectively reset itself prior to the start of the second phase and accordingly, there was no banking or borrowing of allowances permitted between the first and second phases. Entities will be able to carry forward banked emissions from the second to the third phase, but will not be able borrow future allowances from the third phase to cover emissions from the second phase.

4.3.3 Offsets

The ETS allows for offsets – called 'linkage' programs. The EU established the 'Linking Directive' that permits the use of offsets in lieu of emission reductions. Credits are created under the Kyoto Protocol's Clean Development Mechanism. There is no geographic restriction on the offset credits. The criteria used to review and assess projects are delegated to bodies and procedures established under the Kyoto Protocol (Ellerman and Joskow, 2008).

The ETS limits the amount of offsets to 13% of the total allocation during the second period. The third phase will have a lower limit, but the amount has not been set.

4.3.4 Revenue-recycling

The EU has not issued any formal declaration on how revenue generated from auctioning of allowances should be spent. In a 2008 report, the EU stipulated that use of revenues must be consistent with the precautionary principle (Article 174 (2) of the

Treaty establishing the European Community) and recommends that a percentage of the revenues be directed into developing new technologies and renewable energies. The latter objective is designed to help Europe meet its commitment to having 20% renewable energy by 2020.

Table 3: Summary of the design features of cap and trade mechanisms.

	WCI	RGGI	EU ETS
Cap Baseline and Adjustment Rate	- Reduce emissions by 15% by 2020 over 2005 emissions - Downward rate adjustments not yet set	- Reduce emissions by 10% over the first 10 years of the cap - Constant until 2015 then decreases by 2.5% per an to 2019	- Reduce emissions of by 21% of 2005 levels by 2020 - Decreases by 1.74% per an over Phase III
Allocations Mechanism	- Min auction of 10% in first phase, 25% in second phase - No upper limit on auction	- Min auction of 25% - No upper limit on auction	- Max auction of 5% in Phase I - Max auction of 10% in Phase II - No upper limit on auction for Phase III
Offset	- Max of 49% of emissions reductions allowed by offset - Offsets must be sourced from WCI partner or observer jurisdictions	- Max of 3.3% emissions reductions allowed by offset - Adjustable dependent to a max of 5% if cost of abatement is too high - Offsets may be sourced internationally	- Max of 13% of emissions allowed by offset - Offsets must be certified by Kyoto Protocol mechanisms
Banking/Borrowing	- May bank allowances - Limited by a cap on allowances/entity - No borrowing of future allowances	- Unlimited banking of allowances - No borrowing of future allowances	- Unlimited banking of allowances - Limited borrowing of future allowances
Revenue-recycling	- Min 1% of allowance value into tech fund - Some encouragement to provide consumer benefits	- NRG efficiency, low-income weatherization, low-income heating assistance, and clean NRG R & D	- No formal rules - Legislative direction to use portion of funds for renewable

4.4 Historical economic transitions

The Canadian response to trade liberalization and the German response to unification provide examples of policy responses to structural transitions. Using secondary data, I examine the impact and efficacy of each policy response.

4.4.1 Impact of the Canada-US Free Trade Agreement (CUSFTA)

The debate over the need for and benefits of climate policy is similar to that of trade liberalization. The literature focuses on the conflict between those that bear short-run adjustment costs (mostly displaced workers and stakeholders of 'less efficient' plants) and those that garner the benefits of the efficiency gains (stakeholders representing 'more efficient' plants and users of final and intermediate goods) (Trefler, 2004). In practice, the CUSFTA resulted in both short-term costs and long-run gains, and set the stage for medium- to long-term economic expansion though the gains and costs were not evenly distributed (Trefler, 2004). Certain industries of the economy faced high levels of adjustment costs – notably import sensitive firms (Schwanen, 2001). The lesson for the implementation of climate policy is that, while the net benefits of reducing emissions are sufficient to warrant action, there are real distributional impacts that need to be considered.

Upon signing the CUSFTA, the government developed policy responses to mitigate the short-term costs. The focus was on job retraining and the government employed a three-pronged strategy:

- Improved access to training through a more active use of the UI (now EI) program;
- Tax incentives to industry to increase training; and

- Application of a training levy that was applied to industry and used to create a new training fund (Krouzil, 2004).

The Employment and Immigration Minister, Barbara McDougall, articulated the government's focus stating that Canadian competitiveness depended more on workplace skills over continued reliance on natural resources (Krouzil, 2004). Of note, no special adjustment assistance was provided directly to displaced workers on the grounds that it would not be possible to differentiate between workers that were displaced as a result of CUSFTA and those that were otherwise displaced (Krouzil, 2004).

Empirical evidence on the impacts of the CUSFTA differs across industries and time frames. There were substantial employment losses in certain industries– notably import competing industries and the manufacturing industry[21] (Trefler, 2004). The results were not all bad. Labour productivity rose 15% in export and import competing firms and 6% in manufacturing firms over the long-run (Trefler, 2004), and the adjustment period likely set the stage for economic expansion (Schwanen, 2001).

The impact of the policy response is less clear. Presumably the training programs contributed to the increased productivity of firms over the long run; however, it is unclear how much of the retraining and unemployment costs were covered by government and how much were borne by the individual. Studies show that employment levels remained depressed for 5 years after the introduction of the CUSFTA (Schwanen, 2001). It is impossible to determine whether the result would have been worse had these policies not adopted; however, the results suggest that focusing predominantly on retraining individuals and providing increased 'passive' support – in the form of extended EI

[21] Import competing industries suffered a 12% drop in employment and the manufacturing industry, a 5% drop in employment.

benefits – is not effective in smoothing the short-run adjustment costs for displaced workers.

4.4.2 German reunification adjustment policy

In response to reunification, the German government implemented a number of active and passive labour market policies (ALMP and PLMP) (Begg and Portes, 1993).[22] Integrating the East German economy with that of the West – effectively a transition from a centrally planned economy to a market based approach – was costly and, as with trade liberalization, the burden was not evenly distributed throughout the economy (Begg and Portes, 1993). Following reunification, unemployment rose considerably and rapidly. It hit 20% in East Germany in 2003 (Wunsch, 2004) and rose from 1% in East Germany during the second quarter of 1990 to 15.9% by the first quarter of 1992 (Begg and Portes, 1993). The breadth of the German response provides a healthy sampling of labour policies that could be implemented in BC to mitigate climate policy related adjustment costs.

Despite Germany's implementation of PLMPs, I do not consider their impacts. The predominant PLMP in Canada is the employment insurance (EI) program, which is managed by the federal government not applicable to the analysis of potential BC policy responses. Active measures fall under the scope of provincial powers. They differ from passive policies as they target labour market outcomes by attempting to improve the

[22] Active and Passive Labour Market Policies (ALMP and PLMP) are distinguished by their intent. Passive policies aim to reduce the burden of unemployment through the direct payment of benefits during the period of unemployment. Active policies are intended to create jobs by making unemployed individuals more hireable.

employability of an individual (Wunsch, 2004). Specific ALMP programs implemented in Germany include:

- Counselling and job placement services;
- Labour market training – including vocational and skills retraining programs (these programs were targeted towards the recently unemployed);
- Subsidized employment – including targeted wage subsidies to both employers and employees that were paid for up to one year, though individuals could reapply to the program after the end of the year (these programs were targeted towards the longer-term unemployment, those that had been unemployed for 6 months);
- Support for self-employment; and
- Supplementary programs that reduced the costs associated with job search and mobility – assistance was paid to cover transportation to interviews and moving to start a new job.

Source: Wunsch, 2004.

The effectiveness is of labour market policies in Germany is unclear, but are argued to have prevented a worsening of labour-related adjustment costs during the transition (Wunsch, 2004). Results from econometric studies on the effectiveness of ALMPs suffer from simultaneity bias, primarily because the government implemented so many programs that it is difficult to isolate the impact of one program from the others (Martin, 2000). It is also difficult to separate out the impact of a particular program on an individual from what would otherwise have occurred had the person not participated in the program, but the results did.

Despite simultaneity bias and the trouble isolating the impacts of individual programs, researchers do draw conclusions respecting their effectiveness; however, their conclusions should be viewed with caution. When the results are disaggregated, it the evidence suggests that certain policies were more effective than others (Wunsch, 2004).

A meta-study of econometric analyses of the impact of ALMPs show that targeted wage subsidies contributed to a regional growth in employment in East Germany (Wunsch, 2004). This finding coincides with a more general analysis on the effectiveness of ALMPs. An OECD report found that ALMPs are most effective when targeted (Martin, 2000).

4.4.3 Summary of policy responses to structural transitions

Both the Canadian and German experience to structural transitions confirms the hypothesis that over the short-term the benefits of the transition are not evenly distributed across an economy and that the result is a drop in output and employment. In each case, the government's responded with labour market policies.

Table 4: Summary of policy response to historical structural transitions.

Country	Policy	Outcome
Canada	Job Retraining Increased partnership with the private industry for retraining	Limited impact – output and employment dropped over the short-term (particularly in the import sensitive industries) Likely facilitated growth over the medium- to long-term as workers developed the skills to work under new conditions
Germany	Numerous ALMP and PMLP programs	Employment and Output dropped significantly in Eastern Europe despite policy response Targeted wage subsidies, employment counselling and job training reduced negative employment effects somewhat

5: Assessing the cap and trade models of the EU and New England

A number of conclusions can be reached regarding the impacts of the cap and trade models of the EU ETS. It is more difficult to identify successes and failures of the RGGI model due to its recent implementation, but early results from each case can be used to inform the development of the BC model. I base the assessment of RGGI and the ETS on observed and expected results, and secondary data.

Analysis of RGGI and the ETS is focused on the design features that can mitigate adjustment costs (outlined in Chapter 4). There is no baseline level of adjustment costs to work from to evaluate the specific impacts of each design feature. Instead, I identify the trade-off between changes is each design feature and the level of adjustment costs. For four of the five design features (cap level, allocation mechanism, banking and offsetting) the trade-off is linear. Moving from a 'high' cap (at or above current emission levels) to a 'low' cap (a level below current emission levels) increases adjustment costs (*see Figure 4)*. Increasing the number of allowances auctioned will result in higher adjustment costs. Reduced banking and offset provisions will increase adjustment costs. Assessing the impact of a revenue-recycling mechanism is a little less clear as there are a myriad of options to consider.

Figure 4: Representation of measurement system of the impact of each variable.

5.1 Impact of baseline and reduction rate

Setting of the baseline for emissions and the rate at which the cap decreases over time can significantly impact both the level of emissions reduced and the level of adjustment costs incurred. Both RGGI and ETS caps set their baseline at a level near the cap start date, provide significant advance notice regarding scheduled reductions in allowances, and employ a phased approach. The cap reduction rate is low or zero to begin with and increases over time. The time lag on the cap reduction is designed to mitigate adjustment costs as it provides entities with a time to explore a variety of abatement measures and prepare for the implementation of the cap.

Given that aggregate emissions have increased over the recent past, it is likely that setting the cap at current levels benefits most entities. However, entities that have reduced emissions will not receive any benefits for those reductions. It is unclear what impact this may have, but entities that have already employed many potential low-cost options for reducing emissions are likely to be penalized.

5.2 Impact of the allocation mechanism

The decision of whether to auction allowances or grandfather them is core to the discussion of adjustment costs. The argument in favour of grandfathering (GF) is that

firms that are unable to easily reduce emissions and that cannot pass forward to consumers the costs of the allowances will incur a significant increase in production costs. The argument for auctioning is that the increase in costs for covered entities is relatively small and that it increases the overall efficiency of the market, as entities that most require allowances are able to acquire them (Holt et al., 2007).

Adding complexity over the allocation method is that there are a number of different auction mechanisms and the scheme employed can influence the efficiency with which the market operates and its price.[23] There is substantial literature on the different types of auction design, but it is beyond the scope of this study. The focus here is on the higher-level question regarding the trade-offs between increased auctioning or increased grandfathering, though it is important that the province begin to assess auction mechanisms given that a minimum of 10% of the allowances must be auctioned.

There is a clear trade-off between auctioning permits and grandfathering (GF). Regardless of what you do, the creation of a cap and emissions permits creates a new asset and scarcity rents. GF is a transfer of rents and may transfer significant wealth to entities, while auctioning may unfairly burden certain entities, depending on their marginal abatement costs and nature of their markets. The distributional impacts of each allocation mechanism are dependent on the characteristics of a given entity.

Early results from the ETS highlight the distributional impacts. Power producers in the EU are able to pass increased costs to consumers and obtained windfall profits from the free transfer of emissions permits (Ellerman and Joskow, 2008). The most

[23] Whether an auction is sealed-bid or open-bid; single- or double-sided; ascending clock or other can influence the spot price, largely because the different types of auction provide different levels of information to firms who adjust their bids accordingly.

commonly argued remedy to the problem of windfall profits is to auction allowances (Sijm *et al*., 2006). Raymond Kopp highlighted the equity problem when testifying before the U.S. Congress on the lessons learned from the EU ETS. Kopp's comments highlight the importance of the allocation mechanism to the overall adjustment costs. He stated that,

> "Cap-and-trade systems establish a new class of asset—the emissions allowance—and these assets will have immediate value once the system is established; therefore, initial allocation of allowances is an allocation of wealth."
>
> ***Source*:** Resources for the Future, 2007 (p. 3).

Kopp also commented that,

> "The ability of government to distribute the economic burden a cap and trade system will impose on the economy is greatest during the allowance allocation stage. And importantly, the manner in which permits are allocated can alter the economic incentives leading to a variety of unintended consequences."
>
> ***Source*:** Resources for the Future, 2007 (p. 3).

Clearly the allocation mechanism is core to the discussion on adjustment costs and the costs of complying with the cap. The concern with the GF of permits is that depending on the incidence, GF may distribute windfall profits to certain industries. The designers of the RGGI mechanism understood the impact of incidence. Recognizing that power producers are likely able to pass through the costs of allowances through to consumers they encouraged a higher percentage of auctioning and then used the revenue to address the impacts on consumers. The lessen is not that a full auction solves all ills, but rather that understanding the implications of the incidence of emissions pricing is core to choosing the most appropriate allocation mechanism.

The EU ETS recognized the distributional impacts experienced by entities during the first compliance phase and are now pursuing a new allocation mechanism for Phase II that differentiates across industries. Power producers will likely have to purchase close to 100% of allowances through an auction during Phase III. It is not clear whether other industries will be subject to the same rules.

5.3 Impact of offsets

Offsets create a direct trade-off between the level of adjustment costs and the level of emissions reductions. It is difficult to certify that offset projects provide for real reductions in emissions that are irreversible and that represent an emissions reduction that would not have otherwise occurred (Ellerman and Joskow, 2008). Focusing solely on adjustment costs, higher levels of offsets will lower the level of adjustment costs as firms are able to avoid having to invest in new, potentially more expensive abatement technologies over the short-term.

Both the EU ETS and RGGI allow for a limited percentage of emissions to be reduced by offsets. In relative terms, the ETS allows for a higher percentage of permits (13% versus 3.3%) to be offset and allows for a wider range of offset projects to be included, which is likely to result in lower adjustment costs for ETS entities relative to the RGGI entities.

5.4 Impact of banking or borrowing

Banking provisions, like offsets, can impact upon both the level of emissions reductions and the adjustment costs. A WCI report (2008) concluded that allowing

entities to bank emissions is the most effective tool for reducing adjustment costs.[24] Banking is also said to reduce volatility in the emissions price, but there may be a trade-off between banking and borrowing of allowances, and achieving emissions reductions. If the initial allocation of permits is too high, banking can delay emissions reductions (Ellerman and Joskow, 2008). Borrowing of permits can also delay emissions reductions (Ellerman and Joskow, 2008).

Both the ETS and RGGI allow for banking, which will result in lower adjustment costs as firms can better align their investments in new capital with the retirement of existing stocks, assuming that firms have an excess of allowances during the early years of the cap. The EU ETS allows for borrowing of future allowances, which could further reduce the compliance burden on certain industries. RGGI has a mechanism to limit the potential adverse impact of banking by limiting the maximum amount of banked allowances that can be used in a given year. Without such a provision, there is the potential that emissions reductions will be lower than they would otherwise be.

5.5 Impact of revenue-recycling mechanisms

Policies funding clean technologies will likely reduce adjustment costs over the medium- to long-term. Additional funding could foster greater levels of experimentation with clean technologies, which will reduce the option value of adopting clean technology (Jaccard et al., 2006). Experimentation is seen as an important part of supporting the development, deployment and diffusion of new technology and increases the likelihood

[24] Banking can significantly reduce adjustment costs if the emissions price is relatively low over the short-term. This allows entities to withdraw and use emissions allowances that were banked at the low price during times where the price is higher.

that industry will shift to the most effective, least costly clean development pathway (Unruh, 2006; Rotmans, 2005; Foxon, 2008; Jaccard et al., 2006).

A common argument amongst many economists is that any form of emissions pricing provides an opportunity to reduce less efficient taxes, which can produce a 'double-dividend' – the efficient reduction of emissions and the reduction of distortionary taxes (personal and corporate income taxes) (Parry, 1998). Reducing personal or corporate income taxes may be beneficial over the medium- to long-term, but they do not addresses short-term adjustment costs. The severity of adjustment costs – specifically referring to the drop in output and profits, and employment – could limit the applicability of the 'double-dividend' hypothesis. If firms reduce output, gross revenues fall and the amount of the tax reduction will decrease. From the perspective of the individual, those individuals that are laid off will not benefit from the drop in personal income taxes. Additionally, firms whose profits decrease will benefit less from corporate income taxes than firms with no change in profits.

The ETS has not yet dealt with the issue of revenue-recycling, primarily because it has yet to implement a large-scale auction. Preliminary proposals recommend using auction revenue to invest in renewable energies to help the EU meet their commitment to provide 20% of their energy by renewables by 2020 (Ellerman and Joskow, 2008).

RGGI also focuses on funding clean technologies and stipulates that at least 25% of the total value of emissions allowances must be used to fund the development, diffusion and deployment of clean tech. Some states have also directed funds into energy efficiency programs for consumers. At this point it is unclear what the impact of such programs will be.

Table 5: Impact of key design features on emissions reductions and adjustment costs.

	EU ETS		RGGI	
	Policy	**Outcome**	**Policy**	**Outcome**
Baseline and reduction rate	Low reduction rate Phased approach	Lower adjustment costs	Low reduction rate Phased approach	Lower adjustment costs
Allocation mechanism	Limited auction	Lower adjustment costs	Near full auction – some offsets for specified criteria	Higher adjustment costs
Offsets	Higher percentage of offsets allowed Broader range of offsets allowed through Kyoto CDM	Lower adjustment costs relative to RGGI	Lower percentage of offsets permitted (figure is flexible to conditions)	Higher adjustment costs (lower if allowable offsets increases)
Banking or Borrowing provisions	Unlimited banking and limited borrowing	Lower adjustment costs	Unlimited banking during compliance periods, but no borrowing	Lower adjustment costs
Revenue-recycling	Mechanism yet to be detailed	Result unclear	NRG efficiency programs and low-income support	Result unclear

6: Policy options

In this chapter, I develop potential options for the specific design features that BC has discretion over. The status quo option – no cap and trade – is not considered. Having signed onto the WCI initiative, BC has committed to action.

Not all of the design features discussed in Chapters 4 and 5 are amenable to the study of how BC can implement cap and trade. The cap and trade scheme is bound by the rules of the WCI framework. Accordingly, options that conflict with the framework established by the WCI and design features that must be developed through negotiation with partner jurisdictions are not assessed and are beyond the scope of this study.[25] Specifically this means that cap setting, cap reduction rates, the use of the offset mechanisms and setting of an economy-wide price ceiling or floor are not considered as options. One other feature not considered is allowance banking. As noted above, it significantly influences adjustment costs,[26] but given that the WCI draft policy currently permits unlimited banking[27] and there is no environmental justification for not allowing firms to bank unused allowances there is no need to asses different banking options.

Accordingly, I present policy options that differ in respect of their allowance allocation and revenue-recycling mechanisms. The list of policy options presented is not

[25] As the cap and trade scheme is implemented, rules that were/are negotiated with partner jurisdictions should be monitored to determine the impacts and whether any adjustments should be proposed.
[26] Banking is cited as the greatest single factor in reducing compliance costs (WCI Background Report, 2008).
[27] The WCI is considering imposing limits on the number of allowances that can be banked, but has not yet specified an explicit policy.

exhaustive. The intent is to provide a high-level assessment of the impacts and trade-offs between pursuing different options.

Another set of policy options that I do not consider are those that may result in delayed adjustment. Specifically, this means that there will not be any exemptions or an increase in allowances that are beyond each individual firm's baseline level, unless the entity purchases those allowances on the market. The intent behind excluding these types of policies is that they reward firms that continue to emit in a world of carbon constraints, and given the fact that there is a province-wide hard cap, additional allowances provided to on firm can only come at the expense of another firm. Not only is this type of policy likely to be politically contentious, it is dubious on equity grounds and on the incentive it provides for firms.

6.1 Developing cap and trade features specific to BC

With respect to the development of features specific to BC there are, broadly speaking, two different classifications of options – full auction of permits or something less than full auction. If full auction is pursued, then the government need only consider how best to design the auction and decide on implementing one or more of the various revenue-recycling options. If the government pursues something less than full auction, then the government must consider various allocation options that include a component of grandfathering of allowances. Figure 5 depicts a pathway that highlights 3 key decision points facing policy-makers. The first step is the decision on the level of the auction. If full auction is employed, then policy-makers bypass step 2. If some amount less than 100% is auctioned, policy-makers must attempt to develop a mechanism for grandfathering a certain percentage of the allowances. Regardless of the allocation

mechanism selected, a minimum of 10% of the total number of allowances will be auctioned off, meaning that there will be at least some level of auction revenue generated and that the government will have to consider revenue-recycling measures.

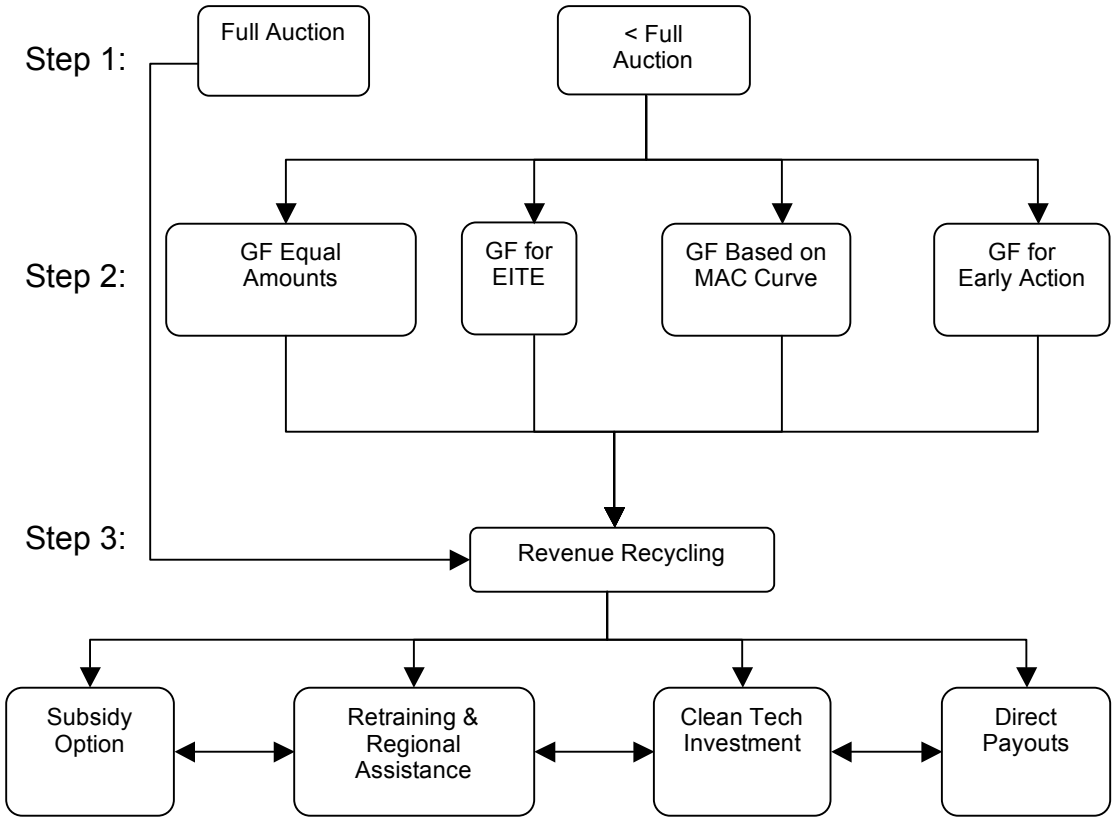

Figure 5: Decision pathway for developing a cap and trade system.

Figure 5 outlines each of the allocation and revenue-recycling options considered. It also serves as the foundation for the analysis of the policy options carried out in Chapter 8.

6.2 Allocation design options

The proposed allocation mechanisms are developed with insight from the RGGI and ETS models, and the proposed Australian cap and trade scheme. Broadly speaking

there are two types of allocation mechanisms – full auction and less than full auction. Within the subgroup of mechanisms that involve less than full auction, there are a number of different options within the grouping of options that auction less than 100% of allowances.

There is some interplay between the allocation mechanism and the total number of allowances, but there is no change in the overall number of allowances under any of the allocation options. The total number of allowances is set at the baseline amount and is based on measured emissions from covered firms. Under full auction, the measured baseline of emissions from each firm covered by the cap and trade scheme is only relevant in that it contributes the total number of allowances that will be auctioned. Entities must then bid to secure allowances through the auction market. If they are unable to secure enough allowances to cover their baseline level, they may purchase allowances from other entities in the market, purchase offsets or reduce emissions.

If the full auction option is not pursued, then a baseline emissions level for each firm is relevant to the allocation mechanism and is used to determine the level of allowances that may be grandfathered. If a firm is exempted from the auction, then they will receive the baseline level of their allowances. If a firm must purchase a portion of their allowances through the auction, the baseline level would be used to determine the amount of grandfathered allowance. Under this scenario, firms would essentially have their total number of allowances topped up to reach to the point where the allowances they hold is equal to their baseline level. This ensures that firms or industries that receive preferential treatment with respect to the distribution of permits do not receive more permits than their baseline level.

6.2.1 Allocation design option #1

The first allocation model involves full auction of allotted permits. Each entity covered by the cap must purchase 100% of their allowances through the auction. This design is partly modelled on RGGI, which pursues full auction – although it should be noted that while some states auction close to 100% of their allowances, none auction the full amount and some auction closer to 50% of the total allowances.

6.2.2 Allocation design option #2

The second allocation model is partly modelled on the EU ETS. It prioritizes the minimization of adjustment costs across all industries by making use of the flexibility built into the WCI framework. Under option 2, each firm must purchase the same percentage of allowances.

In theory, the auction level could be at any point between the minimum (10%) and the maximum (100%). In order to better illustrate the trade-offs between shifting from full auction to a point less than that amount, I assess the implications of pursuing an auction level of 10%.

6.2.3 Allocation design option #3

The third option treats Emissions Intensive, Trade Exposed (EITE) industries differently from non-EITE industries. EITE firms are grandfathered allowances, while non-EITE industries must purchase allowances at full price through the auction. Essentially, the grandfathering of emissions is an upfront subsidy, in this case paid directly to EITE industries. Under this option, EITE firms are grandfathered all of their allowances; however, in theory the level of assistance provided to these firms in the form

of grandfathered allowances is adjustable. The intent here is to illustrate the implications of moving towards the more extreme position.

6.2.4 Allocation design option #4

The fourth option differentiates how allowances are allocated across industries based on their emissions performance since a given date. The baseline could be set at any point, but 1990 levels (Kyoto Protocol) or the baseline year used by the WCI (2010 levels), is the most logical. Under the option, entities that have reduced emissions to levels below the baseline by the implementation date will receive credit for early action. The credit will be grandfathered permits during the first allocation round. The level of credit can be altered with relative ease and could be altered to place more or less emphasis on early action. Depending on whether there is a big divergence in investments to reduce emissions undertaken at different dates, the impacts could be quite large across industries and firms within the industry.

6.2.5 Allocation design option #5

Under option 5, each firm is grandfathered a specific amount of emission allowances, but both the absolute amount and the percentage of allowances allocated to each differs across firms. The percentage of allowances grandfathered is based on the marginal abatement curves for each firm. All else equal, a firm with a steeper marginal abatement curve will incur greater adjustment costs and will therefore receive a greater number of their allowances free. For this option to be implemented, the government will have to calculate the marginal cost of abatement for each covered entity. This will require significant co-operation from industry.

6.3 Revenue-recycling options

Each allocation mechanism has at least a 10% auction component meaning that the government will generate some revenue from the sale of allocations. The revenue-recycling options are not mutually exclusive and are limited only in scope by the amount of revenue that is generated by the auction. While the options are not mutually exclusive, they are analyzed discretely to isolate the expected impacts.

The options are adapted from historical policy responses to economic transitions, literature regarding climate policy and expansion of current WCI policy. I do not consider further cuts in the provincial corporate or personal income taxes because the BC carbon tax has already cut the PIT and CIT rates and because those that will be most impacted by the WCI will benefit the least from further tax cuts. From the industry perspective, firms that face significantly higher costs and thus, lower net income from the cap and trade regime may gain only slightly from income tax cuts. From the labour perspective, workers that lose their jobs will find it difficult to sustain their former income level, and hence won't benefit from reductions in personal income taxes.

None of the options considered consider specific programs to offset any impacts on consumers from carbon policy costs that are shifted forward to them. Given that the natural gas industry and refineries are likely able to pass through the majority of costs to consumers, there is a rationale for including an analysis on options that can reduce the associated burden on consumers. Such options are not considered in this study as the focus is on assessing the impacts on EITE firms; however, it does not necessarily preclude the need or viability of consumer-targeted options.

It is also important to highlight that the options presented and discussed represent a sampling of potential revenue redistribution schemes. Beyond the WCI rule that mandates 1% of the value of all allowances to be directed into a clean technology fund, there are no regulatory or legislative requirements directing the province to use the funds in a certain manner.

6.3.1 Revenue-recycling option #1

The first revenue-recycling option is a subsidy to EITE firms or to labour operating in those firms. If directed towards labour, it could be targeted wage subsidy. If directed towards firms, it could be cash transfer. In each case, a decision would have to be made regarding the timing and duration of the subsidy. It could decrease over time and be phased out (e.g. at the end of the second compliance phase).

With respect to this type of subsidy, there is also the option of tying the subsidy to performance standards. With respect to the direct firm subsidy, it could be made contingent on maintaining employment and/or output levels. The rate at which the subsidy declines is to be stated up front to provide firms with certainty over the timing and subsequent reductions in amount of the subsidy.

There are a number of ways in which the mechanics of a subsidy could be designed[28]. The optimal direct cash subsidy should be specific to each firm and be based on the best estimates of the net expected cost increases. Wage subsidies should also be provided to those firms that are most in need and could be tied to observed employment

[28] One example among many is an EI program where struggling firms pay workers for 4 days of work. The workweek is reduced to 4 days; however, 50% of the 5th day of wages is paid by EI. This allows firms to reduce output during bad times without having to lay off staff.

effects. In both cases some criteria would need to be developed to assess whether individual firms are in need of climate related adjustment assistance.

The subsidy is designed to be temporary to ensure that firms understand that if they do not make the expected adjustments they will simply be delaying the impact of the transition costs and thus have an incentive to invest in emissions reductions.

6.3.2 Revenue-recycling option #2

The second revenue-recycling model focuses on job training and the provision of regional assistance to affected workers and regions. The objective is to assist both affected individuals and regions transition to the low carbon economy. Under this option, the auction revenue is directed into a low-carbon economy fund. This type of option would require the development of a set of criteria to evaluate whether a displaced worker or an affected region qualifies for assistance, and how much assistance will be delivered to each qualified individual or region.

The targeting of the funding would also have to be set. With respect to individuals that are displaced by the impact of the cap, the focus of the assistance could be on improving their development of transferable skills or other skills that are more resistant to economic shocks. Alternatively, the focus could be on developing the necessary skills to work with new low-carbon technologies and processes.

Under this type of option, regions dependent upon EITE industries (could be defined as those regions having more than 25% of their economy dependent on natural resources) will be the beneficiaries. The intent of the fund is to provide affected regions with opportunities to diversify their economies and shift to activities that are less carbon

dependent. As with the job training program, the provision of assistance also necessitates the development of criteria to evaluate proposals from each region. If the focus was on improving the prospects for shifting to low-carbon, the program could provide preference towards providing regions with opportunities to engage in offset projects.

6.3.3 Revenue-recycling option #3

The third revenue-recycling model expands upon the 1% clean technology fund commitment. All of the revenue generated from the auction is directed into a provincial green technology fund. The funds are used to assist with the development, deployment and diffusion of new, clean technologies and processing. Priority funding is granted for the development of technologies that can reduce emissions from industries classified as EITE.

This type of option necessitates the development of a set of criteria outlining what types of technology will access the funds. The prevailing argument on setting out guidelines respecting funding of technologies is that the government should avoid picking winning technologies. Rather, they should focus on providing broad assistance, monitor the market response to technologies and then remove funding to technologies that the market does not support.

6.3.4 Revenue-recycling option #4

The fourth option follows from the definition of a *potential Pareto improvement*. Individuals that are adversely affected by the impact of the cap are compensated directly for their loss. Under this option, policy-makers would have to develop a mechanism for

identifying ‘adversely affected’ entities and develop criteria to establish the quantum of assistance delivered.

7: Criteria and evaluation measures

A broad set of criteria is employed to evaluate each policy option and to highlight the trade-offs facing policy-makers as they develop BC's cap and trade mechanism. The effect of each option on emissions reductions is not considered. Under each alternative, the cap is assumed to remain constant and is set exogenously in negotiation with the WCI. Accordingly, each adjustment policy is not likely to effect emissions over the short-term.[29] Each criterion has a qualitative measure that is derived from my cases and literature review. Table 6 presents a summary of each criterion and measure.

Table 6: Criteria for the assessment of policy options.

Criterion	Definition	Measures
Vulnerability to Adjustment Costs	Evaluates the likely vulnerability of individual industries (specifically EITE industries) to cap and trade related adjustment costs under each policy	Highly Vulnerable Somewhat Vulnerable Not Vulnerable
Gaming	Evaluates the level of gaming likely to result from the implementation of the policy	Very significant Somewhat significant Not significant
Administrative Ease	Predicts the ease of implementation of and cost of compliance with each policy option	High (relatively simple to administer) Medium Low (relatively hard to administer)
Distribution of costs	Evaluates the inter-industry equity of each policy from the perspective of equal burden sharing	High (Costs borne equally) Medium Low
Prospects for Long-term Change	Evaluates each option's potential to facilitate the desired shift to low-carbon over the long-term	High Medium Low

[29] There is an argument that increased funding for clean technology could lead to further reductions over the medium- to long-term, assuming that the increased funding results in more rapid development and deployment of low-emissions technologies.

7.1 Vulnerability to adjustment costs

I consider the impact of each policy on industries of the BC economy that are vulnerable to cap and trade related adjustment costs.[30] It is less important to consider the impact of adjustment costs on industries that are less vulnerable to climate policy. They will experience a far lower burden, largely because they are able to pass through a higher percentage of adjustment-related costs to consumers.

Consumer-related adjustment costs may also necessitate a response, but the impact of the cap and trade on consumers during the first compliance phase will be more diffuse on consumers than it will be on vulnerable industries. The relatively acute impact on certain industries reinforces the notion that it is more pressing to focus on the industries that are covered by the cap.

Another justification for restricting the focus of adjustment costs to industry covered by the cap follows from British Columbia's experience in implementing the carbon tax. There is an argument that the carbon tax revenue-recycling scheme is disproportionately beneficial to consumers (Finlayson, 2008), which reinforces the need to focus on the industry-related costs associated with the cap and trade.

7.2 Potential for gaming

The criterion of gaming attempts to measures the impact of an option on industry behaviour. The gaming concern considered in this study focuses on the impact of firm behaviour in response to the initial distribution of allowances and the redistribution of auction generated revenue. Depending on the policy design, firms may alter their

[30] Vulnerable industries are those identified in Chapter 3 as EITE. They include mining and metals manufacturing, pulp and paper manufacturing, coal manufacturing and cement production. Aluminium may also be considered EITE, but it is less vulnerable than the aforementioned industries.

behaviour to secure more initial allowances; a greater percentage of free permits; or garner greater benefits from revenue-recycling than what is merited.

7.3 Administrative ease

Acknowledging the administrative complexity involved with the design and implementation of allocation and revenue-recycling mechanisms is an important component to selecting the best alternative. Greater administrative complexity increases the costs of compliance and can significantly reduce the likelihood that it will be properly implemented.

7.4 Distribution of costs

Climate change is a collective problem in which we all share the burden of action. This criterion measures how effective the option is at distribution the burden of complying with the cap and trade across the economy.

7.5 Effect on the prospects for long-term structural change

The intent of the cap and trade mechanism is to reduce emissions and facilitate the transition to low-carbon in an efficient manner. Structural adjustment assistance may be required for certain industries, but it should not impede or slow the transition to low-carbon. Accordingly, measures that address adjustment costs should, if possible, be implemented in a way that lays the groundwork for a low-carbon environment. Each policy option is assessed on whether it improves of impedes the likelihood of achieving long-term structural change.

Table 7: Criteria for the assessment of policy options.

Criterion	Definition	Measures
Vulnerability to Adjustment Costs	Evaluates the likely vulnerability of the BC economy and of individual industries (specifically EITE industries) to cap and trade related adjustment costs under each policy option	Highly Vulnerable Somewhat Vulnerable Not Vulnerable
Gaming	Evaluates the level of gaming likely to result from the implementation of the policy	Very significant Somewhat significant Not significant
Administrative Ease	Predicts the ease of implementation of and cost of compliance with each policy option	High (relatively simple to administer) Medium Low (relatively hard to administer)
Distribution of costs	Evaluates the inter-industry equity of each policy from the perspective of equal burden sharing	High (Costs borne equally) Medium Low
Effect on Prospects for Long-term structural change	Evaluates each option's potential to facilitate the desired shift to low-carbon over the long-term	High Medium Low

8: Assessment of options

Designing cap and trade mechanisms is complex and there are many trade-offs within the possible range of design features that it make it difficult to identify whether one option is clearly better than all others. This evaluation highlights the implications of adopting specific cap and trade design features over others.

8.1 Summary of expected impacts of allocation options

The evaluation of each allocation option is based on analysis of the ETS and RGGI mechanisms and literature on the expected impacts of cap and trade systems. I identify the expected impacts for BC. I separate the analysis into two steps, focusing first on the decision of whether to employ a full auction or some amount less than the full amount. The second step is to analyze the options that auction less than 100% of the allowances. As noted, the analysis follows the pathway outlined in Figure 4.

8.1.1 Step 1: Determining the level of allowances to be auctioned

The first step in developing the BC specific cap and trade system is to decide on the level of permits that will be allocated through the auction.

The primary trade-off to consider when pursuing full auction versus some amount less than the full auction is tied to the timing of the delivery and the nature of the assistance that can be provided. Full auctioning of allowances does not necessarily provide any assistance upfront, but provides the opportunity to provide greater levels of assistance in response to observed impacts. Grandfathering some quantum of allowances

provides some level of upfront assistance, but in doing so there is a lost capacity to act in response to observed impacts.

In terms of the nature of the assistance that is provided, full auctioning allows for policy-makers to employ a broader and deeper response. A lower auction component reduces the upfront costs for firms, but comes at a cost; primarily because the government's loses some of its capacity to smooth any cap-related transition costs and any unforeseen consequences.

There is also an ethical component to consider when distributing emissions allowances. People may find it unethical to give 'polluter's allowances without charge because this conveys the notion that they have been given the right to pollute and to earn rents from their allowance holdings.

When considering the auction level, in terms of the timing and nature of assistance, employing a full auction has the potential to reduce adjustment-related costs more effectively than a grandfathering approach. There is a lot of uncertainty respecting the expected emissions price and hence, the actual impact of the policy on firms. This uncertainty provides a strong argument for preserving the ability to react to observed impacts. There is also an argument a full auction with a higher level of revenue-recycling will confer greater benefits than providing upfront assistance, although that depends on the revenue-recycling scheme employed, (Morganstern, 2007).

Additionally, a full auction is the most economically efficient in terms of how it distributes the allowances. It is efficient in the sense that each entity pays what an allowance is worth to them (Holt et al., 2007). It allows government to redistribute

revenues *ex-post* in a manner that targets observed outcomes and reduces inequities (Holt et al., 2007).

Empirically, a full auction plus redistribution is clearly better when analysing the impacts on firms that can pass through the costs of emissions. A recent study focused on the social and private costs of auctioning emissions permits to firms found that the social costs of compliance are far higher with free allocation than with auctioning (Burtraw, 2008). The rationale is that the redistribution of auction-generated revenue can reduce social costs by a greater amount than the amount they rise by in response to the cap (Burtraw, 2008). Burtraw's analysis is valuable; however it only focused on an industry (electricity) that can pass through the costs of compliance.

While there are benefits to full auctioning, it is clear that it is very difficult to implement, particularly because it means that each firm faces the same marginal price for a unit of CO_2 that they emit. Given differences in marginal abatement costs amongst the industries (and firms within each industry), 100% auctioning means entities will face very different adjustment costs. It is likely that the result of the differentiated impacts will lead to a significant level of pressure from industry to reduce the percentage auction level. The experiences of RGGI and the EU ETS highlight these difficulties. Neither of these systems implemented a full auction component and, in some cases, there were significant exemptions provided to certain industries and firms. The fact that RGGI was unable to implement a full auction is perhaps most telling of the difficulty of implementing such a policy. RGGI deals solely with one industry, but still recognize differences in firms' characteristics. The lesson here is that employing a policy where

differences amongst entities are not taken into account is challenging and may not be feasible.

One of the main challenges associated with cap and trade schemes in general, related to the auction component, is that there is no price certainty. The lack of price certainty increases adjustment costs as it makes it more difficult for all affected entities to plan their response and for governments to assess the impacts. While it was not considered in detail in this study, there is an argument that price uncertainties can be reduced through the auction mechanism by setting a price ceiling and floor. Setting a price ceiling for EITE firms is a logical choice in this regard. A recent quantitative study by the IEA (2008) found that price caps reduce much of the cost uncertainty and significantly reduces abatement costs.

One additional consideration with moving away from a full auction is that if a full auction component is not pursued, and each covered industry receives the same level of benefits, there will continue to be a differential between individuals firms' private costs of compliance. If full auction is not pursued, the outstanding question then becomes; how many allowances should be grandfathered and to whom should they be provided, and whether the grandfathering of allowances should be used as a means of reducing the differential costs of compliance across industries. Administratively, this poses a complex set of questions that need to be addressed. The trade-offs between moving away from full auction are highlighted in Table 7.

Table 8: Summary of the evaluation of a full auction and the minimum auction of permits.

Criteria	Full Auction	Min. Auction
Vulnerability to Adjust. Costs	**Highly vulnerable** (Greatest potential to reduce costs with revenue-recycling)	**Low vulnerability**
Gaming	**Low** (Provided auction design resolves auction related gaming)	**Low**
Admin. Ease	**High** (Complexity dependent on auction mechanism)	**High**
Distribution of costs	**Initially Low** (Depends on rev-recycling, but potential to offset)	**Low**
L.T. impacts	**High** (Greater potential with increased revenue-recycling)	**Low** (Limited impact)

8.1.2 Step 2: Decision on how to grandfather emissions allowances

As noted above, if the decision is made to pursue a less than full auction, the question becomes how many permits should be grandfathered and to whom. In considering these options, it is important to consider that the provision of credit for early action can be combined with any grandfathering scheme. As such it is considered separately.

When considering each of the grandfathering options, the key trade-off is between administrative ease and how well the costs are distributed across covered entities. Treating covered entities equally improves the administrative component to the program; however, as noted in section 8.1.1 there remains a significant differential in terms of the private costs of compliance for each firm. In cases where firms are able to pass through

the costs of compliance, grandfathering amounts to a significant transfer of wealth and revenue from the government to those firms. This is precisely what happened in the EU, as firms that were able to pass through the emissions costs captured significant rents (Ellerman and Joskow, 2008).

Essentially grandfathering of allowances is a transfer of rents to covered entities. Each of the options considered involves a transfer of some level of rents. Given that there is a transfer of rents, there is likely to be a significant level of gaming involved with each option.

8.1.2.1 Grandfather permits to each industry based on coverage or vulnerability

The option of grandfathering permits to EITE industries is much more effective at evenly distributing the burden of an emissions price across covered sectors. The key trade-off with this option is same as that considered in step 1 (pursuing full auction or less than full auction). Ultimately, providing vulnerable industries some form of compensation upfront compromises the government's ability to respond to unforeseen consequences and observed impacts.[31]

Targeting EITE industries for assistance through grandfathered permits may also generate much broader support from industry than other modes of providing assistance, but is not without its challenges. Administratively this type of option is complex. It is

[31] A potential way to mitigate the impact of this trade-off involves charging a set price for a permit that lies somewhere below the market clearing price for allowances. This type of option would ensure that while some assistance is still provided, the government would generate a greater amount of revenue. This type of option was not considered in detail in this study, but having considered either extreme (auction vs. grandfathering) I have highlighted the trade-off incurred if government applies a set fee for an individual permit. It provides some assistance up front, but also ensures that there will be a larger revenue pool from which can be recycled to address observed impacts. Another positive impact of a price ceiling is that it provides industry with greater cost certainty.

feasible to conduct a qualitative analysis to determine which industries are likely to be vulnerable (highlighted in Chapter 3) and therefore in need of assistance, but it is difficult to quantify the difference between each covered entity. Basing assistance on qualitative assessments may not provide individual firms with a 'fair' level of assistance. This assessment is consistent with the prevailing argument that it is likely to be politically contentious and difficult to get it right with any certainty (Morgenstern, 2007). Again, a quantitative analysis predicting the adjustment costs for EITE industries would reduce the associated political contentions, but such calculations are complex and based on a number of assumptions regarding diffusion rates of new technology, and the elasticities of firms' inputs and goods.

Despite the complexities associated with developing criteria for grandfathering emissions, some argue that without it, several entities will be at risk. McKinsey & Company (2006) argue that grandfathering is a necessity for emissions intensive firms in Europe and without the assistance, there is the chance that they would no longer be able to operate. They found that firms with high levels of direct emissions (e.g. cement manufacturing) are dependent on receiving free allowances as this scheme offsets a high percentage of adjustment costs. Applying the argument in BC suggests that some firms operating in the pulp and paper, coal manufacturing, mining and material manufacturing, and cement production are likely to struggle in the absence of any assistance and may depend on receiving some quantum of assistance in order to continue their operations.

Another challenge with free allocation is that over the long-term, direct *ex-ante* subsidies (GF of permits) could delay investment in activities that would reduce emissions (Bernard et al., 2007). Evidence from previous transitions suggests that

subsidizing struggling firms may delay efforts to transition, predominantly as they gain the financial capacity to continue production without investing in reducing emissions (McKenzie, 1984). This suggests that an *ex-post* redistribution of funds is likely better as may require that firms make decisions without the benefit of having received the subsidy.

Essentially, with the grandfathering options there is the option to provide support to each firm or targeted assistance. One of the options for providing assistance to each firm justifies the provision of assistance based on quantified data (individual firms' marginal abatement cost curves) and reduces some of the problems associated with straight grandfathering. However, while differentiating assistance based on actual abatement curves is desirable and equitable, it is less plausible. It is difficult to accurately identify the abatement curves of individual firms and any calculation made would require significant input from affected firms, increasing the likelihood of gaming. Also, there is a lot of uncertainty regarding the prospects for technological development and the level of uptake of new technologies (Jaccard, et al., 2006), which undermines the usefulness of predicating decisions on abatement cost curves.

8.1.2.2 Providing credit for early action

Providing credit for early action is also an option for BC; however, it may be too difficult to accurately assess whether firms acted early to reduce emissions. Also, it is important to consider that baseline year selected will influence the result of the program. Perhaps the most beneficial aspect to providing credit for early action is the provision of an incentive for firms to reduce emissions without delay.

When assessing the feasibility of the program, the first aspect to consider is the baseline year. If a year such as 1990 is used, it may be less beneficial. Arguably, GHG reductions from 1990 may not be indicative of improvements in emissions intensity or having taken early action and may be a result of a downturn in the industry (i.e. pulp and paper industry). Another challenge in assessing reductions is because measuring systems have changed over time. Rio Tinto Alcan reported that their emissions levels decreased as a result of a new Environment Canada system for measuring emissions (Rio Tinto Alcan Environment Report, 2007).

Providing credit for reductions between the WCI baseline year and the implementation date (Jan. 1, 2012) may be more feasible and would also provide incentives for firms to take early action where possible; however it may not provide much assistance because emissions are likely to be lower over the coming year due to the economic downturn.

Another administrative challenge to consider relates to determining how much credit should be given for early action. The government would have to identify a rationale for establishing the level of credit. In theory, the level of credit is variable and should only influence firms' incentives to take early action.

8.1.2.3 Summary of the evaluation of grandfathering options

Despite the challenges in identifying how much assistance BC should provide through the allocation mechanism and to whom it should be provided, there are both political and economic grounds for implementing policies that recognize the challenges facing certain industries. Many recent studies highlight the distributional impacts of cap

and trade policy and suggest that in the short-term these impacts require a policy response (Burtraw, Sweeney and Walls 2008). While the qualitative industrial analysis in Chapter 3 identifies the industries of industry that are likely to be most vulnerable to the cap and perhaps answers the question of who should receive assistance, it does not provide a definitive answer regarding the 'optimal' level of assistance.

As noted, studies in Europe concluded that grandfathering was crucial for the survival of vulnerable industries (McKinsey & Company, 2006). While this is a plausible scenario for BC, the study in Europe is more a confirmation on the need for assistance, not the form of assistance required. Arguably, one could conclude from the McKinsey study that the assistance could either be provided upfront through grandfathering or through some alternative redistributive mechanism.

What my study does suggest is that there is justification for providing assistance to EITE industries and that it may be fundamental to there continued survival. The larger question of whether the assistance should be *ex-ante* or *ex-post* is more difficult to assess. Research suggests that the compensating impact of free allowances is difficult to accurately measure (Hourcade et al., 2007) and the difficulty in measuring the impact of free allocation means it will be difficult to determine how many allowances should be allocated without charge. It also does not necessarily provide assistance to individuals that work in affected sectors. Essentially, the outcome for labour and affected regions is dependent on whether the grandfathered permits provide sufficient assistance. Labour and rural regions will only be protected in the event that the grandfathering of allowances ensures that there are little or no output or employment effects.

Table 9: Summary of policy evaluation of allocation mechanisms employing less than a full auction.

Criteria	Equal Auction	GF permits for EITE industries	GF on abatement cost curves	GF credit for early action
Vulnerability to Adjust. Costs	**Somewhat vulnerable** (Depends on # of permits auctioned)	**Lower vulnerability**	**Lower vulnerability**	**Somewhat vulnerable** (Unclear how much benefit there will be and who will benefit)
Gaming	**Not significant**	**Very significant**	**Very significant**	**Not significant** (Unless firms lobby for differing base years)
Admin. Ease	**Medium** (Need criteria to justify setting auction level)	**Low** (Need hard criteria to identify EITE)	**Low** **(Beyond critical value – too complex to implement)**	**Low/Medium** (Depends on baseline year and need to set criteria)
Distribution of costs	**Medium** (Depends on how many permits are auctioned and rev-recyc.)	**High** (Based on accurate measures)	**High** (Based on accurate measures)	Depends on the baseline year More recent baseline year favours low cost emitters
L.T. impacts	**Medium** (Depends on how many permits are auctioned)	**Medium** (May assist struggling firms to shift, but may delay action)	**Medium** (May assist struggling firms to shift, but may delay action)	**High** (Provides additional incentive for reducing emissions)

8.2 Summary of revenue-recycling options

The assessment of each of the revenue-recycling options is based on economic theory and a review of secondary data. Table 9 summarizes the trade-offs between each of the options.

8.2.1 Assessment of revenue-recycling options

As noted in Chapter 6, none of the revenue-recycling options considered are mutually exclusive and each option is limited only in scope by the revenue generated through the auction component. While each option is analyzed independent of allocation mechanisms, greater levels of auction revenue result in more freedom for policy-makers in developing their responses. This is a general argument in favour of auctioning greater levels of allowances, and the evidence suggests that it provides an opportunity to confer benefits to the broader economy (Morgenstern, 2007).

The first option (subsidization labour in EITE industries or the industry itself) is similar in impact to targeted grandfathering (GF) of permits. It acknowledges that industries should be treated differentially based on their ability to cope with adjustment costs. The policy differs from the policy of GF to EITE firms in respect of timing. The GF of permits is an *ex-ante* transfer of cash/wealth whereas the subsidy is an *ex-post* redistribution. The Australian government's Green Paper (2008) on emissions trading assessed the impact of a direct cash transfer to firms. They argued that the impact over the short-term is difficult to accurately assess because of uncertainties over both the emissions price and quantitative impact on firms during the initial stages of the trading schemes' implementation. These uncertainties add administrative complexity for policy-makers who have to approximate the appropriate amount of money to transfer to affected firms and imply a need for a monitoring component to the program to assess whether there is a need to top-up firm subsidies or scale them back.

The provision of a wage subsidy is somewhat different from the *ex-post* or *ex-ante* subsidy. It is tied to employment levels and ensures that the benefits of the subsidy

are shared between labour and shareholders/owners of capital. Studies on the efficacy of wage subsidies shows that when they are targeted, wage or firm subsidies are effective at mitigating negative employment effects (Martin and Grubb, 2001; Wunsch, 2004) and that they reduce negative employment effects (HRSDC, 1994). Perhaps more importantly, it is representative of one of the benefits of employing a full auction. There is only so much than can be achieved through the delivery of assistance grandfathering permits and as noted, the empirical impact is difficult to quantify (Hourcade et al., 2007). With revenue-recycling there are a myriad of options.

Still, there are likely administrative challenges with the direct cash transfer and the wage subsidy. One of the key considerations that influenced the Canadian government's decision to limit direct assistance to displaced workers in response to CUSFTA was due to the perceived difficulties in identifying who is truly affected (Krouzil, 2004). If a wage or cash subsidy was implemented, policy-makers would have to develop; i) a program for delivering the quantum of assistance; ii) criteria to establish who is eligible; and iii) a timetable or schedule of assistance.

Additional administrative problems could arise if the policy contravenes Canada's trade obligations. Canada's NAFTA and WTO obligations must be respected and there may be legal implications to the subsidizing of vulnerable industries. A full assessment on the legal implications of subsidy is beyond the scope of this study, but one would have to be conducted prior to the implementation of an output based subsidy policy.

Assessing the impact of the subsidy over the medium- to long-term reveals the potential for negative, unintended consequences. Wage subsidies tend to depress wages over the medium-term. The planned time horizon of the wage subsidy is short and is only

implemented to assist firms and workers transition; however, if firms reduce wages in response to climate policy and the reduction is offset by the subsidy paid direct to employees, there is little incentive for firms to increase wages back to initial levels as the subsidy is phased out.

Gaming is also a concern with subsidies. The process used to measure the quantitative vulnerability of each industry would likely incite gaming. It provides industries with an incentive to manipulate their behaviour to secure a greater share of the benefits.

Despite all of the issues surrounding a subsidy approach, there is an argument for pursuing the policy. Bernard et al. (2007) argued that there are cases where it is justifiable to exempt certain industries where the distributional impacts are profound and there is uncertainty over which industries will be the clear winners under the new economic conditions. In the context of climate change, it is unknown whether BC's EITE firms can be considered declining industries in the low-carbon environment. For instance, there is every possibility that coal will become the fuel of the future and it is unlikely that the demand for mineral products will be significantly reduced as a result of climate policy. With respect to coal, a lot is likely to depend on the outcome of upcoming American policy decisions and the viability of carbon capture storage technology. The uncertainty over what the economic make-up of the province will be under carbon constraints and the relative success of wage subsidies at reducing the negative employment effect suggest that the government should strongly consider its inclusion in the cap and trade policy suite.

Another option that would directly compensate affected individuals is the inclusion of a cash transfer to displaced workers. While this option would reduce the vulnerability of affected workers and distribute the burden of adjusting to the cap and trade framework more evenly, it does not lay the framework for transitioning to low-carbon. This type of policy has greater currency in response to shifts where the affected industry is in decline and unlikely to recover over the short- to medium-term or where the changes are irreversible; however, as noted, this may not be the case with climate policy where the ultimate outcomes are uncertain.

Providing direct compensation or subsidies to vulnerable entities or individuals provides more immediate assistance. Providing funding for job retraining, regional economic diversification and clean technology are more effective over the long-term.

Evidence from the policy response to free trade in Canada suggests that 'skills training' is an insufficient measure for smoothing short-term costs. Unemployment in Canada rose immediately following the implementation of free trade and persisted despite the focus on job training policies (Schwanen, 2001). This suggests that this type of policy is inadequate for addressing short-term costs; however, it should be noted that may have contributed to the more rapid, sustained economic growth experienced through the mid- to late 1990s (Schwanen, 2001).

Regional assistance is also likely to be ineffective at reducing adjustment costs over the short-term as it will take time for vulnerable regions to diversify their economy and start-up industries that are less adversely impacted by the cap. Still, this does not mean that a regional assistance should be ruled out and it may provide benefits over the medium- to long-term.

The Garnaut Review (2007) on climate policy in Australia supports this type of policy reasoning and points to well-established precedents for the provision of regional assistance. Additionally, if auction revenue is targeted towards retraining and supporting infrastructure for new, low-carbon industries, then there could strong benefits over the medium- to long-term. Such assistance could be particularly effective in BC, as many of its vulnerable regions have the resources to support low-carbon offset initiatives. The types of offset programs that are permitted under the WCI (afforestation, renewable energy, agriculture-related sequestration programs) are viable options in affected regions of BC. In fact, the WCI offset policy – while perhaps limiting the level of emissions reductions likely to be achieved – is expansive and could provide BC with a good deal of economic opportunity. Funding these types of projects could also assist the public sector in achieving legislated carbon neutrality.

The assessment of the technology fund option yields similar results to the job training and regional assistance option. It too is unlikely to significantly reduce the burden on vulnerable industries and workers in the short-term, but that does not mean that there is no benefit to the policy. The development of clean technology is a core requirement of transitioning to low carbon, although the need for clean technology does not necessarily mean that a tech fund will be successful. The success of any technology fund is tied to how it is administered. There is a growing body of literature that is focused on creating the optimum conditions for innovation and is embracing a broad approach that attempts to increase the dissemination of information ('learning-by-doing') related to the development of new technologies (Foxon and Pearson, 2008; Loorbach, 2005; Bossetti et al., 2008); Kemp and Rotmans, 2003). Early results on the successes of

funding the development, deployment and diffusion suggest that there are benefits that accrue if the funds are well-designed, incorporate broad approaches, learning-by-doing and avoid picking winners.

In terms of precedents, the RGGI initiative focuses on investing in clean technology, despite recognizing that it is more effective over the medium- to long-term. A positive effect of funding improvements in energy efficiency is that it can save money for consumers and firms, and reduce the overall demand for energy. This will reduce the total amount of allowances required by the system and associated compliance costs (Energy Northeast, 2008). They do also provide assistance to low-income groups to cope with any price increases that result from the cap. Considering the overall package, they argue that there are significant benefits to both consumers and firms.

While it is important to provide funding for clean technologies, as noted it is more important that the funds are used effectively and create the conditions required to stimulate 'green' innovation. The details of developing effective innovation policy lay beyond the scope of this study, but it is recommended that the BC government assess a range policy options with the objective of stimulating 'learning-by-doing'.

Ultimately, the key trade-off when considering each of the revenue-recycling options is tied to the timing the benefits will accrue. The subsidy and compensation policy provide greater benefits over the short-term when compared to the job training/regional assistance fund and the clean technology fund. Given that none of the options are mutually exclusive, the optimal solution likely includes a mix of policies that provide benefits over both the short- and long-term.

Table 10: Summary of the assessment of revenue-recycling options.

Criteria	Wage/Firm Subsidy to EITE	Job Training and Reg. Assist.	Clean Technology	Direct Compensation
Vulnerability to Adjust. Costs	**Lowers vulnerability** (Over the short-term) (May depress wages over the medium- to long-term)	**Limited impact** (Over the short-term)	**Limited impact** (Over the short-term)	**Lowers vulnerability**
Gaming	**Very significant**	**Somewhat significant** (Regions, workers, firms will lobby to receive benefits)	**Somewhat significant** (Firms will push for technology that aids their firms)	**Very significant**
Admin. Ease	**Medium** (May be difficult to accurately identify displaced workers)	**Low** (Will have some monitoring and valuation costs)	**Medium** (Govt must set criteria on which technologies to fund)	**Medium**
Distribution of the costs	**High** (Compensation is directed at those who need it, distributes the burden more equally)	**High**	**Medium** (Depends on what kinds of technologies are funded and who benefits)	**High**
L.T. impacts	**Unclear** (May delay action)	**Medium/High** (Assists regions and displaced workers adapt)	**Medium/High** (Depends on how fund operates)	**Low** (Squander opportunity to provide for long-term benefits)

9: Conclusion

Often structural transitions intend to change the industrial make-up of an economy. The intent behind free trade was to shift Canadian resources to activities where it held a comparative advantage over the U.S. In response to the CUSFTA, the evidence suggests that it would have been a costly failure for Canada to subsidize declining industries and would have hampered Canada's prospects for long-term growth.

The transitional shift induced by climate policy is different. It is not necessarily passing judgement on industries or picking winners based on productivity and competitiveness. In general, climate policy attempts to shift to a low-carbon trajectory, but it is doubtful that it will eliminate the continued existence of firms that are currently emissions intensive. There is too much uncertainty regarding the future outcome and economic make-up of a world under carbon constraints and it is virtually impossible to say with certainty whether carbon constraints will put any of the industries in BC into permanent decline. Ultimately, this raises doubt as to whether one can accurately predict the composition of the economy over the medium- to long-term.

The different intent and uncertain outcome behind this structural transition requires it be accompanied by a set of transition policies that provide each industry of the economy with the ability to transition to onto a low-carbon pathway.

9.1 Recommendations

The three key findings in this paper are: i) some industries in BC will struggle to pass forward to consumers the costs of emissions permits and are therefore vulnerable to the cap and trade regime; ii) labour in those sectors will likely incur significant costs; and iii) uncertainties over the exact nature of those costs. These findings suggest that BC should seek to incorporate flexible design features that allow for some *ex-ante* action and *ex-post* reaction if required.

The qualitative assessment on the industries covered by the WCI cap provides a public policy rationale to develop options that can alleviate the burden of adjusting to low-carbon. From a political perspective, addressing the distributional impacts is important and will likely enhance the acceptability of implementing more stringent types of climate policy, including the cap itself.

Still, from a practical perspective this research highlights that there are a number of complexities to develop an approach to reduce climate-related adjustment costs. As discussed, the exact nature of the vulnerability of EITE industries is difficult to quantify and makes it difficult to develop a scheme to provide assistance. The uncertainties associated with the implementation of a cap and trade mechanism mean that there is likely some level of 'feeling around in the dark' in going forward. In response to these uncertainties, the operative word for policy-makers should be flexibility, with one caveat. Namely that any action taken to address transition related costs does not result in inaction on the climate file or that it damages the overall effectiveness of the provinces climate policy.

While there is no pure optimal solution for designing BC-specific cap and trade design features, the simplest and likely most effective policy is to implement a full auction. This type of policy is relatively simple to administer and provides policy-makers with the flexibility to address observed outcomes through the development of revenue-recycling options. Administratively, it is much simpler than any other allocation option as it avoids the need to develop mechanisms for grandfathering emissions permits. Despite the advantages to full auctioning, its implementation is likely to be politically contentious; however, the related contentions could likely be reduced by developing revenue-recycling responses and timing the implementation of the programs to coincide with the timing of the cap.

Beyond the political concerns of implementing full auction, there are concerns over whether auctions lead to less price certainty. One of the chief objections of industry to cap and trade systems is that there is more uncertainty over the resultant emissions price than with a carbon tax making it more difficult to incorporate an emissions price into future plans. Selecting the appropriate auction mechanism, and perhaps including broader price floors or ceilings, would also improve the functioning of the auction and reduce the volatility of the price. Reducing emissions price uncertainty would also reduce firms' compliance costs.

In the event that a full auction is not pursued, the government should look for ways that provide targeted assistance, but allow for policy-makers to maintain the capacity to respond to *ex-post* outcomes. Price caps and floors or charging a set fee on any grandfathered allowances would likely reduce the uncertainty facing those firms, yet ensure that policy-makers generate significant revenues that can be used to confer greater

benefits to society. Based on my analysis, the targeted assistance should be provided to EITE industries and displaced workers, as they are most likely to be vulnerable to the impacts of the cap.

With respect to revenue-recycling, each individual option considered warrants further investigation, particularly the clean technology fund as its inclusion is mandated by the WCI. There is also an argument that improving energy efficiency is the most effective way to ensure that the cap and trade scheme works efficiently and is still equitable, as it provides opportunities for firms to reduce emissions and compliance costs (Burtraw, Sweeney and Walls, 2008). Despite the benefits of funding clean technology improvements, it is important to consider that the success of any clean technology fund is dependent upon how the program is implemented. This suggests that there is a need for a much deeper look into the development of the fund.

9.2 Next steps

There is not a lot of time remaining before the details of the cap and trade framework will need to be developed. There are a number of key areas for the government to focus on over the short-term. They include; i) an identification of the quantitative impacts of the cap; ii) an identification of the level of assistance provided by grandfathering permits and each of the revenue-recycling options; iii) an assessment of the various auction design options; and iv) efforts to better understand the impacts and interactions between the WCI set design features (offset, banking and baseline levels) on adjustment costs.

Having qualitatively identified that EITE industries are vulnerable to the cap and trade policy, it is important to attempt to quantify the impacts of each option. As stated, it is difficult to ascertain the expected monetary impacts, but it is important to have an approximation as it improves the basis on which BC can justify policy decisions. Where possible, the government should attempt to quantify the interaction between labour and capital markets in response to a carbon price, and quantitatively examine interregional price differences to determine the true incidence of the policy. Stakeholder consultation is an important part of this process and should be undertaken by the government prior to the development of cap design features.

It is also important to begin to assess various auction design mechanisms and the potential for developing offset projects in BC. With respect to auction design, there are a number of options that can be pursued and many of them have an impact on the emissions price and perhaps more importantly, the volatility in the price.

The impact of the WCI negotiated baseline, offset and banking provisions on adjustment costs and the overall environmental objectives also need to be considered. There is also a question of how these design features will interact with the allocation mechanisms and revenue-recycling mechanisms. As discussed in Chapters 4 and 5, each of these options can all influence adjustment costs. Designing these options in a way that reduces adjustment costs could provide justification for pursuing the full auction component and could allay any fears industry and labour may have over negative output and employment effects.

Finally, and perhaps most importantly, BC should begin to act now. There is not a lot of time remaining before BC will have to develop an allocation and revenue-recycling

mechanism. The high level of complexity associated with the implementation of cap and trade and the development of design options means that there is no more time to waste.

9.3 Additional considerations

Going forward, there are some additional considerations that policy-makers should be aware of when making design recommendations. The impact of i) the current recession; ii) the interaction of the cap and the carbon tax on competitiveness of BC industries; and iii) developments in the U.S. on nationwide climate policy all need to be examined.

Beyond the impact of the current recession on firms, there is a possibility that it may impact the baseline cap and that the level the cap is set at could blunt the economic recovery in covered industries. The baseline is presumably going to be set assuming that emissions, all else equal, are and will continue to be trending upwards increasing. There is the chance that in the baseline year, emissions will be far lower than expected given the reduction in output. If this happens, the cap will be far lower than it would have been if there had been no recession. If firms were not investing in abating emissions over that time, the economic recovery in covered industries could be harmed because firms will have to meet an emissions target that was based on activities in a depressed economy.

Finally, policy-makers need to be aware of developments within the U.S. respecting their push for a nationwide cap and trade scheme. Given that many in the U.S. are beginning to articulate legal arguments for making border tax adjustment against jurisdictions that are not covered by the cap (Pauwelyn, 2007), BC should strive to keep abreast of American developments and look to find opportunities to align their climate

policy with any nationwide American plan. British Columbia's current stance on reducing emissions should have them well positioned to react to American policy. Still, given all of the complexities associated with the development of broad caps it is in British Columbia's best interests to ensure that they have a seat at the table and ensure that they do not face any punitive measures.

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