Economic Impacts of a Cap and Trade Program on BC's Industries

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EXECUTIVE SUMMARY

With climate change now an international priority, more and more countries are beginning to address the issue of climate change by developing and implementing stringent climate policies intended to reduce their greenhouse gas emissions. Though the federal government in Canada has been waiting on the United States to move forward with their own national greenhouse gas reduction policies, the provincial government in British Columbia (BC) has taken significant steps to address the issue of climate change. Specifically, from 2007 onwards, the provincial government has implemented a number of climate policies and initiatives with the objective of reducing the province's greenhouse gas emissions by 33% below 2007 levels by 2020. One of the province's main climate policies is the implementation of a cap and trade program which they plan to implement in 2012 alongside other Canadian and American members of the Western Climate Initiative.

This report was written for Industry Canada, Pacific Region and is intended to provide the department with insight into how a cap and trade program could impact local industries in BC. Cap and trade is a market-based strategy used to control pollution by putting a price on carbon. Specifically, governments put a cap on the amount of greenhouse gases a facility can annually emit and leave it up to the facility to determine the most cost effective way to reduce their emissions to levels below the emission cap. Facilities that emit over their emission cap are required to pay for each additional tonne of carbon dioxide equivalent they emitted, while facilities who emit less than their cap are able to sell these unused emission allowances to those emitting over their cap.

Methodology

The methodology used to collect information for this report included a literature review. The purpose of the literature review was to gain an understanding of cap and trade, the year-round, multi-jurisdictional cap and trade programs currently in operation, and how these cap and trade programs have impacted local industries to date. The United States' Acid Rain Program (ARP) and Regional Greenhouse Gas Initiative (RGGI) were included in the review, as was the European Union's Emission Trading Scheme (EU ETS). Information gathered for the literature review was obtained from academic and professional sources, as well as from attending public presentations, conferences, workshops, and forums on the topic. Semi-structured interviews were also used to gain insight into how a cap and trade program could potentially impact industries in BC. Ten individuals from the provincial government, industry associations, universities, and not for profit organizations with expertise or experience in the area of climate polices and/or a particular industry participated in 20-90 minute phone interviews. During the interview, these individuals were asked a series of pre-determined and open-ended questions related to the topic.

Literature Review Findings

Results from the literature review show that no one industry under the ARP, RGGI, or EU ETS has been significantly impacted by a cap and trade program. Any increases in electricity rates and production costs, profit decreases, job losses, and trade impacts associated with having to comply with these cap and trade programs have not only been modest, but also less than

originally projected. The minimal to modest impact on industries has been attributed to low carbon prices, long-term electricity contracts, allowance over allocation, and the adoption of new technologies. Also, complementary climate policies, high transportation costs, infrastructure, regional research abilities, availability of skilled labour, and proximity to suppliers and consumers have helped mitigate some of the negative effects associated with cap and trade.

Interview Findings

Findings from the interviews show that the degree to which a cap and trade program will impact industries in BC and their competitiveness will be highly dependent on the program regulations, corresponding complementary policies, carbon prices, and the allocation of allowances. The industries believed to be negatively impacted by the program are those considered to be carbon intensive, while those to be positively impacted by cap and trade included the clean technology and renewable energy industries. Overall, the majority of respondents felt that a cap and trade program would not have a significant negative impact on carbon intensive industries when carbon prices were low. However, a cap and trade program would not have a significant positive impact on the clean technology and renewable energy industries. While carbon prices were low, cap and trade was not expected to lead to the relocation of production, significantly affect operational costs and profits, nor was it expected to have a substantial impact on electricity and consumer prices. The majority of respondents felt that cap and trade would stimulate additional investment in clean technologies, manufacturing, and renewable energies but the degree to which it would stimulate investment was unknown.

Discussion

Based on these interviews and the literature review, it is expected that the implementation of a cap and trade program in BC will not have a significant impact on local industries while carbon prices are low. With carbon prices projected to be between $6-$24 per tonne of carbon dioxide equivalent (CO2E) between 2012 and 2020, many carbon intensive industrial facilities covered under the program are expected to be able to absorb or pass on a portion of their compliance costs without significantly impacting profits or competitiveness. However, as emission caps become more stringent and carbon prices become higher, carbon intensive industries may be more substantially impacted by the program. Though the local renewable energy and clean technology industries may only see a minimal increase in demand for their products during the initial years of the program due to low carbon prices and the high costs associated with adopting them, this could change once carbon prices significantly increase.

Recommendations

As a means to provide support to industries leading up to and during the implementation of stringent climate policies such as cap and trade, the federal government was recommended to consider three courses of action. These recommendations include:

- Monitoring the development, implementation, and industry impacts associated with the provincial cap and trade program

- Providing federal financial incentives to support the product commercialization, business development, demonstration, and early-deployment of clean technologies
- Providing federal financial incentives to support the industrial adoption of clean technologies
- Educating carbon intensive industries on the potential carbon reduction strategies, smart practices, and clean technologies that could be used to reduce emissions

Conclusion

As experienced by the ARP, RGGI, and EU ETS, cap and trade programs do not significantly impact industries when carbon prices are low. With carbon prices projected to reach $24 per tonne of CO2E by 2020, it is unlikely that the WCI's cap and trade program will significantly impact industry profits and competitiveness while carbon prices are at this price level. Impacts associated with the program will likely become more substantial when caps tighten and carbon prices significantly increase.

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1. INTRODUCTION

With greenhouse gas emissions increasing at a rapid rate, the importance of discovering effective strategies to reduce emissions has become a priority for the international community. Climate change was initially put on the international community's radar in 1989 when the United Nations created the United Nations' Environment Program and the World Meteorological Organization to monitor the state of the earth's climate. Specifically, the International Panel on Climate Change (IPCC) was tasked at this time to report on the status of climate change and its economic and social impacts every five to six years (IPCC, nd). Based on IPCC reports, the adoption of the Kyoto Protocol by the European Union and 37 other industrialized countries in 1997 was one of the first major steps taken by the international community to address the issue of climate change. Implemented in 2005, the Kyoto Protocol requires signatories to decrease emissions by 5.2% below 1990 levels by 2012. Since the adoption of the Kyoto Protocol, the international community meets annually to discuss global warming and climate change mitigation with the most recent climate conference held December 2009 in Denmark.

Though the December 2009 conference was believed to be a failure due to a post-2012 climate mitigation agreement not having been adopted, addressing the issue of climate change has remained on both provincial and federal government agendas in Canada. For both the federal and provincial government, implementing a cap and trade system has been at the forefront of discussions regarding the implementation of possible policies and programs that could mitigate the effects of climate change. Though cap and trade programs have proven successful in reducing acid rain's sulphur dioxide levels in the Eastern United States and Canada in the past, there is still concern among various industries and government officials in Canada on how a cap and trade program could potentially directly and/or indirectly impact local industries.

This report is written for Industry Canada, Pacific Region and is intended to provide the client with insight into how British Columbia's upcoming cap and trade program could impact local industries in British Columbia (BC). Divided into ten sections, following this first section is section two which provides background information on Industry Canada and the role the Pacific Region plays within the department. Section three provides an overview of the methodology used in this report, while section four and section five provide an introduction to climate change and the provincial climate initiatives currently in place to address this issue. Section six discusses the main elements of a cap and trade system and the various multi-jurisdictional programs currently in operation, while section seven provides a comparison between these programs' projected and actual impacts on local industries to date. Section eight discusses findings from stakeholder interviews. Finally, section nine discusses how the province's upcoming cap and trade program could impact local industries in BC, while section ten provides a series of recommendations for Industry Canada to consider when deciding how to best support industries most affected by climate policies.

2. CLIENT BACKGROUND – INDUSTRY CANADA, PACIFIC REGION

Headquartered in Ottawa, Ontario, Industry Canada is a federal government department whose responsibility is to develop, implement, and oversee policies and programs related to science and technology, commerce, industry, consumer affairs, telecommunications, competition, weights and measures, corporations, intellectual property, bankruptcy, small business, investment, and tourism (IC, 2010). The department is led by the Minister of Industry, the Minister of State for Small Business and Tourism, and the Minister of State for Science and Technology and has five regional offices outside the national capital region.

Industry Canada's mission is to foster a competitive, knowledge-based economy in Canada. The department aims to improve the country's investment conditions, innovation performance, marketplace competitiveness, and trade opportunities by collaborating with industry, academia, and businesses (IC, nd). Specifically, the department's mandate is to 'help make Canadian industry more productive and competitive in the global economy, thus improving the economic and social well-being of Canadians' (IC, nd; IC, 2010, pg.1). Industry Canada uses three interdependent strategies to fulfill its mandate. These include:

- Supporting businesses and improving economic development by developing and implementing programs and policies that will encourage and improve competitiveness and productivity
- Advancing the marketplace by developing and administering effective economic framework policies
- Fostering the country's knowledge-based economy by enhancing local innovation, research and development, training, and skills in a wide range of industries

(IC, 2010, pg.5-7)

Industry Canada, Pacific Region is a regional office located in Vancouver, British Columbia whose role is to support the department's mandate in British Columbia and the Yukon. The region is responsible for delivering programs and services that not only promote Canadian industry competitiveness and sector development, but also ensure efficient marketplace practices are maintained in British Columbia and the Yukon. The Pacific Region is also responsible for providing headquarters with intelligence on the region's political environment, economy, economic and industrial development issues, stakeholders and their concerns, and research and innovation activities (ICPR, 2009). This intelligence provides headquarters with a regional perspective that is later integrated into the development and implementation of national policies and programs, as well as senior management and ministerial support material (IC, nd).

3. METHODOLOGY

The methodology used to collect information for this project includes a literature review, a review of publicly accessible data, and interviews with knowledgeable individuals.

3.1 Literature Review

The literature review is focused primarily on literature regarding operational, year-round, multi-jurisdictional cap and trade programs based on the understanding that BC would be implementing the Western Climate Initiative's (WCI) cap and trade program; a program that is intended to be a year-round, multi-jurisdictional program. A variety of databases were used to obtain information for the literature review. Specifically, these databases included the University of Victoria, Industry Canada, and the Vancouver Public Libraries research databases. To ensure a comprehensive list of sources and perspectives were found, relevant sources were also located using the bibliographies of other relevant publications, internet searches, and publications from think tanks, industry associations, not for profits, universities, and government websites. Also, to ensure the validity and reliability of sources, only publications from academic, government, and professional sources were used.

The purpose of the literature review was to provide the client with an overview of climate change, provincial initiatives, and the multi-jurisdictional cap and trade programs currently in operation. Specifically, the literature review consists of:

- A review of academic literature written on the subjects of climate change, BC provincial climate initiatives, as well as operational multi-jurisdictional cap and trade systems and their economic impacts on industries
- A review of professional literature written on the subjects of climate change, BC provincial climate initiatives, as well as operational multi-jurisdictional cap and trade systems and their economic impacts on industries. Professional literature was found on public, private, and not for profit organization websites
- Attendance at public presentations, conferences, workshops and forums on the subject of climate change, carbon markets, and/or climate policies including:
    - Carbon Offset Workshop Series:
        - The Basics
        - Originating and Developing Offset Projects
        - Project Financing
    - Western Climate Initiative's (WCI) BC Clean Technology Presentation
    - Globe 2010
    - Emerging Solutions for Clean, Green Power Dialogue
    - Pacific Northwest Economic Conference

The results of the literature review are reflected in Section 4 (Climate Change – An Introduction), Section 5 (Provincial Climate Initiatives), Section 6 (Overview of Cap and Trade Systems), and Section 7 (Impacts of Cap and Trade Systems on Industries).

3.2 Interviews

In order to gain additional information on carbon markets, cap and trade systems, and projections on how a cap and trade system could affect industries in BC, semi-structured interviews were conducted with individuals from not for profit organizations, universities, industry associations, and the BC provincial government. Semi-structured interviews use a conversational format that allows the researcher to ask the interviewee a combination of pre-determined and open-ended questions relevant to the topic, thereby allowing for discussions to be more open (Corbetta, 2003; SC, nd).

Pre-determined questions were used as a guide to help direct the interview and to ensure certain topics and questions were discussed (Crabtree, 2006; Zorn, nd). The purpose of using open-ended questions during the interview process was to ensure the process remained flexible, that more in-depth knowledge and insight was gained, and that responses could be clarified if needed (Crabtree, 2006; Gray, 2004; SC, nd; Zorn, nd). Both pre-determined and open-ended questions were designed to specifically identify respondents' opinions and views on certain aspects of the topic, therefore making it easier to analyze and make generalizations about the findings (SC, nd). As well, the questions were designed to obtain information that could be used alongside information obtained from the literature review and public events in the discussion and recommendation section of this paper.

Thirty three individuals from thirty one not for profit organizations, government departments, industry associations, and universities in BC were asked to participate in a 30 to 45 minute interview via email. These individuals were selected based on their expertise and experiences with climate policies and/or particular industries. Of the thirty three individuals contacted, ten agreed to an interview. Reasons for not participating in an interview included: not having enough time, not having enough expertise or experience in the area to provide adequate answers, and being out of the province for the summer. Of the ten people interviewed, two were from the academic community, four were from industry associations, one was from the provincial government, and three were from not for profit organizations.

Interviewees were initially emailed pre-determined questions prior to the interview to provide them with adequate time to think about their responses and the topic as a whole (Horton, Macve, Sruyen, 2004). Interviews were then held over the phone during business hours at the interviewees' place of employment and were recorded using a combination of handwritten notes and digital recording. During phone interviews, interviewees were asked the pre-determined questions. In situations where responses needed to be clarified or elaborated upon, non pre-determined questions were asked. Interviews ranged from 20 to 90 minutes in length, with the average interview being 22 minutes long.

Once interviews were complete, digital recordings were transcribed and added to the hand written notes. Information obtained from the respondents was analyzed using commonly discussed themes. Specifically, these themes included 'what industries would potentially be impacted, either positively or negatively, by a cap and trade program', ' possibility of production relocation', 'potential impact on electricity and consumer prices', 'potential impact on operational costs', ' potential impact on investment and innovation', 'potential impact on

competitiveness', 'potential compliance options used', and 'recommendations to support local industries'.

3.3 Methodology Weaknesses

Some of the weaknesses associated with using literature reviews include incomprehensive list of relevant publications, unreliable sources, too broad a topic, and potential researcher bias (McKee, Britton, 1997; PSU, 2003; Randolph, 2009). To assist in mitigating these issues, a variety of databases, search engines, and academic, professional and governmental websites were used, only literature regarding operational year-round, multi-jurisdictional cap and trade programs was obtained, and only sources from academic, government, and professional organizations were reviewed. In addition, a variety of perspectives on the strengths and weaknesses of cap and trade, as well as perceived and actual impacts of programs currently in operation were obtained.

One of the weaknesses associated with using semi-structured interviews is the in-depth information obtained from the interview is highly dependent on the researcher's interview skills. Inexperienced researchers could either miss out on opportunities to further explore a topic, or have difficulties asking the right open-ended questions. In both cases, the researcher could lose valuable information (Kajornboon, 2005; SC, nd). Also, the information gained in the interview is dependent on how articulate and thorough the respondent is in their responses. Another weaknesses associated with this methodology includes the possible difficultly in analyzing and making generalizations about the information obtained from interviews as a result of the variety and depth of information gained from using open-ended questions (SC,nd). To help mitigate these issues interviewees were given pre-determined questions prior to interviews, questions were designed to make it easier to analyze and make generalizations about the findings, the interviewer was knowledgeable about the topic prior to interviews, and the interviewer actively listened to respondents in order to ask questions that would prevent valuable information from being lost (WLCPS, nd).

4. CLIMATE CHANGE – AN INTRODUCTION

4.1 Natural Greenhouse Effect - Earth's Natural Warming Process

As the sun's energy passes through the atmosphere, the earth's surface absorbs and/or reflects this energy, creating heat (also referred to as infrared radiation) which warms the earth. The surface then emits some of this heat back into the atmosphere where specific gases (known as greenhouse gases (GHG)) absorb most of this heat and re-emit it back to earth (IPCC,2007a). Heat that is not trapped by GHGs escapes back into space. The four primary greenhouse gases are water vapour (H2O), carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O). Excluding water vapour, CO2 is the most prevalent GHG and has an average atmospheric lifespan of approximately 100 years (IPCC, 2007a). The Intergovernmental Panel on Climate Change (IPCC), a scientific and intergovernmental body who reviews and assesses available scientific and socio–economic climate information to predict the potential trends and impacts of climate change, has indicated 50% of CO2 will remain in the atmosphere for 30 years, 30% will remain for a few hundred years, while 20% could stay in the atmosphere for thousands of years (IPCC, 2007b). The atmospheric lifespan of CH4 and N2O is 9-15 years and 114 years respectively. CO2, CH4, and N2O make up approximately 0.036% of the earth's atmosphere and are released through natural processes and human activities (Pidwirny, 2006).

Common sources of GHG include the burning of fossil fuels, the use of nitrogen fertilizers, various industrial and waste management process, landfills, as well as agriculture, deforestation and changing land usage. Without the greenhouse effect's natural heating process, the earth's surface would be approximately 30-60 degrees F(-1-16 degrees C) cooler than what it is today, uninhabitable for most forms of life (UNFCCC, nd; Pew Center, 2009a).

4.2 Enhanced Greenhouse Effect and Climate Change

Since the onset of the Industrial Revolution in the 1750s, human activities have drastically increased the amount of GHG in the atmosphere which has enhanced the natural greenhouse effect. Of the four major greenhouse gases, human activities directly influence water vapour the least as it is a finite gas that is part of a naturally occurring closed system. Greenhouse gases generated by human activities do however indirectly affect the amount of water vapour in the atmosphere (IPCC, 2007a). Rising GHGs cause atmospheric temperatures to rise which results in additional water vapour (in the form of moisture) being held in the atmosphere for longer periods of time. This additional moisture is capable of trapping more heat, thereby enhancing the greenhouse effect (IPCC, 2007a). The extent to which this additional atmospheric moisture affects global temperatures is still unknown (Greenpeace, 2006).

In 2005, CO2 levels had increased 35%, CH4 by 148%, and N2O by 18% compared to the pre-industrial era (Pew Center, 2009a). CO2 emissions are expected to increase at a global annual rate of 1.4% between 2006 and 2030, with emerging economy countries seeing the highest levels of growth (2.2% growth/annually) (EIA, 2009a; EIA, 2009b). As atmospheric GHG concentrations rise, more heat is being absorbed and radiated back to the surface, thereby increasing the earth's temperature. Since 1780, CO2 levels have substantially grown, increasing 107 parts per million (ppm) to reach current levels of 387ppm. This growth has mostly occurred

within the last 40 years with scientists observing an approximate 2ppm annual increase since 2000 (Pew Center, 2009b). CH4 levels have increased 1045 parts per billion (ppb) since 1780 to reach 1745 ppb, while N2O has increased 44 ppb to reach 314 ppb (Pew Center,2009b).

Eighteen of the warmest years ever recorded have occurred within the last 20 years with 1998 and 2005 being the first and second hottest (Pew Center, 2008b). The global temperature has risen approximately 0.74 degrees C over the last 100 years, with some regions experiencing a 4 degree C increase (Pew Center, 2008b). Over the next 100 years, global temperatures are expected to continue increasing, with the global temperature expected to rise, on average, 5.2 degrees C by 2100 (Pew Center, 2008b). The continuous rise in global temperatures has been attributed to human activities, specifically fossil fuel combustion which accounts for approximately 80% of global CO2 emissions and the majority of global warming (Pew Center, 2009a). Climate change has caused sea levels to rise, arctic sea ice, glaciers and ice sheets to melt, hurricanes to strengthen, ecosystems to become threatened, temperatures to rise, forest fires, droughts, and water shortages to become more frequent, clean water and food to become increasingly scarce, and has contributed to the extinction of many plant and animal species.

Though Canada ranks near the bottom of the top ten global emitters (accounting for approximately 2% of total global emissions), it has one of the highest per capita/emissions ratios in the world (McKeown, Gardner, 2009). If all human-induced GHG emissions stopped today, much of the damage done is irreversible and global temperatures would remain high for centuries as a result of the atmospheric persistence of CO2 (IPCC,2007b). Oceans also contribute to persistent high temperatures as ocean currents store a substantial amount of energy deep in the ocean, later releasing it in the form of heat. This lagged warming effect is a phenomena known as thermal inertia and is expected to increase the global temperature by 0.5 degrees C by 2100 if the atmospheric concentration of CO2 remained at levels seen in 2000 (Teng, Buja, Meehl, 2006). If the global community refuses to take substantial steps to reduce the impacts of climate change, the costs and risks associated with the issue will be equivalent to a 5-20% loss in annual global GDP. The costs associated with taking a strong stance against climate change on the other hand are equivalent to approximately 1% of annual global GDP (Stern, 2006a).

4.3 The Carbon Cycle

The carbon cycle plays an integral role in climate change and the enhanced greenhouse effect. Carbon, a common element found in all plants, animals and humans, bonds with other elements to form carbon compounds that are stored on the earth's surface, in sediments, in oceans and in the atmosphere. CO2 and CH4 are examples of carbon compounds. Carbon continuously moves between the oceans, biosphere, atmosphere and geosphere through natural processes such as photosynthesis and vegetation respiration and decay. Within this cycle there are various sinks and sources of carbon. Sources produce carbon and release it into the atmosphere, while sinks remove carbon from the atmosphere and store it. The exchange of carbon between sources and sinks represents the carbon cycle.

Prior to the industrial era, concentrations of these gases remained constant with little net influx of carbon in the atmosphere. However, the burning of fossil fuels, the use of nitrogen fertilizers, various industrial and waste management processes, landfills, as well as agriculture, deforestation and changing land usage have drastically increased the amount of carbon stored in

the atmosphere. Typically natural sinks create a balance between the release and removal of carbon in the atmosphere. As human activities intensify, sinks are no longer capable of removing sufficient amounts of excess carbon from the atmosphere, creating an imbalance in the cycle.

This excess of carbon in the atmosphere, in particular CO2 and CH4, enhances the greenhouse effect, negatively affecting the earth's temperature (Climatex, nd; CET, nd; Pidwirny, 2006). Specifically, CO2 is estimated to account for 60% of the enhanced greenhouse effect (UNFCC, nd).

4.4 BC Context

Due to its northern location, many regions of BC have experienced warming rates that are double the global average (BC, 2008a). Higher temperatures have led to a 50% decline in snow packs, a 20% increase in total annual precipitation rates, longer droughts, and frequent water shortages over the last 50-100 years (BC, 2008a). As climate change causes sea levels to rise, BC's coastal communities will risk loss of land and important infrastructure, while rising water temperatures and changes in river flows will put strain on numerous species of fish. Also, major infrastructure in many parts of the province will become increasingly vulnerable to extreme weather such as flooding, forest fires, storm surges, snowstorms and landslides (Walker, 2008). Water supply will decrease as a result of changing precipitation patterns and long periods of drought, while drought and restricted water supply will put strains on agriculture (Walker, 2008). Historically controlled by cool winters, the mountain pine beetle has been able to thrive in unseasonably warm winters and has destroyed approximately 13 million hectares of the province's forests or approximately 23% of the province's total forest (BC, 2008a). Between 2003-2005 the province has paid, on average, $86 million per year to handle extreme weather events, in particular forest fires, storm surges, flooding, and drought. This is a $76 million per year increase from the average annual payout ($10 million) seen between 1999 and 2002 (Whyte, 2006; Walker, 2008).

In 2007, BC was estimated to have generated 67 mega tonnes of GHGs or approximately 9% of Canada's total GHG emissions (747 mega tonnes). The energy sector is the province's biggest emitter accounting for 80% of the province's total GHG emissions (MoE, 2009; EC, 2009). Within the energy sector, transportation and stationary combustion sources are the biggest emitters, accounting for 37% and 35% of the province's emissions respectively (MoE, 2009). More specifically, fossil fuel and manufacturing industries account for 56% of the GHGs emitted by stationary combustion sources, while passenger and heavy duty vehicles account for 67% of transportation emissions (MoE, 2009). The local industrial sector on the other hand has seen emissions decrease from 19% in 1990 to 14% in 2006. Integrating new climate initiatives into industrial processes and procedures has led to this sector's emissions reduction (BC, 2008a).

If no actions were taken to reduce BC's emissions, emissions would rise 14% per year between 2007 and 2020 generating a total of 76 million tonnes of carbon dioxide equivalent (CO2E) annually. This increase would be primarily attributed to a growing population and economy, as well as rising energy demands (BC, 2008a). Currently, the Fort Nelson gas plant is province's top emitter, emitting approximately 1.25 mega tonnes of CO2 per year (Lee, 2009).

5. PROVINCIAL CLIMATE INITITATIVES

To provide a general understanding of what actions the province is currently taking to address the issue of climate change, an overview of the provincial government's major climate initiatives and programs will follow. A detailed description of the major climate initiatives and programs, as well as a description of the province's various smaller initiatives is outside the scope of this paper.

5.1 Climate Action Legislation

Beginning in 2007, the BC government has developed and implemented aggressive provincial climate initiatives to assist in the global fight against climate change. In 2008 the provincial budget committed over $1 billion to climate action programs, initiatives, and tax incentives over a four year span and another $75 million in 2009. The government has passed eight pieces of climate action legislation that are central to the province's ability to reduce greenhouse gases and meet reduction goals. They are:

- *The Greenhouse Gas Reductions Targets Act*
- *The Greenhouse Gas Reductions (Cap and Trade) Act*
- *The Greenhouse Gas Reductions (Vehicle Emissions Standards) Act*
- *The Greenhouse Gas Reductions (Emissions Standards) Statutes Amendment Act*
- *The Utilities Commission Amendment Act (2008)*
- *The Greenhouse Gas Reductions (Renewable and Low Carbon Fuel Requirements) Act*
- *The Local Government (Green Communities) Statutes Amendment Act (2008)*
- *The Carbon Tax Act*

The Ministry of Environment, specifically the Climate Action Secretariat, is responsible for overseeing the province's climate legislation and initiatives. The Secretariat works alongside other levels of government, ministries, communities, industries, organizations, academics and businesses to effectively coordinate the province's climate policies and achieve the province's emission reduction goals. Within the Climate Action Secretariat the Climate Change Branch is responsible for developing and implementing emission reduction policies, identifying ways to adapt to climate change, preparing greenhouse gas inventories, and administering emission reduction programs (BC, nda).

Each of the Acts is discussed below.

Greenhouse Gas Reductions Targets Act (GGRTA)

Enacted in January 2008, the GGRTA is the province's key climate action legislation which sets the province's greenhouse gas reduction targets. The GGRTA requires the BC public service to become carbon neutral by 2010, and requires the province to reduce greenhouse gas emissions by 6% below 2007 emission levels by 2012, 18% by 2016, 33% by 2020, and 80% by 2050 (BC Climate Action Team, 2008; BC,ndb). The 2007 emissions baseline for the province was 67 mega tonnes of CO2E, representing total provincial greenhouse gas emissions at that time.

The GGRTA is the first legislation enacted in North America that requires public sector organizations to either eliminate or offset all greenhouse gas emissions generated from their day to day activities. To offset emissions, Ministries purchase credits that represent greenhouse gas reductions achieved by other facilities. Ministries are required to report annually on what measures they are taking to reduce and offset emissions, their strategies to continue reducing emissions, as well as the amount of emissions they produce. All other public operations, such as schools, health authorities, crown corporations, and post secondary institutions are required to be carbon neutral by the end of 2010.

The *Pacific Carbon Trust* (PCT) is a provincial Crown Corporation established in 2008 under the authority of the GGRTA to assist the public sector (and local organizations) in achieving their carbon neutral goals by providing them with high quality, low cost carbon offsets. The province allocated $24 million to the PCT over the course of four years to develop the province's offset trading system which currently charges $25 per emission offset.

The corporation also supports the growing carbon offset trading market in BC by stimulating investment in local processes and technologies proven to reduce greenhouse gas emissions. With estimated offset demand expected to be one million tonnes per year, the PCT is required to purchase offsets from projects that were started in BC after November 29, 2007 and that meet the Ministry of Environment's internationally recognized offset criteria (PCT,2010).

Greenhouse Gas Reductions (Cap and Trade) Act (GGRCTA)

Given Royal Assent in May 2008, the GGRCTA is the first piece of legislation in Canada that enables a provincial government to implement a provincial cap and trade system that requires major greenhouse gas emitting industries to reduce emissions. A cap and trade system has yet to be implemented in BC; however the province is working in partnership with the *Western Climate Initiative (WCI)* to implement a regional cap and trade program. The WCI is an independent collaboration of eleven jurisdictions across Canada and the United States. Jurisdictions partnering in the WCI include: British Columbia, Ontario, Quebec, Manitoba, Washington, Oregon, California, Arizona, New Mexico, Utah, and Montana. BC currently co-chairs the executive committee and sits as a chairperson on the organization's offset and economic modelling team committees, as well as the WCI Liaison position.

Representatives from participating jurisdictions are working together to identify, develop, and evaluate a market based, regional cap and trade program capable of being implemented on a regional level. The WCI expects to implement the first stage of their cap and trade program by January 2012, with full implementation expected by January 2015. Affecting all GHG sources that emit over 25,000 tonnes of GHG annually, the program's current regional goal is to reduce emissions by 15% of 2005 emission levels by 2020 (WCI, 2009b). The WCI cap and trade program is expected to work within BC's carbon tax regime and initiate growth in the province's clean technology sector (BC, ndc). Details of the WCI cap and trade program will be discussed further in section six of this report.

Though emission caps have yet to be implemented in BC, as of January 2010 organizations and facilities emitting over 10,000 tonnes of CO2E annually are required to report the amount of emissions they generate to the Ministry of Environment once a year.

Greenhouse Gas Reductions (Vehicle Emissions Standards) Act (GGRVESA)

Enacted in May 2008, the GGRVESA allows the government to implement emission standards for new light duty motor vehicles, such as small SUVs, cars, and light duty trucks. Standards used will be equivalent to those used by the state of California, as indicated in the two jurisdictions' Memorandum of Understanding which aims to place stringent emission standards on light duty vehicles (BC, 2009a). Under the GGRVESA, automakers will be required to ensure their fleet's emissions average does not exceed predetermined amounts and may require them to manufacture zero emitting vehicles in the future. Currently California's emission standards for a 2009 vehicle weighing under 3750 lbs is 323 grams of CO2E per mile, while 2010 vehicles are set at 310 grams of CO2E per mile. By 2012 these emission standards will be 233 grams per CO2E per mile. Compared to vehicles manufactured prior to 2009, standards are expected to decrease greenhouse gases from light duty vehicles in BC by a minimum of 30% by 2016 (BC, 2009a; BC, 2008d).

Greenhouse Gas Reductions (Emissions Standards) Statutes Amendment Act (GGRESSAA)

Effective as of January 2009, the GGRESSAA regulates landfill gas and establishes criteria for capturing and/or reducing landfill gas, furthering gas recovery opportunities, and identifying potential uses for capture methane gas. Landfills consisting of over 100,000 tonnes of waste or who accept more than 100,000 tonnes of waste a year are required to report on the amount of gas generated on site, as well as the methods used to capture this gas.

The provincial government has set methane emissions thresholds at 1000 tonnes of CO2E annually. Those who exceed this threshold are required to submit a gas collection plan by 2012 and have installed gas capture equipment that captures a minimum of 75% of generated gases by 2016.

Utilities Commission Amendment Act (2008)

Enacted in 2008, the Utilities Commission Amendment Act requires the BC Utilities Commission to consider the BC energy plan and the energy policies associated with it when transmission planning and arranging energy supply contracts. Specifically, the Commission must encourage public utilities to reduce emissions, use clean and renewable sources to produce energy, use innovative clean technologies to generate electricity, and must continue developing needed transmission infrastructure.

Greenhouse Gas Reductions (Renewable and Low Carbon Fuel Requirements) Act

Taking effect January 1, 2010, this Act aims to reduce transportation fuel's carbon content by a minimum of 10% by 2020. Transportation fuel includes gasoline, diesel, natural gas, ethanol, propane, electricity, and bio-fuel used for transportation purposes. To reduce carbon intensity,

fuel distributors must ensure 5% of their gasoline and 3% of their diesel is renewable. Distributors are able to comply with these standards by altering their fuel mix content, improving refining, and/or improving the growing process of bio-fuel crops. This regulation is expected to benefit the renewable fuel industry and reduce emissions, however it is also expected to increase the cost of fuel by one cent per litre until renewable fuel becomes more plentiful (BC, ndd; Pembina,2009).

Local Government (Green Communities) Statutes Amendment Act

The provincial government estimates that approximately 45% of the province's emission can be controlled by local governments. Therefore, amendments were made to the *Local Government Statutes Act* requiring local governments to develop and implement emission reduction targets, as well as develop emission reduction policies and climate action plans. Since 2008 the provincial government has distributed approximately $1.6 million to fifty two communities in BC to assist them in developing projects that support sustainable land use, reduce greenhouse gas emissions, and support efficient energy planning.

Carbon Tax Act

In July 2008, the BC government implemented a revenue neutral carbon tax on fossil fuels. Carbon tax is a method used by governments to price carbon. Specifically the tax is used as an incentive to reduce individual carbon use by increasing the cost of purchasing and using high carbon products. At that time, organizations and individuals purchasing or using fossil fuels were required to pay $10 for every tonne of CO2E they emitted. Fossil fuels most commonly used for transportation and heating purposes were the first to be taxed and include gasoline, coal, natural gas, coke, propane, home heating fuel, and diesel (BC,2008b; Pembina,nd). When a cap and trade system is implemented in BC, double taxation will be avoided by integrating the carbon tax into the cap and trade system. Overall it is estimated that 76% of BC's greenhouse gas emissions is covered by the province's carbon tax (Pembina, 2009).

Increasing the cost of high carbon products is expected to change individual consumption behaviour, thereby reducing greenhouse gas emissions. Revenue collected from this tax is given back to taxpayers in the form of small business, corporate, and personal tax reductions, low income climate action credits, and funding to emission reducing initiatives. An annual increase of $5/tonne has occurred since 2008 and will continue until the $30/tonne target is reached in 2012. Once this target is met, the provincial government will consider further increases. Currently the price stands at $20 per tonne of CO2E which translates to an additional ¢4.82 per litre of gasoline and ¢5.52 per litre of diesel (BC, 2008b). Since its inception, the province has collected a total of $306 million from the carbon tax and has returned over $313 million to British Columbians (BC, nde). As indicated by the consultants MK Jaccard and Associates (2008), the carbon tax is expected to reduce BC's emissions by a total of three million tonnes of CO2E annually by 2020 (Pembina,nda).

What follows is a general overview of the province's major climate initiative, the *Climate Action Plan,* and the province's *BC Renaissance Capital Fund Ltd*; both of which stem from the above legislation.

5.2 Climate Action Plan (CAP)

In terms of moving towards a low carbon economy, BC is ahead of many North American jurisdictions. In 2007 the province implemented the Climate Action Plan; BC's major climate initiative aiming to ensure the province's future sustainability and ability to compete in the emerging global low carbon economy. CAP focuses on supporting GHG reductions across the province and is expected to account for 73% of the province's 2020 emission reduction goal (BC, 2008a).

CAP includes a diverse number of climate initiatives ranging from monetary incentives to remove pre-1995 vehicles from the road and improve the energy efficiencies of homes, to increasing public transit and improving roads and bridges, to standardizing the energy efficiency of new buildings, to improving bio-energy opportunities of BC's land, to achieving net-zero deforestation through the planting of new trees when others are removed. CAP includes various emission reduction plans and strategies that specifically focus on one area of GHG reductions.

5.3 The British Columbia Energy Plan

The British Columbia Energy Plan is a provincial strategy aimed to improve the conservation of energy, support the development of clean energy technology, and increase provincial energy efficiency and security. Specifically, the strategy's long term goal is to create a province that is energy self sufficient by 2016. The strategy focuses on using clean energy sources such as bio-energy, geothermal, hydroelectric, solar, wind, and hydrogen to meet provincial energy needs, as well as eliminating emissions from electricity generation. Targets set to reduce the use of the electricity within the province include (BC, 2008a; BC,ndf):

- Implementing energy efficient building standards by 2010
- Ensuring clean and renewable energy accounts for a minimum of 90% of the electricity generated in the province
- Requiring BC Hydro to acquire 50% of its resource needs through conservation measures, install Power Smart meters in all BC residences by 2012, and pursue cost-effective and competitive demand-side management programs (Pembina, 2009)

In 2008, as part of the BC Energy Plan, the provincial government allocated $10 million over the course of three years to the *Bio-energy Strategy*. The Bio-energy Strategy aims to improve the competitiveness of local bio-fuel producers, ensure 50% of BC's renewable fuel requirements come from bio-fuel production, and ensure a minimum of ten community based energy projects convert local biomass into bio-energy by 2020 (BC, 2008a; BC,ndf). The Strategy is intended to help diversity the economies of rural communities who heavily rely on the forestry and/or agriculture industry by providing them with the opportunity to produce local clean energy.

As part of the BC Bio-energy Strategy, the *Bio-energy Network* was established and given a $25 million grant from the provincial government to encourage the research and development of new or improved bio-energy technologies. Specifically the Network focuses on increasing the value of the province's biomass resources, developing and supporting bio-energy technology and

applications developed in BC, and increasing the local production of renewable energy (BC, 2008a; BC,ndf).

5.4 British Columbia Hydrogen Highway

Implemented in 2004 and integrated into the BC Energy Plan, the provincial government contributed $2 million to the *BC Hydrogen and Fuel Cell Strategy*; a strategy to invest in the development of hydrogen and fuel cell technology, attract global investment in BC's hydrogen economy, and contribute to developing a global hydrogen market (BC,2008a; BC,2008c; FWC, 2004). Recognized internationally as a leader in hydrogen and fuel cell technology, investment in BC's hydrogen economy has lead to the development and construction of the BC hydrogen highway which stretches from Victoria, BC to Whistler, BC (BC, 2008a; BC, 2008c).

5.5 Innovative Clean Energy (ICE) Fund

Created in 2007, the ICE fund provides $25 million a year in funding to clean energy and technology projects to further the development of the province's thriving clean energy and technology sectors. The fund focuses on supporting new (or not currently used), pre-commercial, commercially viable clean technologies developed in the province to solve specific provincial environmental and energy issues. Technology funded by the ICE fund has the potential to be used on both a national and international level. The fund supports projects such as gasification, carbon capture and sequestration, alternative energy and fuel technologies, bio-diesel and ethanol fuel, as well as hydrogen fuel cells. Between 2008 and 2009 forty two projects were approved for funding through the ICE fund (BC, ndg).

5.6 BC Air Action Plan

The Air Action Plan takes steps to reduce provincial fine particulate matter and ground-level ozone levels, the two main contributors to air pollution. Implemented in 2008 in partnership with local governments, communities, and local industries, the provincial government allocated $28.5 million over the course of three years to the Air Action Plan. Actions taken under this plan contribute to not only the overall reduction of air pollution, but also greenhouse gases as the source for both are typically the same (BC, 2008a; BC, 2008c).

5.7 Live Smart BC

Implemented in 2008, Live Smart BC is a $60 million provincial initiative that encourages and provides financial incentives to individuals and communities taking measures to improve their energy efficiency and reduce their personal GHG emissions. According to Pembina Institute (2009), since implementation this initiative has led to an average 2.59 tonnes per house GHG reduction and a 31% decrease in energy usage.

5.8 Pacific Institute for Climate Solutions (PICS)

In 2008 the BC government provided $94.5 million in funding to establish PICS. Located at the University of Victoria in Victoria, BC, PICS brings together climate researchers from BC's four research intensive universities to work on developing innovative climate change solutions, to

help facilitate BC's low-carbon economy, and to help inform climate change policies (PICS,nd). PICS also forms partnerships with the private sector and government.

5.9 BC Renaissance Capital Fund Ltd (BCRCF)

In support of the Climate Action Plan, the BC government established the BC Renaissance Capital Fund Ltd (BCRCF) in 2008. BCRCF is a Crown Corporation that provides capital funds to provincial venture capital managers looking to invest in one or more of BC's four growing technology sectors; clean technology, information technology, digital media, and life sciences. Specifically, BCRCF aims to improve BC's reputation as an attractive place to invest, to grow the province's venture capital market, and to stimulate further innovation in the province (BCRCF, nd). Since its inception, the BCRCF has committed a total of $90 million in capital to seven venture capital managers. Of this $90 million, $37 million was invested in BC companies (BCRCF, nd).

6. OVERVIEW OF CAP AND TRADE SYSTEMS

This section introduces the general components of a cap and trade program, provides an overview of operational, year-round, multi-jurisdictional cap and trade programs, and briefly discusses the issues these programs have encountered during their first few years of operation. Specifically, the European Union's Emission Trading Scheme (EU ETS), the United States Regional Greenhouse Gas Initiative (RGGI), and the Acid Rain Program (ARP) will be discussed. Though the Western Climate Initiative (WCI) cap and trade program will not be implemented until 2012, a general overview will also be provided to show the differences between BC's program and the EU ETS, RGGI, and ARP. A table showing the similarities and differences between these four programs is presented in Appendix A.

There are also a number of countries and jurisdictions across the world (such as the Midwestern United States (US), Japan, China, and New Zealand) that are currently considering, are in the process of developing, or have independently implemented their own seasonal or year-round cap and trade programs. These programs, as well as voluntary offset trading programs, will not be discussed as they are outside the scope of this paper. The United Nation's Kyoto Protocol will also not be discussed as international agreements typically do not have formal, international enforcement mechanisms in place to monitor and enforce compliance within each signing party's jurisdiction. Without legitimate international enforcement mechanisms in place, it is the responsibility of individual countries to police and penalize themselves for non compliance, therefore making Kyoto more of an optional than mandatory program (Victor, 2001).

6.1 An Introduction to Cap and Trade

From the 1960s to the 1980s, greenhouse gas emissions were generally regulated by government authorities who set and enforced emission limits, as well as dictated what compliance methods were to be used to reduce emissions (Wheeler, 2007). From the 1980s onwards, governments began considering the use of market-based strategies as an alternative to the use of command and control strategies (Wheeler, 2007). Cap and trade is considered to be one of these market-based strategies as it relies on market forces to help price pollution (Pew Center, 2008a; WCI, 2009a).

Cap and trade programs are designed to provide emitting facilities with the flexibility to decide how they want to reduce their emissions at the lowest cost (Pew Center, 2009; Pew Center, nd; WCI, 2009a). Cap and trade programs are unable to achieve total emission reductions on their own as they only target specific greenhouse gas sources. Therefore, complementary policies that work alongside cap and trade programs, such as carbon taxes, energy efficiency standards, vehicle emission standards, and renewable energy initiatives, are needed if jurisdictions want to achieve their reduction goals (Pew Center, 2008a; WCI, 2009a).

Governments are responsible for deciding what sectors and/or industries will be included in the program and are responsible for setting annual emission caps that restrict the amount of emissions jurisdictions (either national or regional depending on the level of government responsible for implementing the program) and facilities can generate. Caps decrease over a specific period of time and are intended to spur innovation and encourage facilities to improve processes and technologies (Pew Center, 2008a; WCI, 2009a; IEDC, 2009; Horne, 2008).

Governments either freely allocate and/or auction off a specific number of emission allowances. These allowances represent the number of tonnes of carbon dioxide equivalents (CO2Es) facilities are authorized to annually emit and, when added together, total the jurisdiction's overall emissions cap (WCI, 2009a; WCI, nda; IEDC,2009; Horne,2008).

Allowances are treated as commodities and rely on market forces to determine price (WCI, 2009a; IEDC, 2009). Restricting emissions and issuing allowances create an allowance supply, while energy demands, reduction strategies, and technology costs creates allowance demand (WCI, 2009a; Carbon Positive, 2009). Allowance prices are subject to supply and demand fluxes, are dependent on the price of oil, electricity, coal, and gas, and are affected by what is happening in the global economy (WCI, 2009a; Carbon Positive, 2009; IEDC, 2009). Revenue generated from allowance auctions are often used to fund research and development, provide assistance to facilities transitioning to a low carbon operating environment, and/or fund complementary climate policies (Pew Center, 2008a; IEDC, 2009).

Cap and trade programs are divided into compliance periods; a pre-determined period of time (typically two to eight years in length) within which facilities can generate emissions. At the end of each compliance period emitters are required to surrender enough allowances to cover annual emissions (WCI, 2009a; WCI, ndb). Facilities that fail to submit enough allowances to cover their annual emissions are penalized, while those who emit less than their annual cap are able to sell extra allowances to facilities emitting over their limit. Depending upon the regulations, allowances are either sold annually or at any point in time within each compliance period.

Allowance trading allows emitters to buy additional allowances in circumstances where the price of allowances is less than alternative reduction methods (Pew Center, 2009; WCI, nda; Horne, 2008). Some programs allow facilities to borrow and/or bank allowances as a means to comply with their emission cap at the least possible cost. Borrowing allowances allows facilities to use future allowances today with the expectation that they increase emission reductions in the future, while banking emissions allows facilities to carry forward unused allowances from one compliance period to the next. Banking is the method most commonly integrated into cap and trade programs as it provides facilities with the opportunity to carry unused allowances over to the next compliance period where they are used to either offset higher emission levels or are sold to make a profit (Pew Center, 2008a).

Offsets are emission reductions, removals, or avoidances generated by offset projects outside industries covered by the program and are purchased by facilities to offset their own emissions restrictions (IEDC, 2009; Pembina, ndb; Pew Center, 2008a). To ensure validity, offsets must represent real emission reductions, be clearly owned by one provider, be additional, measurable, and permanent, and be verified by a third party verifier (Pew Center, 2008a, WCI, ndb; Horne, 2008). A major risk associated with using offsets is the possibility for offsets to flood the market, thereby reducing offset and allowance prices. These low prices result in facilities purchasing offsets and allowances to comply with caps instead of reducing their own emissions as it is more cost effective to purchase offsets than it is to upgrade technologies, equipment, and processes (Horne, 2008).

There are a number of advantages associated with cap and trade programs. It provides sectors, industries, and facilities with the financial incentive to be innovative in how they reduce emissions and provides an incentive to create alternative, low carbon products and services (Pew Center, 2008a; IEDC, 2009). Specifically, having to pay for allowances can negatively affect a company's profit margins. To ensure impacts on profit are kept to a minimum, facilities will look for ways to reduce emissions at the lowest possible cost. Those who have taken the steps needed to reduce emissions below their emission limits can financially benefit from the program by selling their unused allowances to companies who have exceeded their cap (Pew Center, 2008a; IEDC, 2009; WCI, 2009a). Cap and trade programs also stimulate investment in the development of new, low carbon technologies and processes, as well as encourages the development of alternative energy sources (such as wind, solar, and bio-fuel energy), new business opportunities (such as offset projects), and green jobs (such as energy auditors, environmental engineers, renewable energy technicians, and offset verifiers) (Pew Center, 2008a; WCI, ndb; IEDC, 2009; Gittell, Magnusson,Shump, 2009; ENE, 2010). Compared to command and control systems, cap and trade is typically administratively less costly for governments as they are only responsible for ensuring emissions are accurately reported, that the proper number of allowances are surrendered, that unfair competition is avoided by ensuring one facility does not acquire the majority of allowances in the industry, and that new market entrants are able to fairly compete against pre-existing players who have already received free allowances (WCI, nda; IEDC,2009).

Some disadvantages associated with cap and trade include the likelihood that allowance and offset prices will remain volatile during the first few years of operation due to maturing emission trading markets, climate patterns, and fluctuating commodity prices (Horne, 2008). This price volatility can deter investors from investing in offset projects and technologies, thereby inhibiting the development of new technologies and offset projects (IEDC, 2009). Once trading markets have matured, factors such as changes in climate patterns and commodity price fluctuations will have less impact on the price of offsets and allowances. Facilities are also likely to shift compliance costs downstream to end users resulting in higher energy costs and a potential decrease in consumer spending (IEDC,2009; EPA,2009e). Additional compliance costs may lead to energy intensive facilities re-locating to jurisdictions with less stringent climate policies. Known as emission or carbon leakage, this situation prevents global emission reductions and leads to regional job losses (IEDC, 2009). While some argue that fluctuating energy costs associated with fluctuating emission prices and the purchase of allowances and offsets could affect a facility's or region's competitiveness (IEDC,2009), others believe this additional cost does not significantly harm competitiveness as compliance costs are minimal compared to gross operational costs (Horne, 2008; Abaza et al., 2009; Bataille, Dachis and Rivers, 2009). Trade exposed industries such as oil and gas are most likely to be negatively impacted competitively by cap and trade (Horne, 2008).

6.2 Greenhouse Gas Cap and Trade Programs

Western Climate Initiative (WCI)

BC has worked alongside WCI members to develop a cap and trade program suitable for implementation in the province. Being part of a regional cap and trade program is expected to be more beneficial to the province than implementing an independent program as it helps maintain each jurisdiction's relative competitiveness, saves administrative costs, increases trade

opportunities with member states, and minimizes carbon leakage (WCI, 2009b). Specifically, the WCI is working towards reducing the region's emissions by 15% below 2005 levels by 2020 (WCI, 2009b). What follows is a general overview of WCI, and therefore BC's, proposed regional cap and trade program.

Expected to cover approximately 90% of WCI's emissions and include more industries than any other cap and trade program by 2015, the WCI program targets not only CO2, but also methane (CH4), nitrous oxide (N20), hydro-fluorocarbons, per-fluorocarbons, and sulphur hexafluoride (WCI, 2009b). WCI covers an extensive range of emission sources including:

- industrial process emissions
- electricity generation (including imported electricity consumed in the region)
- fossil fuel combustion from transportation
- residential, commercial, and industrial level fossil fuel combustion

(WCI, 2009b; IEDC, 2009)

Sources emitting or selling products that emit over 25,000 metric tonnes (mt) of CO2E a year are obligated to comply with the program's reporting and regulatory requirements.

The program is divided into two phases and is designed to include, if desired, other greenhouse gases and/or industries. Phase one is scheduled to begin January 2012 and will include emissions from electricity, industrial processes, and large industrial combustion sources. Phase two will begin January 2015 and include the above sources as well as transportation and space heating fuels. Compliance periods will last three years, while sources emitting over 10,000 metric tonnes of CO2E annually are required to monitor and report emission levels beginning January 2010.

The initial regional cap for 2012 has yet to be set, however it will be based on forecasted 2012 emissions, voluntary and mandatory emission reductions, as well as population and economic growth (WCI, 2009b). To prevent carbon leakage, a combination of freely distributed and annually auctioned allowances will be used and early reduction credits will be encouraged. Specifically, the majority of allowances will initially be allocated for free with member jurisdictions required to auction at least 10% of their allowances in 2012 and at least 20% by 2020 (WCI, 2009b). A portion of revenue earned from these auctions will be dedicated to energy efficiency, renewable energy, and community adaptation initiatives, promoting reductions within uncapped industries, as well as research and development in the areas of carbon capture and sequestration, energy efficiency, renewable energy, and transmission and storage. Overall, allowance costs are expected to remain below $25/tonne until at least 2020 (WCI, 2009b).

One of the unique features of the WCI program is that member jurisdictions are given the opportunity to uniformly standardize the allocation of a particular industry's allowances in situations where industry competition between member jurisdictions becomes an issue. To minimize compliance costs, facilities are also able to bank, but not borrow, unused allowances. Offset purchases are allowed under the program, but must not exceed 49% of a facility's cap to ensure over 50% of reductions occur within the WCI region (WCI, 2009b). Facilities that do not comply with their cap must submit three allowances for every tonne of CO2E they are unable to cover (WCI, 2009b). While the cap and trade program is key to WCI's climate initiative, the

WCI requires members to implement other complementary climate policies that work alongside the cap and trade program to ensure the program is not only cost effective, but successful (WCI, 2009b; WCI, nda).

European Union Emission Trading Scheme (EU ETS)

With 27 participating European countries, the EU ETS is the largest cap and trade program currently in operation. Implemented in January 2005, the EU ETS is intended to assist the EU in achieving its Kyoto greenhouse gas reduction targets (8% below 1990 emission levels by 2012) (Kopp, 2007; Pew Centre, nda; Ellerman, Joskow, 2008).

There are a few differences between the EU ETS and the WCI program, the main one being that the EU ETS was initially divided into two compliance periods, 2005-2007 and 2008-2012 with the intent that it continues into 2013. The initial period was to be a trial phase for the EU, providing participating countries the opportunity to adjust to their 2008 Kyoto obligations (Kopp, 2007; Pew Centre, nda; Ellerman et al., 2008; Grubb, 2004). Emission reductions were expected to be no more then 1-2% in the first period (Ellerman et al., 2008; Pew Centre, nda). No regional cap was set during the first two periods and countries were responsible for setting their own reduction goals (Duggan, 2009; Ellerman et al., 2008; EU, 2008). Unlike the WCI system, the EU ETS only covers CO2 (with the exception of the Netherlands who also included N2O), does not include transportation sources, and targets electricity generation and specific industrial facilities that emit over 10,000 tonnes of CO2 annually (Pew Centre, nda; Ellerman et al., 2008; EU, 2008; Grubb, 2004). By 2012, aviation is expected to fall under the program (EU, 2008a).

In the first compliance period an unlimited number of offsets could be used to comply with caps, while facilities were able to borrow future allowances, 'opt out' of the program if they were reducing a significant amount of CO2 emissions on their own, and collectively pool resources to meet an industry's emission cap (Ellerman et al., 2008; EU, 2008; Pew Centre, nda). Non-compliant facilities are required to not only increase reductions the following year, but are also monetarily penalized (€40 per excess tonne of CO2 in the first period and €100 per tonne in the second) (Pew Centre, nda).

The third phase (2013-2020) of the EU ETS is currently under development and is becoming increasingly similar to the WCI's framework. Differences between the third phase of the EU ETS and the WCI include the EU ETS's focus on protecting trade exposed industries by no longer providing free allowances to electricity producers, decreasing the amount of free allowances non-trade exposed industries receive, and freely distributing all allowances to trade exposed industries who experience a 30% increase in production costs as a direct or indirect result of the EU ETS (Duggan, 2009; EU, 2008a). The third phase will require countries to put 50% of auction proceeds towards climate initiatives and will include the capture, transport, and storage of all greenhouse gases (Duggan, 2009; EU, 2008a).

Regional Greenhouse Gas Initiative (RGGI)

Implemented in January 2009, the RGGI includes ten American States: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and

Vermont. Facilities regulated by the RGGI are required to reduce CO2 emissions by 10% below 2009 levels by 2018 (RGGI, ndb; ENE, 2009).

Unlike the WCI the RGGI affects only one industry: electricity. Specifically, the RGGI targets fossil-fuel fired electricity and power plants. Though states are required to auction at least 25% of their allowances on a quarterly basis and use 25% of auction revenues to support clean energy solutions, approximately 87% of allowances were auctioned in 2009 with approximately 71% of auction revenue invested in clean energy initiatives (RGGI,ndb; IEDC, 2009; ENE,2010). Unlike other cap and trade programs, the RGGI sets a price floor of $1.86 (or 80% of what the market value is at the time) for auctioned allowances and, to ensure the majority of emission reductions occur in the region, allows only 3.3% of emissions to be offset (RGGI, ndb; Horne, 2008). The RGGI also incorporates a two stage price trigger which is used when allowance prices exceed $7 and $10/tonne. Specifically, facilities are able to offset 5% of their emissions when prices average more than $7/tonne during a twelve month period and 10% of their emissions when prices average more than $10/tonne (RGGI, 2007).

The RGGI has been criticized for including only the electricity industry, an industry that accounts for only 24% of the region's emissions, and for increasing electricity rates by 1-3% (IEDC, 2009; ENE, 2009; DEC,nd). That said, governments are reinvesting auction revenues into other climate initiatives and tax credits which is expected to alleviate some of this cost (RGGI, ndb)

6.3 Sulphur Dioxide and Nitrogen Oxide Cap and Trade Program

The Acid Rain Program operates in the US and focuses on reducing sulpher dioxide (SO2) and nitrogen oxide (NOX), the main components of acid rain, fine particulate matter (pm), and ground level ozone. Though this program does not specifically target CO2 or CO2E, it is relevant to this paper as CO2, NOX and SO2 come from the same sources. Therefore, it seems reasonable to assume that the effects of the NOX and SO2 program on industries will be similar to those programs targeting greenhouse gases.

Acid Rain Program (ARP)

In 1995, the US implemented the ARP, a program aimed to reduce SO2 emissions in the eastern and mid-western region by 50% below 1980 levels by the end of 2010 and to reduce NOX emissions in the northeastern region and the District of Columbia by two million tonnes below 1980 levels by 2000 (IEDC, 2009; EPA, 2009b; Ellerman, Joskow, Harrison, 2003). After 2000, facilities under the NOX component of the program are required to annually decrease NOX emissions by 15% (EPA, 2009c).

The ARP caps SO2 and NOX emissions from fossil fuel burning and electric power plants. Like the EU ETS, SO2 and NOX reductions are divided into two phases, one starting in 1995 and the other in 2000. Only coal burning electric plants are included in phase one of the SO2 component of the program, while phase two includes both oil-, gas-, and coal-fired plants, and utility plants generating over 25 megawatts of power. The SO2 component does not allow the use of offsets (IEDC, 2009; Horne, 2008; EPA, 2009b).

The NOX component focuses solely on coal-fired electric utility boilers, includes boiler specific emission restrictions for each facility instead of an overall NOX cap, and does not distribute allowances (EPA, 2009c). The primary difference between the two NOX phases is the addition of various boiler types in phase two of the program. The penalty for both program components includes a $2000 fine for each excess tonne of SO2 and NOX emitted, and requires facilities to increase emission reductions the following year (EPA, 2009b).

6.4 Program Challenges and Successes

Challenges

Volatile Trading Markets - Each of the above cap and trade programs have encountered their share of challenges and successes. One of the most common issues that programs face during their first stage of operation is a highly volatile allowance and offset trading market. The over allocation of allowances caused by high set emission caps and uncertainty around allowance and electricity demand are typically the main contributors to price volatility (Grubb,2004; Ellerman et al.,2008). Having an over allocation of allowances minimizes emitters' incentives to invest in new technologies and reduce dependency on fossil fuels, thereby lowering emission reductions (IEDC, 2009; ENE, 2010; Kopp, 2007; Pew Centre, nda; Ellerman et al., 2008). In the EU ETS, the inability to bank unused allowances, increased accessibility to updated emissions data, and entry of new allowances and reduction credits led to an allowance surplus in the trading market causing prices to drop and increasing market volatility in the first phase of the EU ETS (Pew Centre,nda; Duggan,2009; WCI,2009b; Ellerman et al.,2008). Ultimately, as seen in Figure 1, this volatility led to allowances being worth zero dollars by the end of 2007 and few reductions were actually made (Pew Centre, nda; Duggan, 2009; WCI, 2009b; Ellerman et al., 2008; Grubb, 2004).

Figure.1 EU Emission Trading Scheme Allowance Prices

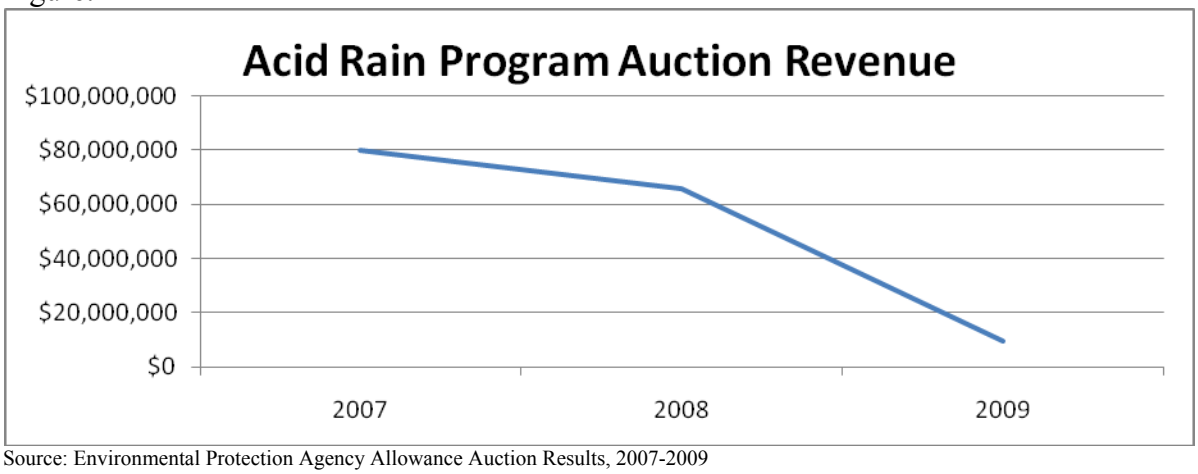
Source: Huttenbach,2009 from European Energy Exchange

To prevent allowance prices from reaching zero dollars, as experienced by the EU ETS, the RGGI implemented an allowance price floor. That said, prices are expected to be low during

RGGI's first few years of operation which will negatively affect facilities' investment in new technologies, processes, and offset projects (ENE, 2009; ENE, 2010).

From the second compliance period onwards, emissions data from the first compliance period is typically used to set lower caps as a means to decrease price volatility and prevent allowance and offset oversupply in the future (Ellerman et al.,2008; EPA, 2009b). The 2008/2009 economic recession, however, has led to reductions in industrial output and electricity demand in both the EU and US, creating an oversupply of allowances and increasing volatility in the allowance and offset trading market (Ellerman et al., 2008; Economist, 2010). As shown in Figure 1, facilities began selling off their allowances in late 2008 as a means to quickly raise revenue during economic hardship which also contributed to the oversupply of allowances and volatility in the allowance market (Huttenbach, 2009; Szabo, 2009). The EU ETS has experienced a 13% decrease in allowance and offset prices between January 2009 and December 2009, declining from €14.60/tonne to €12.70/tonne over this period (Economist, 2010). Similarly, as shown in Figure 2, the ARP has seen auction revenues decrease 88% between 2007 ($79.7 million) and 2009 ($9.5 million) (EPA, 2007; EPA, 2009d).

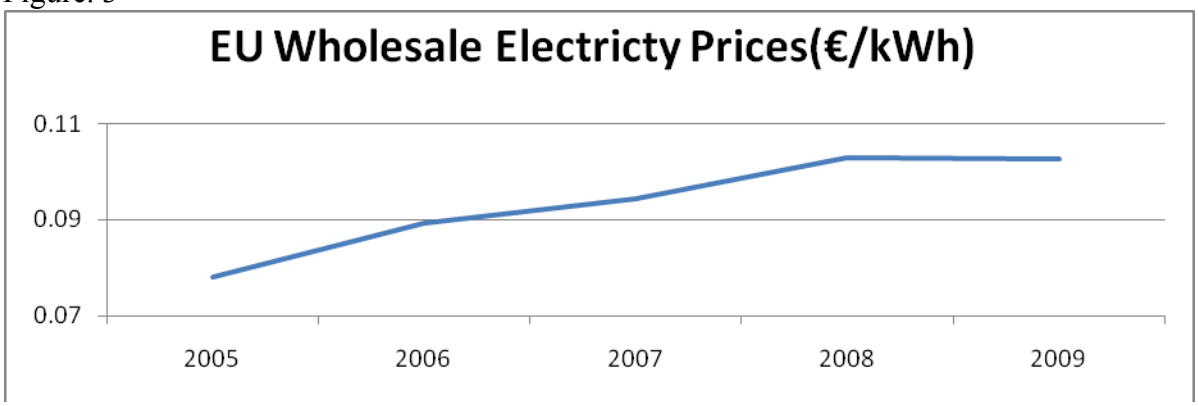
Figure.2



Source: Environmental Protection Agency Allowance Auction Results, 2007-2009

High Caps and Windfall Profits - The first phase of the EU ETS also experienced issues around caps being set too low for energy producers and power companies gaining windfall profits from the free distribution of allowances (Ellerman et al., 2008; Grubb, 2004). Energy producers' caps were initially set relatively low with the understanding that their susceptibility to international competition was minimal and that they could easily find alternative fuels for electricity generation (Ellerman et al., 2008). However, with energy demands increasing and few facilities initially selling their extra allowances, the low cap led to an increase in allowance demand which caused allowance prices to spike from €8/tonne to €20/tonne within the first five months of operation (as shown in Figure.1) (Ellerman et al.,2008). In the case of windfall profits, power companies abused their monopoly position by passing along to consumers the market cost of allowances that they had received for free, which contributed to an increase in wholesale rates (as shown in Figure 3) and maximized company profits (Ellerman et al.,2008, Grubb, 2004).

Figure. 3



Source: Eurostat, 2010

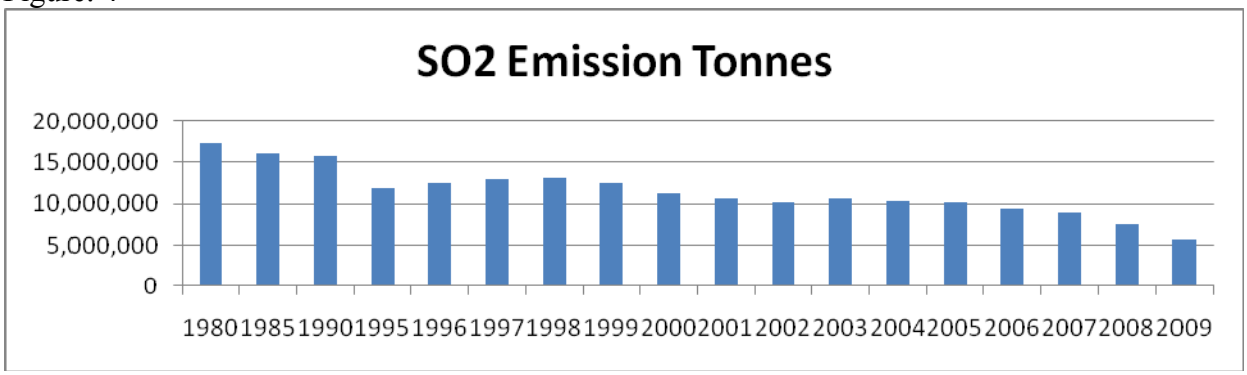
The electricity price increase seen in Figure 3 was only partially attributed to electricity generators passing opportunities costs on to wholesalers. Other factors, such as oil and gas price fluctuations and weather conditions, were the primary contributors to this increase.

In the third compliance period, the majority of allowances will be auctioned and emission benchmarks will be used to determine the number of free allowances a facility should receive. These measures have been put in place to prevent power companies from continuing to profit off of the EU ETS (EU, 2008c; ENE, 2009).

Successes

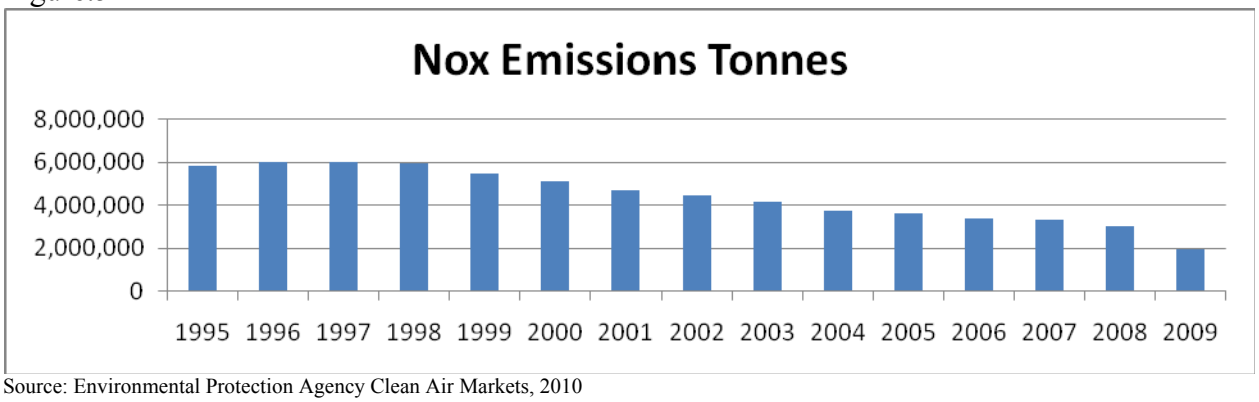
Overall the above cap and trade programs have performed well, experiencing 99-100% compliance rates and initiating new improvements and developments in technology (EPA, ndc; WCI, ndb). As shown in Figures 4 and 5, the SO2 component of the ARP surpassed its goal by 2008 and, though the NOX component has yet to reach its goal, has reduced NOX emissions by 48% between its inception in 1995 and 2008 (IEDC,2009; EPA, ndb; EPA,ndc).

Figure. 4



Source: Environmental Protection Agency Clean Air Markets,2010

Figure.5



Source: Environmental Protection Agency Clean Air Markets, 2010
Note: NOX emissions data for 1980-1994 could not be located.

Program costs for the RGGI have been less than expected with annual costs averaging $1.1 to $1.8 billion, instead of the annual $6 billion originally projected (IEDC,2009). The above programs have also been successful in earning revenue for governments. In 2009 alone, the RGGI's auction earned over $494 million US (ENE, 2010).

7. IMPACTS OF CAP AND TRADE PROGRAMS ON INDUSTRIES

The purpose of this section is to discuss how cap and trade programs have impacted local industries to date. Both projected and actual impacts are discussed, as are direct and indirect impacts. Direct impacts refer to the costs, losses, and benefits associated with having to participate in the program, while indirect impacts refer to price increases attributed to the cap and trade program (such as electricity) that affect industries and consumers outside of the program.

Literature and data on the actual impacts of these programs is limited for a variety of reasons. These reasons include the length of time in operation, lack of data, difficulty in establishing base case scenarios, and the difficulty in identifying indicators that effectively measure the specific effect of compliance costs on investment, revenue, trade, employment, and production (Demailly et al, 2007; Lund, 2007; Oberndorfer, 2009; Reinaud, 2008; Reinaud, 2008b; Reinaud, 2009;Yu, 2009). Where available, literature on industry trade, innovation, and investment trends was consulted when considering the impact of cap and trade programs on local industries. Specifically, trade was used as a program impact indicator based on the understanding that a region would be importing significantly more goods and/or exporting less of the same goods if the program negatively affected a particular industry (Reinaud, 2008; Reinaud, 2009). Innovation and investment trends were used as a program impact indicator based on the understanding that stringent climate policies provide incentives for companies to lower compliance costs. These financial incentives would thereby stimulate innovation, investment, and ultimately growth in technology and energy efficiency (Johnstone et al, 2010).

The limitations associated with the studies projecting industry impacts include the lack of consideration for future technological and operational changes (Reinaud, 2008b). In the case of actual industry impact studies, there are limitations to using trade data as an indicator of whether cap and trade programs have positively or negatively affected an industry. Specifically, changes in commodity prices, raw material, transportation costs and economic stability are also reflected in trade data, making it difficult to isolate the impact of cap and trade (De Bruyn et al, 2008; Kenber et al, 2009; Reinaud, 2008b). In the case of using innovation and investment trends as a measure of program impacts, it must be noted that innovation and investment is not only driven by environmental regulations, but also depends on the scientific capacity of a region, trade flows, and market conditions (Johnstone et al, 2010). Finally, it has proven challenging for academics, economists, governments, and associations alike to effectively isolate the impacts of cap and trade from other economic factors that can also affect production.

This section begins with a discussion on the projected and actual impacts of the Acid Rain Program (ARP) on local industries, followed by discussions on the projected and actual impacts of the Regional Greenhouse Gas Initiative (RGGI) and the European Union Emissions Trading Scheme (EU ETS). As indicated in section six of this report, the ARP and the RGGI are the United State's multi-jurisdictional SO2 and NOX and greenhouse gas cap and trade programs that are currently in operation, while the EU ETS is the European Union's greenhouse gas cap and trade program.

7.1 Impacts of the Acid Rain Program on Local Industries

The Acid Rain Program (ARP) incorporates only electricity generation facilities (in particular coal-fired power plants) thereby limiting its direct impacts. The ARP indirectly impacts energy intensive industries such as manufacturing and mining, as well as the clean technology, service, and renewable energy industries. Though in operation for fifteen years, information on how the ARP has impacted industries remains limited.

Projected Impacts

Prior to implementation, it was believed the ARP would negatively impact local industries by increasing operational costs, decreasing profits, and reducing their competitiveness relative to other jurisdictions. The industry expected to be hardest hit by the ARP was the mining industry, specifically coal mining as 90% of the coal produced in the United States during the 1990's was for power generation (EPA, 2001). Initially it was believed the ARP would result in the loss of up to 16,000 mining jobs between 1995 and 2001. However, by the year 2000 projected mining job losses decreased to 4,100 by 2010, while new jobs created were estimated to be 3,600 (EPA, 2001).

Improvements in productivity and the adoption of new mining processes and technologies, all of which were occurring prior to the implementation of the ARP, were the cause of this reduction in projected job losses (EPA, 2001). Overall, mining job losses attributed to the ARP between 1990 and 2010 were now expected to be small, representing 5-10% of total job losses in the industry (EPA, 2001). Increasing demand for low emitting, less labour intensive, low-sulfur coal was expected to drive this 5-10% decline in employment as demand for high emitting, labour intensive, high-sulfur coal decreased (EPA, 2001). Also, the switch from high- to low-sulfur coal was expected to negatively impact regions mining high-sulfur coal, thereby positively impacting regions mining low-sulfur coal (EIA, 1997; EPA, 2001).

The literature indicates that the electricity industry was expected to see profits decline as operational costs increased as a result of the ARP, however projections were not given. Also, with low-sulfur coal being used for not only electricity generation, but also steel production, competition between the two industries for low-sulfur coal was expected to increase the steel industry's operational costs (Lange, 2010).

Actual Impacts

Contrary to initial expectations, the ARP has had minimal effects on the country's electricity prices and compliance costs have been 66% lower than originally expected due to the flexibility of the program's compliance mechanisms, mining productivity improvements, low boiler modification and scrubber technology costs, the over-allocation of allowances in phase one and two, as well as low shipping costs for low-sulfur coal (DSBIIP, 2009; Ellerman, 2003). Costs power generators have incurred represent approximately 0.6% of their total operational costs; therefore they have been able to pass these additional costs on to consumers via increases in electricity prices (EIA, 1997).

The ARP has also been attributed to employment gains and growth in the transportation industry (specifically rail), the manufacturing industry (specifically the manufacturing of pollution control equipment), and sectors of the service industry (specifically the installation and operation of pollution control equipment) (Burtraw et al, 2005; EPA, nd). Being the primary compliance measure used to date, the increasing demand for low-sulfur coal led to the creation of the 3,600 mining jobs mentioned above. This increasing demand is expected to continue well into phase two of the ARP, resulting in the possible creation of additional mining jobs (Bellas, Lange, 2005; EIA, nd; EIA, 1997).

The increased use of scrubber technology (a technology that removes pollutants from industrial waste streams) has also positively affected employment opportunities in certain sectors of the manufacturing industry, however these benefits have not been as high as originally expected. Though capital costs for scrubbers have decreased 50% since 1992, costs remain high which has resulted in only 10% of electricity generation facilities using scrubbers as a means to comply with the ARP (Bellas et al, 2005; Burtraw et al, 2005; Carlson et al., 2000; Ellerman et al, 2000; EIA, nd; EIA,1997; ED, 2000; Napolitano et al., 2007). Ultimately, demand for these technologies has been lower than previously expected.

Though the ARP was expected to negatively impact not only the electricity generation industry, but also the steel industry, evidence has proven otherwise. Within the first five years of the program, emissions decreased while at the same time demand for electricity increased, electricity prices remained stable, and the United States GDP grew, on average, 4.0% annually (BEA, 2010; ED, 2000). Though difficult to find literature discussing the ARP's impact on the manufacturing industry, one could assume that the manufacturing industry has not been negatively affected by the program as electricity prices have remained stable. With regards to the steel industry, the mining industry increased low-sulfur coal production to meet the demands of both electricity generators and steel producers, thereby mitigating any impacts on the steel industry (Lange, 2010). The EPA (2009) indicated that the ARP has contributed to growth in the service industry, specifically within the allowance trading environment where emissions brokers, financial firms, and allowance traders are needed to trade allowances. Though the EPA has indicated that there has been growth in certain sectors of the service industry, no statistics were provided to support this claim.

In regards to the clean technology industry, there has been debate as to whether the ARP has stimulated significant growth in the industry or if it has had minimal impact. Bellas el al (2005), among others, argue that, though the ARP is thought to have initiated improvements in scrubber and boiler technology which have lowered abatement costs, progression in new scrubber and boiler technology has been limited (Bellas et al, 2005; Barron et al.,2008; Burtraw et al, 2005; ED, 2000). Ultimately, this argument suggests that the lack of progression in pollution control technologies is a possible indication that the ARP has done little to stimulate new growth and employment in the clean technology industry. Burtraw and Palmer (2003) and Napolitano (2007) on the other hand argue that the ARP has unexpectedly initiated innovation in the clean technology needed to successfully blend low-sulfur coal with other variations of coal to produce cleaner burning coal, as well as improved energy efficient technologies (Burtraw et al, 2000; Burtraw, Palmer, 2003; Napolitano et al., 2007). The ARP has also led to the development of adaptive boiler technology that allows high-sulfur boilers to burn low-sulfur coal and fuel blends

at costs lower than buying and installing new technology (Burtraw et al, 2000; Ellerman et al, 2000; ED, 2000; Lange, 2010). Overall, writers such as these argue that by providing a market for pollution control and energy efficient technologies, the ARP has stimulated innovation, and therefore growth, in the clean technology industry (ED, 2000; Napolitano et al., 2007).

7.2 Impacts of the Regional Greenhouse Gas Initiative on Local Industries

Like the Acid Rain Program, the Regional Greenhouse Gas Initiative (RGGI) currently only directly impacts electricity generation facilities and indirectly affects energy intensive industries, as well as the service, clean technology, and renewable energy industries. Due to it being in operation for only a short period of time (since January, 2009), there is currently little information and data available on how the program has impacted local industries to date.

Projected Impacts

From the outset, the majority of literature indicated that the RGGI would not drastically impact states' economies and industries as direct and indirect impacts were expected to be minimal. There is some debate on the degree to which the RGGI was expected to affect the region's regional gross domestic product (GDP). Elliott et all (2006) estimated GDP decreasing by 0.1%, while Gittell et al (2008) and the CIER (2007) projected an increase of up to 0.06% (CIER, 2007; Elliott et al, 2006; Gittell, Magnusson, 2008). Specifically, the electricity industry was expected to profit due to their ability to pass allowance costs on to consumers (Burtraw et al, 2006, Conklin et al, 2008; NYDEC, nd). There was also debate around the RGGI's impact on electricity prices. Business associations were concerned that electricity prices would drastically increase as a result of compliance costs being passed on to consumers, thereby devastating energy intensive industries like manufacturing (Brett et al., 2006). Others projected only slight increases in electricity prices, with retail electricity prices estimated to increase by 0.2-2.9% a month by 2021, while wholesale electricity prices would increase by 1-2.4% a month (Breslow et al, 2005; Gittell et al, 2008; Reisch, 2010; NYDEC, nd; Eliott et al, 2006). Finally, others argued that electricity prices would not increase, but instead decrease as a result of more energy efficient products being purchased and energy efficient processes being adopted (CIER, 2007; Conklin et al, 2008; Eliott et al, 2006).

Ultimately, slight increases in electricity prices were not expected to drastically impact industries in the region as electricity costs represented only a small portion of total operational costs. The RGGI was also expected to stimulate growth in the renewable energy, construction, and service industries, as well as growth in the manufacturing sectors that produce energy efficient products, equipment, and technologies (Conklin et al, 2008; Levy, 2006; Pool, 2010). Also, growth attributed to the RGGI was expected to increase the region's employment opportunities by 0.8% by 2021 (Eliott et al, 2006). Though coal-fired power generation plants were expected to see profits decrease slightly, no closures or job losses were projected (CIER, 2007; Conklin et al 2008).

Actual Impacts

All states involved in the RGGI have chosen to invest their allowance auction revenue into energy efficiency programs and renewable energy incentives (Gittell et al, 2008; McCord, 2009).

Between January 2009 and March 2010, $583 million in revenue has been raised in the region as a result of allowance auctions, all of which has been invested in energy efficiency, renewable energy, and clean technology (Pool, 2010; RGGI, 2010). This allocation of auction revenue has contributed to the creation of new jobs in the region, has assisted in reducing electricity bills, and has driven additional private and public investments in the development of new technologies and the adaptation of others (Pool, 2010; RGGI, 2010). Specifically, an estimated 1,000 jobs were created in 2009 in Maine and 4,000 jobs are being created in Massachusetts over the next three years as a result of new energy efficiency programs funded by RGGI auction revenues (RGGI, 2010; Wilensky-Lanford, 2010). The region's service industry has also experienced growth (specifically in new 'green jobs' such as energy auditors, field technicians, weatherization technicians, computer software developers, and environmental engineers), as has the construction industry (retrofit professionals, insulation installers, and building remodelers), and manufacturing industry (energy efficient products and materials) (Gittell et al., 2009; RGGI, 2010).

Though difficult to measure specific growth in these industries and sectors due to lack of data, the increase in employment opportunities attributed to the RGGI is a reflection of the positive impact this program has had on local industries to date. One could also infer from the new investment in technologies that the RGGI has assisted in stimulating growth in the renewable energy and clean technology industries. Electricity prices did not significantly increase during the first year of operation and in some cases even decreased as a result of new energy efficiency programs, declining natural gas prices, above average temperatures during the winter months, and the 2008-2009 economic recession (Foley et al, 2009; Reisch, 2010). Though there is currently no literature or data available to confirm this, one could reasonably assume that any slight increase in electricity prices has not seriously impacted the manufacturing industry and in fact may have benefited some sectors as demand for energy efficient products and technologies has grown.

Many states have other climate programs and policies in place, such as green procurement, incentives for high performing buildings, and energy consumption caps, which may have also contributed to certain industry growth trends, thereby making it difficult to specifically assess the RGGI's overall impact in the future (Conklin et al, 2008).

7.3 Impacts of the European Union Emission Trading Scheme on Local Industries

The degree to which the EU ETS affects various industries is highly dependent on the energy intensity of the industry, their ability to pass costs on to consumers, the availability of product alternatives, the carbon intensity of products, and the degree of competition outside the EU (Ho et al., 2007). It must be noted that many of the findings discussed below could change in the third phase of the EU ETS as emission reduction targets tighten, fewer allowances are freely distributed , and the long term effects of the EU ETS on investment, profits, and production become more apparent (Reinaud, 2008b; Reinaud, 2009;Yu, 2009).

Projected Impacts

Prior to implementation, it was believed the EU ETS would not significantly impact most industries financially as the majority of industries were able to pass at least half of their

compliance costs on to consumers during the initial stages of the EU ETS (De Bruyn et al, 2008; McKinsey and Ecofys, 2006). Nor was it expected to drastically impact employment and production (Reinaud, 2008b). Specifically, the industries believed to be at highest risk were the steel, aluminum, cement, chemical, and pulp and paper industries. When paying €10-20/tonne of CO2E and taking into consideration rising electricity prices, production costs were estimated to increase 10-25% in the cement and steel industry, €1 barrel in the petroleum industry, and 1-12% in the aluminum, chemical, and pulp and paper industries (Carbon Trust,2008; De Bruyn et al, 2008; Grubb, Brewer, Fazekas, Heilmayr, Sato, 2009; McKinsey et al, 2006). Only McKinsey et al (2006) felt production cost increases would be higher for the cement industry, projecting an increase of 37% (McKinsey et al, 2006). The Carbon Trust (2008) had lower projections, estimating production costs to increase by no more than 2-4% depending on the energy intensity of the industry.

After passing compliance costs on to consumers, demand for the above industries' products were projected to decrease by only 1.5% in the steel and aluminum industries and less than 1% in the other industries during the initial years of the EU ETS (Morgenstern, Aldy, Herrnstadt, Ho, Pizer, 2007). The reduction in demand was expected to be minimal based on the understanding that relatively small increases in production costs were unlikely to significantly impact an industry's production levels, product prices, and competitiveness, nor were large production cost increases expected to significantly impact low trade intensity industries such as cement (Graichen et al, 2009). As indicated by Carbon Trust (2008), costs associated with fluctuating exchange rates, labour and tax conditions, and fluctuating raw material prices were more likely to have a significant impact on industries, than the EU ETS (Carbon Trust, 2008). There was concern, however, that though passing compliance costs on to consumers would initially generate additional revenues for many industries, continually rising compliance costs would eventually significantly impact product prices. Significant increases in product prices would then lead to decreases in consumer demand for carbon intensive products, which in turn would negatively affect production, profits, jobs, and market shares (Carbon Trust, 2008; Demailly et al, 2007). Though it is too soon to know if these concerns held true, they remained throughout the first and the second phase of the EU ETS as a result of their being a limited amount of information and data available (Demailly et al, 2007).

The EU ETS was expected to have varying effects on high risk industries. Though not a direct participant of the EU ETS, the aluminum industry was expected to be the most financially impacted by the EU ETS as a result of rising electricity prices and not being allocated free allowances. Being highly susceptible to outside competition, the industry was not expected to be able to pass these additional costs on to consumers (De Bruyn et al, 2008; Lund, 2007; McKinsey and Ecofys, 2006; Carbon Trust, 2008; Reinaud, 2008b). Refineries, on the other hand, were expected to see profits decrease by no more than 1% as a result of the EU ETS due to their ability to pass at least 75% of their compliance costs on to consumers and the likelihood that high capital costs would prevent the industry from moving production to jurisdictions with less stringent climate policies (Carbon Trust, 2008; De Bruyn et al, 2008; Reinaud, 2005).

The steel industry was expected to see profits slightly increase during the initial years of the EU ETS because of their ability to sell unused allowances and pass up to 66% of their compliance costs on to consumers. Also, high transportation costs were expected to protect the industry from

outside competitors (Carbon Trust, 2008; De Bruyn et al, 2008; McKinsey et al, 2006). In regards to the cement industry, there was debate over the industry's ability to pass compliance costs on to consumers. The majority of critics estimated that 10-40% of compliance and additional electricity costs could be passed on without drastically impacting product prices. Like the steel industry, high transportation costs were expected to protect the industry from outside competitors (De Bruyn et al, 2008; Carbon Trust, 2008). McKinsey et al (2006), on the other hand, estimated that only a maximum of 15% of costs could be passed along (McKinsey et al, 2006).

In regards to the pulp and paper industry, the general consensus was that impacts associated with the EU ETS would be difficult to project due to the multiple technologies, material, and processes used in the industry, as well as variations in electricity use (De Bruyn et al, 2008; Demailly et al, 2007; Carbon Trust, 2008). That said, McKinsey et al (2006) estimated that up to 20% of the paper industry's compliance costs could be passed on to consumers, while the pulp industry could pass on 50% (McKinsey et al, 2006). The EU ETS was also expected to positively impact employment and profits in such industries as the renewable energy and clean technology industry, as well as various sectors of the service industry (Reinaud, 2008b). In sum, overall industry impacts associated with the EU ETS were expected to be minimal, with the EU's GDP estimated to decrease by no more than 0.3-0.6% as a result of the program (De Bruyn et al, 2008).

Actual Impacts

As mentioned in section six of this report, the majority of participants received an over allocation of allowances in the first and second phase of the EU ETS. Those that did not, have experienced lower than expected allowance prices which, along with over allocation, has assisted them in minimizing the economic impacts of this policy. As previously thought, most industries are believed to have been able to either fully or partially pass opportunity and compliance costs on to consumers which has also assisted in mitigating costs. Also, in most cases participating industries have either profited from the EU ETS or have seen operational costs remain relatively stable, primarily due to their ability to sell unused allowances (Carbon Trust,2008; Grubb et al., 2009; Kenber et al, 2009; Yu, 2009).

Profit decreases that were seen during the initial stage of the EU ETS are primarily attributed to fluctuating energy prices which are in part due to the EU ETS, but are also a result of changes in commodity prices, complementary climate initiatives, and the 2008-2009 economic recession (Kenber et al, 2009). High transportation costs, raw material locale, specialization of products, import duties, and available infrastructure have also acted as trade barriers for some EU industries, thereby protecting domestic markets from international competitors (De Bruyn et al, 2008; Grubb et al., 2009).

Overall, the economic impacts are believed to have been less or on par with previous expectations, however this has been difficult to prove as it has been challenging to isolate the specific effects and cost increases associated with the EU ETS, to measure the degree to which industries have or are able to pass on compliance costs, and to incorporate current and predicted industry dynamics and global economic pressures (Anger, Oberndorfer, 2008; De Bruyn et al,

2008; Demailly et al, 2007; Grubb et al., 2009; Reinaud, 2008b). That said, based on recent impacts, the EU ETS is expected to cost the EU no more than 0.3-0.7% of their GDP by 2020 (Grubb et al., 2009; Yu, 2009).

When looking at the industries believed to be at highest risk of being negatively impacted by the EU ETS, the impacts to date have been modest at best. This is primarily due to the allocation of free allowances which has essentially provided allowance recipients with government subsidies that have assisted in minimizing the direct impact of compliance costs (Schmidt, 2009). Specifically, though exact numbers have not been provided, the steel industry experienced minimal operational cost increases during the first phase of the EU ETS, and no significant changes were seen in trade and production patterns (Oberndorfer, Rennings, Sahin, 2006); Demailly, 2008; Reinaud, 2008b; Reinaud, 2009). Costs incurred were passed on to consumers which has contributed to the rise in EU steel prices (Demailly et al, 2007; Demailly et al, 2008; Kenber et al, 2009; Reinaud, 2008b). The rise in steel prices is expected to slightly impact demand and result in a 0.5-2% production decrease in the EU. This decrease, however, is not expected to significantly affect profits, jobs, or competitiveness as the industry is, and will continue to, sell unused allowances to offset any losses (Demailly et al, 2008; Reinaud, 2008b).

In regards to the pulp and paper industry, as predicted the chemical pulp sector is believed to have passed on 50% of their costs, however the recovered pulp sector and the paper industry were only able to pass on 0-0.7% and 0-20%, respectively (Demailly et al, 2007), a percentage less than what was previously estimated. This could imply that the pulp and paper industry has been impacted more than originally thought. However there is currently no information available indicating specifically the degree to which it has been impacted. It has also proven to be difficult to locate literature on how the EU ETS may have positively impacted other sectors of the forestry industry, such as the production of biomass which is used as a renewable energy source.

In the first phase of the EU ETS there was no indication that the aluminum industry was significantly impacted by the program. Electricity prices continue to rise globally as a result of fluctuations in oil prices, gas prices, weather, and temperature and, though EU electricity prices have increased slightly more than the global average (the small price difference being attributed to the EU ETS), prices continue to remain relatively stable in the EU and therefore have had little effect on the aluminum industry (Reinaud, 2008; Demailly et al, 2007; Feilhauer, 2009; Yu, 2009; Zachmann and Von Hirschhausen, 2008). Using trade as a possible indicator of EU ETS impacts, Reinaud (2008) was not able to confirm that rising electricity prices impacted trade in the EU aluminum industry as imports did not significantly increase during the first two years of operation (Reinaud, 2008; Reinaud, 2009).

Ultimately, high aluminum prices and the majority of smelters (85%) being in long-term electricity contracts are believed to have protected the industry from major operational cost increases and profit reductions (Reinaud, 2008; Reinaud, 2008b). Due to their inability to pass costs on to consumers, the costs they have incurred are believed to have been absorbed via small profit reductions (Reinaud, 2008; Reinaud, 2008b). The full impact of the EU ETS on the aluminum industry is expected to be seen either in the latter half of the EU ETS's second phase or in phase three when 65% of smelters are no longer under their current electricity contracts (Reinaud, 2008).

Though demand for aluminum is growing in the EU, there is no new investment in place to increase the industry's capacity. Reinaud (2008) believes that this lack of investment can be partially attributed to the region's electricity prices being slightly higher than the global average (Reinaud, 2008). This could indicate that, though the aluminum industry has not been significantly impacted by the EU ETS to date, rising electricity prices and operational costs attributed to the EU ETS are driving away the investment needed to increase the region's capacity and production, thus preventing the industry from obtaining additional market share which they could have possibly acquired if the region was seen to be an economically attractive place to build new smelters.

As predicted, the oil and gas and cement industries have also not been significantly impacted by the EU ETS due to their ability to pass on compliance and opportunity costs (Reinaud, 2008b). Specifically, in the initial years of the EU ETS the oil and gas industry was not directly affected by the program as it received an allowance over-allocation of up to 7%. In fact, the industry has profited from the EU ETS by selling these unused allowances. Trade and production pattern fluctuations have been minimal which indicates that the industry has not lost market share as a result of the program (Lacombe, 2008; Reinaud, 2008b; Reinaud, 2009). Even with tightening emission caps, there has been no indication that regional oil and gas exports will decrease in the future as a result of higher prices, nor is there indication that facilities will move to other jurisdictions as a result of carbon pricing. This is primarily due to the industry's high capital costs and permitting timeframes (Demailly et al, 2007; Reinaud, 2005). Minimal fluctuations in cement prices, production, and trade as well as the over allocation of allowances has revealed that, as expected, the cement industry was not significantly impact by the EU ETS during its first stage (Ellerman and Buchner, 2008; Ponssard and Walker, 2008; Reinaud, 2008b; Reinaud, 2009). On par with previous projections, certain sectors in the chemical industry, specifically the manufacturing of industrial gases, are believed to have been indirectly impacted by the EU ETS, experiencing production cost increases of up to 6% (Demailly et al, 2007). That said, these sectors have been able to pass compliance costs on to consumers which indicates that the industry has experienced only minor impacts (Demailly et al, 2007).

In regards to the clean technology and renewable energy industries, there has been some debate as to how the EU ETS has impacted these industries. Some have stated that demand for new technologies and renewable energy is currently low as a result of low allowance prices and the over allocation of allowances. They argue that these two factors have limited the incentives needed to significantly increase new investment in the research and development of clean technology and renewable energy, or increase the adoption of new technologies (Kenber et al, 2009; Demailly et al, 2007; Grubb et al., 2009; Hoffman, 2007). Specifically, Hoffman (2007) indicates that there were no significant changes in the development of new power generation and clean technologies during the first phase of the EU ETS (Hoffman, 2007).

Though it has been argued that the EU ETS has not stimulated new investment, and therefore growth, in the clean technology and renewable energy industries, New Energy Finance (2009) found evidence suggesting investment in energy efficiency and renewable energy increased 40% in Europe between 2006 and 2008. They also indicated that, in 2008, 42% of global clean energy investments resided in Europe (New Energy Finance, 2009). This investment growth and the fact that almost 50% of global clean energy investments are situated in Europe could be a possible

indication that the EU ETS has indeed initiated growth in these industries since both outcomes occurred during the first phase of the program. Dechezlepreter et al (2009) also found evidence showing the clean technology industry growing by approximately 9% a year between 1998 and 2003, suggesting that the ratification of the Kyoto Protocol and the anticipation of the EU ETS influenced industry growth. This increase was primarily attributed to growing demand for wind, waste, biomass, lighting, and methane technologies (Dechezlepreter et al, 2009). The increased use of these technologies could also be considered evidence of growth in the renewable energy industry as the majority of these technologies are used in the generation of clean energy.

In line with the argument that the EU ETS has positively affected the clean technology and renewable energy industries, the Conference Board of Canada (2010) indicated that the EU was the primary exporter of clean and renewable technologies between 2002 and 2008. Between 2002 and 2008, Germany, the top global exporter of these technologies, saw exports increase by 15%, while Italy saw exports increase by 10%, France by 7%, Denmark by 12%, and Belgium by 13% (CBOC, 2010a). In comparison, Canada and the United States, neither of which have a national greenhouse gas cap and trade program in place, saw clean technology exports grow by 0% and 5%, respectively (CBOC, 2010a). Increasing EU clean technology and renewable energy exports is a reflection of growth in these industries which could possibly be attributed, at least partially, to the EU ETS. In regards to carbon offsetting, Llewellyn (2007) has indicated that offsetting has created new opportunities in the region, however there is no mention of what these opportunities are or what industries they have positively affected (Llewellyn, 2007). With only 152 United Nations Joint Implementation offset projects currently in operation in the EU, one could assume that the opportunities Llewellyn mentions are minimal at best as offsets are not being heavily used by EU ETS participants. This lack of offset usage is likely due to the current over allocation of allowances and low allowance prices.

7.4 Conclusion

Overall, ex-post studies done on the ARP, RGGI, and EU ETS have shown that increases in production costs, job losses, and trade impacts have not only been modest, but also less than originally projected (Anger et al, 2008; De Bruyn et al, 2008; Kenber et al, 2009; McKinsey et al, 2006; Reinaud, 2008b). In many cases, the job losses that have occurred are believed to have been offset by employment gains in other industries (Ho et al, 2008). As mentioned throughout this section, it is believed that a combination of low carbon prices, long-term electricity contracts, the adoption of new technologies, high transportation costs, complementary policies, allowance over allocation, infrastructure, availability of skilled labour, regional research abilities, and the proximity to raw material suppliers and consumers has assisted in mitigating substantial losses in industry market shares and profits (in particular in the energy intensive industries), as well as prevented the relocation of industry operations (Aldy et al, 2009; De Bruyn et al, 2008; Demailly et al, 2007; Kenber et al, 2009; McKinsey et al, 2006; Reinaud, 2009).

Though no industry has been drastically affected by the above cap and trade programs to date, there is a possibility that as caps become more stringent impacts will become more substantial (Reinaud, 2008b; Reinaud, 2009;Yu, 2009). No information is currently available on the specific impacts of cap and trade programs on the service industry, specifically the sectors providing services to allowance trading schemes, energy efficiency, and low carbon technologies (CBOC, 2010a). This is a result of it being difficult to locate international data on the environmental

services segment of the service industry (CBOC, 2010a). Though there is no data available to measure this sector's growth, the Conference Board of Canada (2010) believes growth in clean technology is likely a sign of growth in the environmental services sector (CBOC, 2010a).

8. INTERVIEW FINDINGS

To ensure the confidentiality of respondents, interview findings are organized thematically below. Topics discussed during interviews focused on gaining a better understanding of what industries could be impacted by the Western Climate Initiative's (WCI) cap and trade program, as well as how they could be affected. Representatives from a range of organizations, including the provincial government, universities, industry associations, and not for profits were interviewed in order to provide a well-rounded perspective on key topics. Specifically, discussion focused on identifying the industries that could be positively and negatively affected by a cap and trade program, its potential impact on industrial operational costs and industry competitiveness, its potential effect on industry investment and innovation, identifying possible compliance options, as well as identifying possible support measures for both the federal and provincial government to consider before implementing the program.

8.1 Industries Potentially Impacted by a Cap and Trade Program

Negatively Impacted Industries

The majority of respondents believed that the industries most likely to be negatively impacted by a cap and trade program were those that were either carbon intensive, a major energy consumer, a price taking international exporter, an import competing industry, an industry with little profit surplus, or a combination of all five. Specifically, these industries included mining, certain forestry sectors, electricity generation, oil and gas, iron and steel, aluminum, cement, and manufacturing. Some respondents indicated that the extent to which these industries would be impacted was highly dependent on the program's rules and the kind of complementary policies in place.

Mining

Over the last fifteen to twenty years, the mining industry has taken action to reduce their emissions, increase production efficiency, and reduce fuel consumption as a means to decrease costs associated with rising fuel prices. Specifically, the mining industry has taken advantage of BC's clean energy by electrifying some of their diesel equipment and engaging in some large modernization projects. Because the industry has already taken steps to adopt the newest equipment on the market, one respondent stated that there was little else the industry could do to further reduce emissions aside from curtailing production, thereby forcing the industry to purchase allowances or offsets in situations where they did not receive enough free allowances to cover their emissions. Also, it was felt that the industry would be unable to pass compliance costs on to wholesalers as their commodity was sold on the world market and therefore subject to globally set prices. Ultimately, the local industry was expected to absorb any compliance costs associated with the program which in turn could negatively affect their bottom line and their ability to expand and grow. Though respondents did not expect the cap and trade program to significantly impact the industry when carbon prices were low (as is currently the case with the carbon tax), a few respondents were concerned that production could potentially relocate to countries with less stringent climate policies once the price of carbon significantly increased. The

relocation of production would not only negatively affect industry employment, but also the regional economy.

Cement

During the initial onset of the cap and trade program, one respondent argued that the cement industry would most likely only be minimally impacted as the industry had some alternative reduction options available. Specifically, this respondent argued that the cement industry could quickly convert their fuel source from coal to natural gas, thereby allowing them to easily reduce emissions while the cap was high. Depending on the program's design, the industry was expected to be most impacted by cap and trade when emission caps were low as there would be fewer reduction options once the industry switched to natural gas. As it stands today, there is little opportunity for the cement industry to further reduce emissions by switching to low carbon fuel alternatives such as bio-fuel or to reduce process emissions until more energy efficient, low carbon technologies for the cement industry are developed and commercialized. Relocation was believed to be unlikely for the cement industry as the cement produced in BC is sold to a local customer base. Not only would it be difficult for companies to serve this region once they relocated elsewhere, but the capital costs associated with building new facilities and the high costs associated with transporting cement long distances would not make it economically feasible to move production elsewhere.

Forestry

Similar to the mining industry, the forestry industry has also taken steps over the last ten years to improve energy efficiency and adopt fuel switching technologies as a means to improve productivity and adapt to rising fuel costs which has already led to significant emission reductions. Some respondents argued that there was little else the industry could do to reduce emissions until new fuel switching and energy efficiency technologies were developed or until old technology was improved upon. Therefore, depending on the rules and final design of the program, the forestry industry was expected to be at risk of being negatively impacted by cap and trade if they received few allowances, if the carbon price was high, and/or they were assigned unrealistic emission reduction targets.

Because forest products are sold on the world market at globally set prices, the industry was expected to be unable to pass compliance costs on to their wholesalers, thereby forcing them to absorb any additional costs. With the forestry industry not having high profit margins, these additional costs could potentially significantly impact the industry and result in a loss of jobs and the closure of many mills. One respondent indicated that, like the mining industry, the current carbon tax is believed to have had only a marginal impact on the industry to date as a result of its low price and that a low carbon price associated with the cap and trade program would probably have a similar effect. In situations where reduction targets and carbon prices were high and allowance allocations were minimal, mills were believed to be more likely to close production than to relocate to jurisdictions with less stringent climate policies. Specifically, high capital costs and complex environmental assessment processes associated with opening new mills was expected to prevent companies from relocating.

Manufacturing

Unlike the forestry and mining industry, the manufacturing industry in BC has done little to reduce emissions to date. An industry respondent argued that this was primarily because 80% of manufacturers in BC were small to medium size enterprises (SMEs) who typically operated on small profit margins and therefore did not have the resources available to invest in new technologies and production processes. Only large manufacturers were believed to be considering climate issues and taking steps to reduce emissions as they had the resources available to do so. With 97% of manufacturers in the province indicating that the carbon tax had not affected the way they did business (implying that the carbon tax has had little impact on industry to date), it was believed that manufacturers (in particular SMEs) were waiting on clear policy direction from the provincial, federal, and American governments before actively pursuing opportunities to reduce emissions.

The degree to which cap and trade would affect the manufacturing industry was believed to be highly dependent on the program's final design and its corresponding regulations. Specifically, it was argued that the industry would be at a competitive disadvantage if industry reduction targets were not realistically achievable. Ultimately, it was believed that becoming less carbon intensive would benefit the industry as it would make them more competitive. However, if incentives were not given to increase investment in new technologies and processes, if an ample amount of time was not given to switch to more energy efficient, low carbon technologies, and if manufacturers were not properly educated on the program, the industry was likely to be negatively impacted.

Also, high emission monitoring and reporting costs, as well as possible electricity price increases associated with the program were expected to have some negative impact on SMEs. SMEs were likely to pass compliance costs on to consumers when possible. In cases where they were unable to pass costs on and profit margins were too small to adequately absorb these costs, it was believed that SMEs may be forced to fully or partially close operations, thereby negatively affecting jobs. A few respondents also argued that relocation of production could be an issue for BC's manufacturing industry if the cap and trade program severely impacted the industry's competitiveness.

Overall, some respondents felt the program would not significantly impact the BC economy as the few sectors believed to be at risk of being negatively impacted by the program did not represent a substantial percentage of the regional economy. Only one individual felt cap and trade would devastate all industries in BC, arguing that the Americans would implement complementary policies that were trade protectionist and would use the program and their associated complementary policies to transfer wealth from Canadian provinces to American states.

Relocation

Overall, the extent to which negatively affected industries would relocate facilities to jurisdictions with less stringent climate policies was believed to be minimal by many respondents as the predicted carbon price over the next ten years was expected to be low ($5-30 per tonne of CO2E) in comparison to the daily fluctuation of exchange rates and commodity

prices. As a result, these low prices were not expected to drive industries elsewhere. A few respondents also suggested that the extent to which relocation would be an issue in the future was highly dependent on the program's regulations, the number of participating jurisdictions, industry profit margins, and the ability for industries to pass costs on to consumers.

Positively Impacted Industries

In regards to industries that could be positively impacted by a cap and trade program, the majority of respondents felt the clean technology industry would benefit as heavy emitting industries would be forced to adopt less carbon intensive production processes and technologies to meet their reduction targets. On the other hand, a few respondents argued that the technology needed to reduce carbon intensive industries' emissions would cost more than purchasing low priced allowances or offsets, therefore, during the initial onset of the program, the additional adoption of clean technologies by carbon intensive industries would be modest at best. These individuals felt that the industry would not be positively impacted by the program until carbon prices were higher.

Alternative fuel and energy industries, such as natural gas and renewable energy, were also believed to possibly benefit from the program due to speculation that more industries would adopt low carbon fuel and energy sources to assist in meeting their reduction targets. Though BC is currently not a large exporter of renewable energy technology, some respondents argued that the province's substantive amount of knowledge, expertise, and technology developments in the renewable energy industry could result in an increase in the industry's exports as developed countries began to adopt renewable energy regulations. Depending on the final design, some individuals felt that industries that were able to easily reduce emissions through the adoption of new clean technologies or less carbon intensive fuels (such as mining, cement, and oil and gas) could potentially benefit from the program if the adoption of these methods reduced their emissions to levels below their allowance allocations. Specifically, these individuals believed that these industries could potentially profit from the program in cases where they could sell unused allowances or sell offsets.

As indicated earlier, the forestry industry was, overall, expected to be at risk of being negatively impacted by the cap and trade program. However, one respondent felt that certain sectors of the forestry industry could potentially benefit from selling offsets depending on how the offset market was set up, while others argued that the biomass sector would benefit from an expected increase in demand for renewable energies and low carbon fuels.

8.2 Potential Impact on Electricity and Consumer Prices

Opinions were mixed in regards to how the program would affect electricity prices. One respondent argued that electricity prices would increase under the cap and trade program due to the expected increase in the use of alternative energy sources (which are known to be more expensive than large-scale hydroelectric power or the combustion of traditional fossil fuels to produce electricity), however the degree to which electricity prices increased would be dependent on the WCI's carbon pricing scheme. While another respondent felt electricity prices would significantly increase under a cap and trade program, a few others expected the program

to have little impact on electricity prices as the province was already primarily a user of clean energy.

In regards to consumer prices, a number of respondents felt prices would increase as a result of some industries passing all or a portion of their compliance costs on to consumers, however, these increases were expected to be minimal. There was some concern from a few respondents that, though price increases were expected to be small, there was the possibility that this increase could affect consumer behaviour, thereby indirectly affecting industries that produce more carbon intensive products (such as some manufacturing sectors). Respondents did not expect to see increases in the wholesale price of price taking commodities such as forest products and mining as these prices were set by the world market. Therefore any cost that was incurred as a result of the program would need to be absorbed by the industry.

8.3 Potential Impact on Operational Costs

There was consensus among respondents that the program would have some effect on industries' operational costs as a result of the additional costs associated with complying with the program, as well as the possible rise in electricity prices. Some respondents indicated that, in comparison to fluctuating commodity prices and exchange rates, these additional costs would not have a significant impact on operational costs when carbon prices were low. One respondent felt that the adoption of new low carbon technologies could have a significant impact on operational costs as the cost for these technologies was typically high.

A few respondents argued that, in cases where carbon prices were low, industries with high profit margins (such as oil, gas, and mining) could possibly absorb some or most of these operational costs without significantly impacting profits. However, these same individuals felt that once carbon prices were higher the likelihood that these industries would be able to absorb compliance costs without significantly affecting profits was minimal. Others felt the degree to which cap and trade would impact operational costs would be dependent on the final design of the program and any complementary policies that coincided with it. Specifically, the question whether the program included possible exemptions, incentives for early emission reductions, and/or free allowances was believed to affect the degree in which operational costs would be impacted by cap and trade.

8.4 Potential Impact on Innovation and Investment

Leading up to the implementation of cap and trade, many respondents felt that the current lack of definitive rules around the WCI program and the indecisiveness of the federal government in regards to their own climate policies prevented companies from moving forward and investing in new technologies, energies, and production processes. Until both levels of government provided more certainty in regards to their climate policies, this hesitancy to move forward was expected to continue.

After the implementation of cap and trade, the majority of participants agreed that the program would probably stimulate additional investment in and testing of renewable energy, alternative fuels, and clean technologies as it would signal a move towards a low carbon economy. Specifically, it was felt that, if industries wanted to remain competitive in the emerging low

carbon economy and wanted to minimize any impact on their bottom line, they would have to make changes to their production processes through the adoption of such things as new technologies, energies, and fuels. Also, it was believed that the need to electrify transportation and industries in order to minimize emissions would drive investment and innovation.

Respondents felt that the cap and trade program would reinforce the need for both industries and households to become more energy efficient, which would potentially stimulate additional investment and innovation in the province's manufacturing industry as the demand for less carbon intensive and energy efficient products increased. In regards to the forestry industry, one respondent felt that the extent to which the program initiated additional investment in the industry was dependent not only on the design of the program, but also on the industry's economic circumstances. With the forestry industry experiencing extreme economic hardship since 2007 as a result of the mountain pine beetle infestation, high exchange rates, export constraints associated with the softwood lumber agreement, and the 2008-2009 economic recession, it was felt that the industry had just begun recovering from the most severe economic downturn they had ever encountered. Therefore, it was felt that the industry's main priority would most likely be on reducing the backlog of capital projects that were put on hold during the initial downturn instead of trying to attract new carbon reducing investments and increasing related innovation.

Overall, there was uncertainty among respondents in regards to the degree to which the cap and trade program would affect investment in the region. One individual argued that, though the program may stimulate additional investment in industry capital, the return on this capital was expected to be low. Others felt that the level of investment flowing into the province as a result of the program would depend on the carbon price. Ultimately, these individuals thought that a high carbon price would drive innovation and investment in the province as industries looked for new low cost ways to reduce emissions, while a low carbon price would not make it economically viable for industries to adopt new processes, fuels, and technologies.

8.5 Potential Impact on Competitiveness

In regards to the impact the program could have on the region's competitiveness, there were a diverse number of responses given by respondents. Many believed that the degree to which the program could impact industry competitiveness and trade opportunities was dependent on the WCI's final design, the likelihood that other regions and/or countries would adopt similar climate policies in the near future, and how allowances were allocated. Specifically, it was argued that industries would be at a competitive disadvantage against those that were not subject to similar climate policies and/or were not allocated a similar number of allowances.

One respondent suggested that many of BC's major industries, such as forestry and manufacturing, had their own competitiveness issues to deal with independent of cap and trade (for example the softwood lumber agreement), therefore the program would just aggravate these issues. Other individuals argued that the ability for some industries to absorb costs could potentially minimize any impact on their competitiveness. Another respondent argued that, because there were few carbon intensive industries in BC, the program would not negatively impact the region's competitiveness and, instead, could potentially improve the region's competitiveness. Specifically, this individual argued that the province had the potential to

become more competitive under a cap and trade scheme because the region already used a substantial amount of clean energy and less carbon intensive inputs in their production processes, therefore putting them in a better competitive position against their more carbon intensive competitors.

With the number of countries in the process of adopting climate policies beginning to rise, many respondents felt that BC's clean technology, renewable energy, and alternative fuel industries would be at a competitive advantage over their American and Canadian counterparts in the WCI as the province already had significant expertise and knowledge in these industries. This knowledge and expertise could then be competitively exported to regions which are in the process of adopting climate policies and which lack such expertise and technologies.

8.6 Compliance Options

In regards to whether companies were more likely to buy offsets, allowances, or adopt low carbon technologies as a means to comply with regulations, the majority of respondents felt it would be highly dependent on the final design and regulatory regime of the program, how allowances were allocated, and the carbon price. The consensus among respondents was that companies would choose the least expensive compliance option or, depending on the circumstances, a combination of all three. There was also an agreement among respondents that companies would first consider internal abatement options, such as adopting new technology or switching to less carbon intensive fuels, prior to purchasing offsets and allowances if it proved economically feasible. In cases where it was cheaper to purchase allowances and offsets or in cases where the industry had already adopted the most energy efficient technology on the market, some respondents argued that industries would initially buy offsets as the price of offsets was currently low at $25/tonne per CO2E.

8.7 Recommendations to Support Local Industries

All respondents felt that the final design and regulatory regime of the WCI program was key to ensuring industries covered under the program were not significantly negatively impacted by cap and trade. Specifically, many respondents indicated that it was necessary for the provincial government to ensure all industry concerns regarding the program were dealt with prior to implementation as it would be difficult to address these concerns via secondary policies and programs after the program came into effect.

When designing the program, some respondents argued that the province needed to find a healthy balance between achieving their emission reduction targets and extracting a reasonable amount out of the economy. One respondent felt that BC had set its carbon reduction targets too high and that the local economy could not afford to achieve these targets without extracting an unreasonable amount of money from the local economy, thereby negatively affecting industries. Other respondents stressed the need for WCI partners to create a regulatory environment within each partner jurisdiction that was the same, or at least similar too, the environment seen in other partnering states and provinces. Having every WCI partner subject to the same climate policies and energy regulations was believed to be an effective way to prevent one WCI partner's industry from having a competitive advantage over the same industry in another partner's jurisdiction.

In regards to whether allowances should be freely allocated or auctioned off as a means to either eliminate or minimize competitive risks, the responses were mixed. Some respondents argued that the final design should allow for a higher percentage of allowances to be auctioned (currently the WCI program proposes a minimum of 10% of allowances be auctioned) as the revenue generated from these auctions could be used to mitigate any unwanted and unforeseen industry consequences associated with the program. It was also suggested that, much like the revenue neutral carbon tax, auction revenue be used to provide additional financial support to industries, thereby preventing any future constraint on other budgets, such as healthcare or education, a scenario that could possibly occur under a system where the majority of allowances were freely allocated.

A few respondents felt that freely allocating the majority of allowances would not only potentially constrain other budgets (such as healthcare), but may also provide unnecessary short-term protection to trade exposed industries. Specifically these individuals felt that as the global low carbon economy continued to emerge, local industries that were energy and carbon efficient would likely be the most competitive, while those that were energy and/or carbon inefficient would be less competitive. Therefore, freely allocating the majority of allowances would potentially prevent innovation in low carbon alternatives, thereby negatively impacting the province's long term competitiveness as industries in BC would lag behind their competitors in becoming energy and carbon efficient. Other respondents argued that, in order to maintain their competitiveness, energy intensive, trade exposed industries should not only be given free allowances because of their inability to pass compliance costs on to consumers (as is the case for less energy intensive, trade exposed industries), but should also be given additional allowances or financial credits for adopting energy efficient, low carbon technology prior to implementation.

Once the program was implemented, tax credits to offset the cost of adopting clean technologies, border tax adjustments, accelerating the depreciation of less carbon intensive technologies, as well as streamlining regulatory approval processes were recommended to help mitigate any negative effects associated with the program and to assist in maintaining and/or improving the province's competitive advantage. Also, it was suggested that both levels of government begin significantly investing in research and development in the clean technology, forestry, mining, and manufacturing industries as a means to help these industries continue to grow and to minimize any negative effects associated with the program.

Some respondents felt that the federal and provincial government should encourage and increase investment in energy efficient buildings as buildings' fuel combustion would fall under the WCI program in 2015 (and would likely be incorporated into any future federal cap and trade program). These investments were considered to be not only beneficial to the construction industry, but also some manufacturing sectors. A few respondents also suggested that the federal and provincial government begin significantly encouraging innovation and investment in various clean energy sources (such as biomass, wind, and solar), as well as begin implementing programs that supported energy efficiency and provided financial incentives to facilities who adopted new clean technologies.

9. DISCUSSION

The following discussion is based on information collected from interviews, literature, local statistics, as well as recent findings on how the Acid Rain Program(ARP), Regional Greenhouse Gas Initiative (RGGI), and European Union Emission Trading Scheme (EU ETS) have impacted local industries. The discussion is limited to an overview of how local industries could potentially be impacted by a cap and trade program in BC. At this time, it is difficult to know the extent to which industries will be affected by cap and trade for several reasons. The Western Climate Initiative's (WCI) program is not yet in effect, relevant data is either limited or difficult to locate, there is minimal local knowledge on the issue, industrial allowances and caps have not yet been allocated and set, and there remains uncertainty around what the regulatory environment within each WCI partner's jurisdiction will look like once the program is implemented. Also, the WCI's program will be the most extensive greenhouse gas cap and trade program seen in the international community to date as it includes not only industrial and electrical production emissions, but also emissions from transportation and building fuel combustion. Therefore, it is difficult to gain a specific understanding of how the program could impact the region's construction and transportation industries as no other cap and trade program has included these sources of greenhouse gas emissions to date.

The following discussion is based on the assumption that carbon prices will be low during the initial ten years of implementation as projected, all WCI partners will move forward with their cap and trade commitments, and that, as foreseen, industries will receive some, if not the majority, of their allowances for free. As it stands today, the projected carbon price for the WCI program is US $6-10 per tonne of CO2E by 2015 and up to US $24 per tonne of CO2E by 2020 (Bramley et al., 2009; WCI,2009b). As indicated by Bramley et al (2009), carbon prices around or below $30 per tonne of CO2E will be of minimal risk for most industries (Aldy et al., 2009; Bramley, Partington, Sawyer, 2009). Also, to avoid double taxation, BC's carbon tax will be integrated into the province's cap and trade program (MoF, 2010).

Though the WCI initially began with eleven partners, in the past few months Arizona and Utah have pulled out of the initiative due to concerns that the program would slow their state's economic recovery from the 2008-2009 recession, while Oregon, Washington, and Montana have recently failed to get legislative approval for a cap and trade program, thereby potentially stalling their ability to implement the program in 2012. Also, California's high unemployment rate (12.4% in May, 2010) has led to the creation of a voter initiative that, if passed in the upcoming November 2010 election, could block the implementation of the state's California Global Warming Solutions Act (which includes cap and trade) until the state's unemployment rate falls below 5.5% (EDD, 2010).

9.1 General Discussion

As reflected in the interview findings, there has been some consensus that, because of low carbon prices, the WCI's cap and trade program will not have a significant negative impact on local industries during the initial ten years of the program. Though local opinions on the potential impact of the program on electricity prices have varied, evidence from the ARP, RGGI, and EU ETS suggests that cap and trade programs have had only a minimal impact on electricity

prices while carbon prices were low. This scenario will most likely hold true for BC as carbon prices are not only expected to be initially low, but also the majority of BC's electricity is generated from low carbon intensive sources (specifically hydroelectric). Therefore, it is unlikely that the program will have a significant impact on the electricity generation industry and indirectly negatively affect consumers via high electricity prices. As service industries represented 78% of the province's GDP and 80% of its employment in 2009, the program will likely have little impact on the BC economy as a whole considering that the industries covered under the WCI program will represent less than 22% of the province's GDP (BC Stats, 2010). Only 40 industrial facilities in the province emit over the program's 25,000 tonnes of CO2E a year threshold (Simpson, 2010). Therefore, one could argue that the program will have a minimal impact on the majority of industries as only a small number of facilities will actually be required to comply with program regulations (Finlayson, 2009; Olewiler, 2009). Specifically, facilities from the pulp and paper, energy, mining, oil, and natural gas industries, as well as transportation and some manufacturing sectors such as aluminum, cement, and steel production will be covered under the WCI program (Finlayson, 2009).

Though initial volatility in the EU ETS's allowance prices is believed to have made it difficult for industries to make long term investment decisions, price volatility will likely not be an issue in the WCI region. The WCI's requirement for facilities to start reporting annual emissions in 2010 will provide government officials with a more accurate picture of the quantity of greenhouse gases emitted in each region, thereby making it easier to determine effective industry emission caps and allowance allocations (Olewiler,2009). Ultimately, it is expected that the current emission reporting scheme will prevent the over-allocation of allowances in the future, which in turn will reduce the possibility of allowance price volatility. The implementation of cap and trade is also expected to stimulate additional innovation and investment (and therefore employment opportunities) in the region as it provides investors with long term policy certainty, as well as provides industries with some assurance that their investment in new processes, technologies, and energies will result in long term cost savings (Globe, 2010b; SP, 2010). However, the degree to which cap and trade will initiate additional investment in the province remains unknown due to uncertainty about carbon prices, allowance allocations, complementary policies, and emission caps.

As seen in the EU ETS and ARP, cap and trade typically has little impact on local industries' competitiveness when carbon prices are low (Bataille et al., 2009; ICTSD, 2009). Those who are impacted are typically industries that are more carbon intensive and trade exposed such as some manufacturing and forestry sectors (Bataille et al., 2009). One could argue that a decline in competitiveness was not a significant issue in the EU ETS due to all EU countries being subject to the same cap and trade regulations, but could potentially be an issue in BC as there is no national or North American cap and trade program in operation that forces all American and Canadian industries to be subject to the same cap and trade regulations.

While the United States (BC's major trading partner) does not have a national cap and trade program in place, BC's industries will likely not be at a significant competitive disadvantage against their American (and Canadian) competitors while carbon prices are low as the majority of large states and provinces are anticipated to be subject to some kind of cap and trade program by 2012 and BC is currently less carbon intensive than many of its American and Canadian

counterparts. Twenty-three states and four provinces will be subject to some form of greenhouse gas cap and trade program by 2012 as a result of the implementation of the RGGI, WCI, and Midwestern Accord programs, thereby potentially minimizing local competitiveness issues with industries located in non-WCI partnering jurisdictions in Canada and the United States (Aldy et al, 2009). When carbon prices are high, competitiveness may become an issue if other jurisdictions have not adopted stringent climate policies by that time (Bataille et al., 2009).

What follows is a discussion on how cap and trade could potentially impact specific industries in BC. Industries discussed were chosen based on information obtained from interviewees, Industry Canada's interests, and the literature. These include forestry, mining, natural gas, renewable energy and clean technology, manufacturing, offsets and environmental services, and cement.

9.2 Forestry

As indicated in the findings and as shown in the EU ETS, the pulp, paper, and wood product sectors will likely have to absorb any compliance costs associated with the WCI program as the industry will be unable to pass the majority of these costs on to wholesalers due to their market prices being set on the world market. This could potentially negatively impact these sectors as many of the facilities selling these products are currently operating on low profit margins. However, as shown with the carbon tax, this impact will likely be minimal during the initial years of the program since the industry is expected to be allocated free allowances, electricity prices are expected to remain fairly stable, and carbon prices are projected to be low for at least ten years after implementation.

In addition, compared to fluctuations in commodity prices and exchange rates, the program is not expected to have a drastic effect on the industry's competitiveness while carbon prices are low and relocation of production will be unlikely due to high capital costs and complex environmental assessment processes associated with setting up new mills. In the future, however, the program could potentially have a significant impact on these sectors and their competitiveness in situations where carbon prices are high, technologies are not improved upon, and/or few allowances are not freely distributed to the industry. If this scenario were to occur, the industry would likely close non-profitable facilities instead of relocating production resulting in a loss of regional jobs.

Some of BC's forestry sub-sectors could potentially benefit from cap and trade, in particular the biomass sector could see demand for their products increase. BC has a substantial amount of biomass available which could be used to produce bio-energy and bio-fuel, both of which are clean alternative sources of energy and fuel which could be used by various industries in the WCI region to assist in reducing their emissions. Specifically, BC has over half of Canada's capacity for biomass electricity production (Phillips,2010).

Although the Province's Bio-energy Strategy (which aims to have 50% of the province's renewable energy requirements met by bio-energy by 2020) and the cap and trade program may stimulate growth in this sector, during the initial years of the program this growth may be modest at best. Costs associated with harvesting, transporting, and purchasing feedstock for bio-energy and bio-fuel production remain high, thereby making these products more costly than alternative sources of energy and fuel like natural gas and hydroelectric which are currently fairly

inexpensive. The forestry industry may also benefit from selling offsets in the future, however the degree to which it will benefit is highly dependent on whether forestry offsets will be considered 'real greenhouse gas reductions' in all WCI partnering jurisdictions (GoO,2009). Currently, there is some disagreement as to whether forestry offsets should be valid under a stringent offset system due to difficulties in ensuring the permanency of their greenhouse gas reductions, making it difficult to know the extent to which the industry would benefit from selling offsets.

9.3 Natural Gas

As shown in the EU ETS, a cap and trade program will likely not have a significant negative effect on the natural gas industry, especially if the industry receives an over allocation of allowances as was seen in the EU ETS. Though it was thought that the European Union's gas industry was able to pass compliance costs on to consumers, local interviewees indicated that having products traded on the North American market prevented the natural gas industry from being able to pass on compliance costs and would have to absorb any costs associated with the program. Because the industry operates with large profit margins, having to absorb compliance costs is not expected to significantly impact industry profits while carbon prices are low and may minimize any impact on the industry's competitiveness during the program's initial years. While having to comply with the program's regulations may result in the industry having to incur some additional costs, the natural gas industry will likely benefit from cap and trade and other climate policies as demand for natural gas is expected to continue increasing in the future due to industrial facilities in BC and other jurisdictions looking for easy, low cost methods to reduce emissions (WCI, 2010b).

Industries like cement will most likely switch their fuel source from oil or coal to natural gas in order to meet reduction targets as natural gas is not only cleaner than oil and coal, but also less costly than other low carbon fuel alternatives such as bio-fuel. As indicated by Demailly et al (2007) and Reinaud (2005), a region's natural gas exports are not expected to decrease when carbon prices are high, nor are production facilities expected to relocate due to the high capital costs and long permitting processes associated with setting up new production facilities (Demailly et al, 2007; Reinaud, 2005). In its shift towards a low carbon economy, the province has already taken steps to transition away from the use of coal to natural gas by beginning to develop the infrastructure needed to effectively transport substantial quantities of natural gas. Infrastructure underdevelopment may become an issue in the future if demand for natural gas (due to the implementation of such climate policies as cap and trade) increases faster than the development of the infrastructure needed to transport it. If this were to occur, the underdevelopment of infrastructure could negatively impact the industry (Globe, 2010b; WCI, 2010b).

9.4 Mining

The mining industry will likely not be significantly impacted by cap and trade while carbon prices are low (as seen with the carbon tax). Though the mining industry will be unable to pass compliance costs on to consumers, having to absorb these costs is not expected to have a substantial impact on the industry's profits while carbon prices are low as they are currently operating with high profit margins. Also, similar to the natural gas industry, being able to absorb

costs without significantly affecting profits could potentially protect the industry's competitive edge during the initial years of the program. Facilities that are able to cost-effectively modernize their equipment or electrify certain aspects of their production process during the initial years of the program could potentially benefit through the sale of allowances if they are able to reduce their emissions to levels below the number of allowances received. High carbon prices and the allocation of fewer allowances could have a significant impact on the mining industry's profit margins in the future which could in turn affect the industry's ability to grow and its competitiveness. Though some interviewees were concerned that high carbon prices could initiate the relocation of mining production to jurisdictions with less stringent climate policies, as shown in the EU ETS, high capital costs, environmental assessment processes, and the availability of local resources, expertise, and necessary infrastructure will most likely act as trade barriers against the relocation of local mining production in cases where carbon prices are high.

9.5 Cement

As indicated in the interviews and as seen in the EU ETS to date, the local cement industry is unlikely to be significantly impacted by cap and trade while carbon prices are low due to the industry's ability to easily switch their primary fuel source from coal to natural gas, as well as their ability to pass compliance costs on to consumers. Depending on the number of allowances freely allocated, the cement industry may initially benefit from the program after switching to natural gas if the reductions attributed to this fuel switch bring emissions below the facility's emission cap, thereby allowing them to sell unused allowances. Unless new technologies that further reduce emissions are developed by the time the program is implemented, when carbon prices are high or if free allowances are not distributed, the industry will likely be slightly negatively impacted by the program as it will begin to lose some of its competitiveness. Production relocation will be unlikely as high capital and transportation costs will prevent production from moving elsewhere. However, with high carbon prices cutting into profits, the industry may have to decrease production resulting in the loss of jobs.

9.6 Clean Technology

As the global low carbon economy continues to quickly emerge, climate policies, such as cap and trade, will help drive BC and Canada's transition to a low carbon economy, of which clean technology will play a key role (CBOC, 2010b; CBOC, 2010c). As seen in other cap and trade programs and as indicated by interview respondents, the need to have less carbon intensive industrial production processes to comply with cap and trade regulations while remaining competitive in a low carbon economy, will likely stimulate additional growth in BC's clean technology industry by attracting additional private investment in the development and adoption of clean technology, as well as improve provincial competitiveness (Atkinson et al, 2010; CBOC, 2010c; Phillips, 2010; Aldy et al., 2009; Globe, 2010b; SP,2010; Guhr, Schaefer, 2009; SDTC, 2010b). In particular, the manufacturing, transportation, power generation, construction, some forestry and mining sectors, and renewable energy industries will benefit from the development and application of new technologies (CBOC, 2010b; Guhr et al., 2009). That said, as mentioned by some interviewees and as speculated in the ARP and EU ETS, initial growth and investment in the clean technology industry during the onset of the program may be modest at best.

Domestic demand may be initially low due to some carbon intensive industries having already taken steps to adopt relevant technologies currently on the market, low regional carbon intensity in comparison to other North American jurisdictions as a result of BC's reliance on hydro-electricity, and projected low carbon prices potentially preventing significant private investment in the initial adoption of high cost clean technologies (Demailley et al., 2007; Grubb et al., 2009, Kenbar et al., 2009; Globe, 2010b; SDTC, 2010; SP, 2010). Also, with substantial knowledge and expertise in BC due to the province having the third largest clean technology cluster in the world, both BC and the federal government have already taken steps outside of cap and trade to stimulate cluster growth through the use of clean technology funds (most of which focus on research and development, demonstration, and pre-commercialization) (CBOC, 2010c; Phillips, 2010; Guhr et al., 2009). These clean technology funds are expected to invest an estimated $1 billion into the BC industry between 2010 and 2014, creating an estimated 13,000 clean technology jobs in BC and increasing provincial GDP by an estimated $866 million (CBOC, 2010c). Therefore, though cap and trade will likely initiate some additional growth in the industry, with these technology funds currently in place it is difficult to speculate the degree to which cap and trade will initially impact industry growth in comparison to what is attributed to these funds.

The local industry will most likely see significant private investment in the development and adoption of clean technologies further in the future when carbon prices are higher and new technologies are on the market. With the global clean technology industry expected to be worth $600 billion US by 2020 due to the growing number of countries implementing stringent climate policies, a cap and trade program will likely provide local investors and industries with a price signal that indicates a global shift towards having to pay for carbon (Atkinson et al, 2010; Phillips, 2010). This could potentially attract some additional private investment in the pre-commercialization and commercialization of these products, putting the industry in a better position to meet some of this future global demand when carbon prices are higher. Overall, any investment in the clean technology industry, whether for the development or adoption of such technologies, will positively impact the province. Cap and trade may act as a catalyst for the early adoption of clean technologies for some industrial facilities which may potentially offset future job losses in carbon intensive industries, as facilities will less likely be significantly impacted by climate policies and high carbon prices (CBOC, 2010c). Also, as indicated by the Conference Board of Canada (2010), any investment made in the local industry will result in regional job creation. The Board expects that for every $100 million invested in the province's clean technology industry, 1,000 jobs will be created (CBOC, 2010c).

9.7 Renewable Energy

Cap and trade is also expected to stimulate growth and investment in BC's renewable energy industry as there is speculation that some industrial facilitates relying on fossil fuels in the WCI region will convert to cleaner energies and fuels in the near future to comply with cap and trade regulations and maintain their long term competitiveness in a low carbon economy (EY, nd; Globe, 2010b; Olewiler, 2009). An increase in domestic demand for renewable energy will likely be modest though as the majority of energy used in BC is currently generated from low-cost hydro-electricity, making alternative sources of clean energy less attractive. At the same time, WCI jurisdictions that rely on more carbon intensive sources of energy will likely see an increase in demand for clean energy (CBOC, 2010a; Phillips, 2010; Guhr et al., 2009; WCI, 2010b).

Ultimately, as demand for clean and renewable energy in the WCI region increases, BC will be in a good position to meet some of this demand via clean energy exports as the province has a substantial amount of natural resources and clean technology expertise available to generate clean energy. Industry growth and the potential increase in clean energy exports may be minimal during the initial years of the program as carbon prices are expected to be low, adoption of such energies is expensive, access to capital remains a challenge, and the energy infrastructure currently in place in North America is designed for fossil fuels, not renewable energy (EY, nd; Phillips, 2010; Globe, 2010b; SP, 2010).

The degree to which cap and trade will stimulate growth and investment in the renewable energy (and clean technology) industry may prove difficult to measure in the future as other climate policies (such as the new provincial Clean Energy Act) and rising energy costs will also likely increase demand for and investment in clean technologies and renewable energies.

9.8 Manufacturing

With the relatively low carbon tax having little impact on the local manufacturing industry to date ($20 per tonne of CO2E as of July 1, 2010), the cap and trade system is expected to have similar effects on the industry as long as carbon prices are low, free allowances are distributed, the industry is properly educated about the program, and carbon prices remain low long enough to allow the industry to cost effectively adopt cleaner technologies. Though emission monitoring and reporting costs may be high for local small and medium sized enterprises (SMEs), the initial low carbon price and BC's extensive use of low cost hydroelectric energy will assist in minimizing any economic impacts associated with cap and trade. The current use of hydroelectricity could result in local manufacturers' compliance costs being initially lower than some their WCI counterparts, making BC's manufacturers potentially more competitive than some of their carbon intensive WCI counterparts.

Also, as seen in the EU ETS, compliance costs are initially expected to be low in comparison to other economic factors such as fluctuating exchange rates and transportation costs. These costs will have minimal impact on profits and make it easier for manufacturers to pass at least a portion of their compliance and reporting costs on to consumers without significantly impacting consumer prices (Bataille et al, 2009). As indicated by Aldy et al (2009), slight price increases may negatively impact demand for carbon intensive products. However, this reduction in demand will likely be minimal while carbon prices are low and, therefore, will not have a significant impact on current industry profits and employment (Aldy, Pizer, 2009; Bataille et al., 2009; Bramley, 2008). Depending on the final allocation of allowances, the manufacturing industry could initially benefit from a cap and trade program through the sale of unused allowances. The industry has done little to date to adapt to climate change and could quickly decrease emissions below their emissions cap through the adoption of clean technologies and more energy efficient production processes which could result in some facilities being able to sell unused allowances and reduce compliance costs.

Though low carbon prices and compliance costs are expected to have little impact on current profits and employment, as speculated in the EU's aluminum industry, an increase in operational costs associated with cap and trade could prevent additional investment in regional industry capacity, possibly stagnating future growth for certain carbon intensive manufacturing sectors.

As carbon prices gradually increase, high carbon prices and corresponding rising consumer prices could have a significant impact on carbon intensive sectors of the industry, such as steel and aluminum, in the future. Demand for carbon intensive products and sector competitiveness could decline as a result of these high prices, leading to the relocation of production if facilities are unable to find alternative, cost effective ways to further reduce emissions.

As seen in other cap and trade programs, manufacturing sectors that produce energy efficient products and clean technologies will likely see some growth under a cap and trade program due to an expected increase in demand for these products, which could contribute to increases in regional employment opportunities (CBOC, 2010c; Globe, 2010b; Olewiler, 2009). However, as indicated at Globe 2010 and as seen in the ARP, demand for energy efficient products and clean technologies may be modest at first due to low carbon prices which could potentially prevent investors from investing in new products and inhibit facilities from adopting expensive clean technologies. Also, the majority of energy efficient products and clean technologies developed in BC are manufactured in the developing world (Globe, 2010b; Olewiler, 2009). Though cap and trade provides an opportunity and incentive for local manufacturers to begin increasing local production of these products, these opportunities may not initially be acted upon while carbon prices are low due to this potential lack of both investment and significant demand for such products (Olewiler, 2009).

9.9 Offset and Environmental Services Industries

Some interview respondents speculated that BC's offset industry would benefit from the cap and trade program as demand for offsets would grow as facilities looked for low cost methods to comply with the program. However, as seen in the EU ETS, demand for offsets is dependent on the price of allowances and the accessibility and cost effectiveness of adopting new technologies or production processes. In the case of BC, offsets generated in the province are currently selling for $25 per tonne of CO2E while the price of allowances is estimated to be approximately $24 per tonne of CO2E by 2020. Therefore, in situations where it is more cost effective to purchase offsets or allowances instead of adopting new technologies and production processes, facilities in the province will likely purchase allowances over offsets (if supply permits).

In addition, there remains some uncertainty about the type of offset projects that will be considered eligible under the WCI program, making it difficult to determine which industries may benefit from the sale of offsets. As well, the WCI program is expected to allow not only offsets from WCI jurisdictions, but also international competitors which could result in modest growth in the province's offset industry as demand for local offsets may be less than originally expected (Bramley et al., 2009). Any expansion in the offset industry could indirectly benefit industries as offsets compete against the sale of allowances keeping carbon prices low (Olewiler, 2009).

As indicated by Olewiler (2009), the Conference Board of Canada (2010), and as predicted in the ARP and the RGGI, the program will most likely contribute to growth in sectors of the service industry that cater to emissions trading and tracking such as emission brokers, offset verifiers, financial firms, software developers, and allowance traders (CBOC, 2010b; Olewiler, 2009). Depending on the allocation of allowances and the carbon price, this growth could be minimal at first as there may not be a large regional carbon-trading market in place during the initial years

of the program. With the global carbon-trading market expected to be worth $2-3 trillion US by 2020, local growth in the service sectors catering to carbon-trading will likely become more significant in the latter half of the program as carbon prices become significantly higher and facilities receive fewer allowances (CBOC, 2010b). The Conference Board of Canada (2010) expects that any growth occurring in the clean technology industry will lead to growth in the environmental services sector, such as energy auditors, green building, retrofitters, environmental protection, and environmental engineers (CBOC, 2010a).

One interview respondent expected cap and trade to have a significant impact on all BC industries if partnering American states implement other environmental statutes, regulations, and complementary policies that coincide with the WCI program and are protectionist in nature. This, in turn, would allow American industries to benefit from cap and trade at the expense of Canadian exporters. Though analyzing the impact of American environmental complementary policies, statutes, and regulations on BC is outside the scope of this paper, it is difficult to predict whether this scenario will occur due to uncertainty regarding program regulations and the type of complementary policies, regulations, and statutes the American's will implement nationally or at the state level in the near future. Once there is a better understanding of the WCI's regulations and the full scale of American climate policies, statues, and regulations becomes more apparent, this may be an issue for the federal government to closely monitor.

9.10 Conclusion

In summary, the degree to which a cap and trade program will impact industries will be highly dependent on how allowances are allocated in BC and other partnering WCI jurisdictions, the percentage of allowances auctioned in each participating jurisdiction, carbon prices, and the type of offset projects eligible in each jurisdiction (Olewiler, 2009). If partnering jurisdictions take steps to align their allowance distributions, offset activities, and auction components, situations where an industry in one partnering jurisdiction has a competitive advantage over others would be reduced.

Currently, as seen in the EU ETS and as foreseen by the majority of interview respondents, a cap and trade scheme in BC will have minimal negative effects on local industries initially. Specifically, while carbon prices are low, many facilities will be able to absorb or pass a portion of their compliance costs on to wholesalers or consumers without significantly impacting the industry (Olewiler, 2009). Whatever minimal negative effects are seen during the initial years of the program will likely occur in BC's more carbon intensive industries such as mining, some manufacturing and forestry sectors, and natural gas (Bataille, Dachis, Rivers, 2009; GoO, 2009).

Increase in demand for clean technologies and renewable energy is expected to be modest while carbon prices are low due to the high costs associated with adopting these technologies. Also, as seen in other cap and trade programs and as discussed in the literature, the program is expected to have minimal effects on provincial and state economies and competitiveness when carbon prices are low (Bataille et al., 2009; ICTSD, 2009; GoO, 2009). As caps become more stringent and carbon prices become substantially higher, the likelihood that local carbon intensive industries will be negatively impacted by cap and trade could increase. At the same time, the clean technology and renewable energy industries, as well as the manufacturing sectors that

manufacture energy efficient products would benefit from the increased demand and investment high carbon prices are expected to bring.

10. RECOMMENDATIONS AND CONCLUSION

What follows is a discussion of three recommendations and corresponding strategies Industry Canada could consider as a means to support industries leading up to and during the implementation of a cap and trade program. This discussion is followed by an overall conclusion.

10.1 Recommendations

Recommendation 1: Monitor the Development, Implementation, and Industry Impacts Associated with the Provincial Cap and Trade Program

The final design and regulatory regime of cap and trade is key to ensuring industries are not significantly impacted by the program. Specifically, a balance between what is needed to achieve provincial emission reduction targets and setting realistic industrial emission caps that are not only achievable, but also will not significantly impact competitiveness, profitability, and scale of production is important. Therefore, it is important for governments to gain insight into industry perspectives on what emission reductions they will be able to realistically achieve without harming competitiveness and profitability.

Though both the WCI and the province have already taken steps to obtain stakeholder feedback on certain aspects of the program's design and corresponding regulations, local communities feel that the design may not adequately address their concerns and remain frustrated with the degree of uncertainty that still surrounds the program. Facilities covered under the program are unaware of the number of allowances they will be freely allocated and, as a result, are unsure of the degree to which the program will impact operational expenses. Therefore, this uncertainty has made it difficult for industrial facilities to know how to prepare for the program.

With there being prospects for a federal cap and trade program in the foreseeable future as the federal government coordinates efforts with the United States, it would be beneficial for the federal government (in particular Industry Canada) to observe how the provincial program unfolds and to closely monitor industry impacts. Specifically, it could prove useful in gaining a better understanding of industry concerns regarding such climate programs, impacts on industries, and effects on the regional economy. Acquiring this knowledge would put the public service in a better position to inform future national climate policies.

At this point in time, it would be best that the federal government not participate in the development and implementation of BC's cap and trade program. This is due to the program being a provincial initiative, uncertainty around the implementation of the program being a controversial issue within the industrial community, and there remaining an uncertain level of political support for such climate initiatives within the federal system.

Strategies that the federal government could consider when monitoring the development and implementation of the provincial cap and trade program include:

a) Attend Conferences, Workshops, and Forums Relevant to the Provincial Cap and Trade Program and its Associated Impacts

Attending public events related to the provincial cap and trade program would provide the department with opportunities to collect intelligence regarding issues that were encountered during the program's development and implementation stage and solutions used to address these issues. As well, these events would provide intelligence on how the program has affected industries, the regional economy, innovation, and competitiveness. Events hosted by universities, industry associations, the Western Climate Initiative (WCI), and/or the provincial government would be the department's primary focus. The information collected at these events could be used to inform national climate policies.

b) Keep Up to Date with Relevant Literature

Reading ex-ante and ex-post studies and other literature relevant to the WCI's cap and trade program will also allow the department to closely monitor the development and implementation of the provincial program. Such documents could provide the department with intelligence on the challenges experienced during the development and implementation stages, smart practices that were used, negative and positive impacts on industries in BC and the WCI region, and effects on the regional economy. The information collected from these sources could be used to inform future national climate policies.

Recommendation 2: Federal Financial Incentives to Support the Product Commercialization, Business Development, Demonstration, and Early-Deployment of Clean Technologies

Currently, the federal government has a number of programs and initiatives in place that support and provide funding for the research and development (R&D) of clean technologies. These include, for example, the *National Research Council of Canada's Industrial Research Assistance Program* (NRC –IRAP), programs and initiatives under *Natural Sciences and Engineering Research Council of Canada (NSERC*), *Natural Resources Canada* (NRCan), *Western Economic Diversification* (WED), *Sustainable Development Technology Canada* (SDTC), as well as the *Scientific Research and Experimental Development* (SR&ED) tax incentive program.

It is important for the federal government to continue funding these programs as it helps minimize some of the high level risk associated with investing in these projects for private investors, thereby making them more attractive to investors. They also help to advance early-stage research that may not yet be sufficiently advanced to attract commercial investment.

Though it remains important to continue funding R&D programs, clean technology SMEs are finding it more difficult to secure the funding needed to commercialize their products and bring them to market. Currently, Sustainable Development Technology Canada's (SDTC) *SD Tech Fund* and *NextGen Biofuel Fund* are the primary sources of federal funds for the development and demonstration of clean technologies. With these funds set to expire at the end of 2010, there will be much more limited public funding available for the demonstration of clean technologies.

There is also only a limited amount of federal funding currently available for product commercialization (including testing), business development (including market research, marketing, distribution channel improvements, patents, and third party validation), and early-

deployment of clean technologies. In addition, the recent downturn in the venture capital market has negatively impacted the amount of financing SMEs have been able to raise to assist in moving their products to market. Therefore, there is a need for the federal government to begin providing additional financial funding for these areas as a means to encourage and help leverage private investment. With over 50% of the country's clean technology companies in the product commercialization, market development or demonstration stage, federal efforts to close this funding gap would prove useful in initiating local and national growth in clean technology and energy industries. Also, it would assist in bringing additional clean technologies to market, providing industrial facilities with a variety of technologies to choose from when deciding how to best reduce their emissions.

Strategies that the federal government could consider when providing additional financial support for the product commercialization, business development, demonstration, and early-deployment of clean technologies include:

a) Extend SDTC's SD Tech Fund and NextGen Biofuel Fund

With SDTC's funds set to expire the end of 2010, the federal government could consider replenishing (and possibly increasing) these funds to ensure an adequate level of public funding is available to support the development and demonstration of clean technologies in Canada. Continuing to provide federal financial support for such activities could help attract much needed private investment in the clean technology industry as it minimizes some of the risk associated with investing in the development of new technologies. In addition, maintaining an adequate level of public funding for the development and demonstration of clean technologies could help expedite the process of bringing new products to market.

b) Contribute to British Columbia's Innovative Clean Energy (ICE) fund

In 2007 the provincial government created the ICE fund to support the development of new BC clean technologies and energies. Specifically, the fund aims to support new (or not currently used), pre-commercial clean technologies that have the potential to meet regional and international market demand. The goal is to demonstrate the commercial viability of selected technologies and to provide an opportunity to showcase these technologies to the local and international community.

The federal government could offer to contribute federal funds to the ICE fund under the agreement that the fund be broadened to incorporate not only support for the demonstration and early-deployment of clean technologies, but also business development and product commercialization. These federal funds could potentially be allocated through WED's Western Economic Partnership Agreement (WEPA), a $50 million fund ($25 million of which comes from the federal government) that focuses on business competitiveness, productivity, regional economic development, and the low carbon economy. Contributing to an existing funding mechanism is believed to be a practical, administratively low cost way to provide additional financial support to the product commercialization, business development, demonstration, and early-deployment of clean technologies.

Recommendation 3: Federal Financial Incentives to Support the Industrial Adoption of Clean Technologies

As industrial facilities are not expected to significantly invest in clean technologies when carbon prices are low, financial incentives would encourage facilities to invest in the early adoption of clean technologies to better prepare themselves for when carbon prices are higher. These incentives would not only stimulate growth in the industry, but would also reduce costs associated with purchasing these technologies, decrease their emissions, and assist in their transition to a low carbon economy. Encouraging the adoption of clean technology would also likely benefit the manufacturing sectors who manufacture these technologies, as well as the environmental service sectors that install and service them.

Currently, there is only a limited number of federal financial incentives in place for the industrial adoption of clean technology. Instead of focusing on all forms of clean technology, incentives that are in place focus primarily on the industrial installation of equipment that generates heat and electricity from renewable sources, or equipment that conserves energy. These incentives are managed by NRCan and Canada Revenue Agency.

A strategy that the federal government could consider when providing additional financial support for the industrial adoption of clean technologies is:

a) Expand the Accelerated Capital Cost Allowance Program

As a means to encourage companies to switch to less carbon intensive technologies and processes, Industry Canada could consider working with NRCan and the Department of Finance to expand the Accelerated Capital Cost Allowance program. Currently the program allows for increased rates of capital cost allowance (depreciation) of equipment that generates heat and electricity from renewable sources or equipment that conserves energy.The program could be expanded to include clean technologies that reduce greenhouse gas emissions from industrial production processes.

Overall, initiating growth in the country's clean technology industry will help create more technical solutions for industries, organizations, and individuals to reduce their emissions, thereby minimizing any costs associated with current and future climate policies. It will also help ease the country's transition to a low carbon economy, as well as put Canada in a better position to potentially capitalize on the growing global demand for clean technologies.

Recommendation 4: Educate Carbon Intensive Industries on Potential Carbon Reduction Strategies, Smart Practices, and Clean Technologies

Currently there is little understanding and awareness within industrial sectors on how climate policies could impact their business, carbon-emission reducing strategies that could be implemented, smart practices related to industrial emission reduction, and the availability of relevant clean technologies. This is especially true for SMEs. To ensure industries are better prepared to adhere to future provincial and federal climate regulations and to effectively

transition to a low carbon economy, the federal government could take steps to better educate industries on the options available to reduce carbon-emissions.

Strategies that the federal government could consider when deciding how to best educate industries on potential carbon reduction strategies, smart practices, and clean technologies include:

a) Partner with Industry Associations to Produce Jointly-Funded Research Projects

The federal government could work with industry associations, whose members would be impacted by climate policies (such as cap and trade), to research carbon reduction strategies and emission reduction smart practices that could potentially be used by their members. This research could also include an exploration of available clean technologies that are relevant to industrial production processes and that are located either regionally or nationally. Research projects would be jointly-funded by the federal government and participating industry associations, and contracted out to companies specializing in the production of such reports. Industry associations would be responsible for distributing finished information products to their members, thereby providing opportunities for members to better educate themselves on the strategies, practices, and technologies available to reduce their carbon emissions.

b) Educational Forums and/or Workshops

The federal government could hold a series of forums and/or workshops that provide information on relevant carbon emission reducing technologies and methods for industrial companies affected by climate policies. The ultimate goal of these workshops and forums would be to properly educate companies on possible emission reduction strategies and smart practices, as well as provide information on the availability of related clean technologies. These events could be hosted alongside the province and/or industry associations and be used to share the results of any local research that has been done on the topic. The government could also consider inviting local clean technology suppliers to participate in these events. This would provide an opportunity for the federal government to connect carbon intensive industries with local and national clean technology suppliers that have emission reducing products available, thereby increasing the visibility of such technologies.

Below is a brief overview of the above recommendations and strategies.

Recommendation 1- Monitor the Development, Implementation, and Industry Impacts Associated with the Provincial Cap and Trade Program:

- Attend Conferences, Workshops, and Forums Relevant to the Provincial Cap and Trade Program and its Associated Impacts

- Keep Up to Date with Relevant Literature

Recommendation 2 – Federal Financial Incentives to Support the Product Commercialization, Business Development, Demonstration, and Early-Deployment of Clean Technologies:

- Extend SDTC's SD Tech Fund and NextGen Biofuel Fund

- Contribute to British Columbia's Innovative Clean Energy (ICE) fund

Recommendation 3 – Federal Financial Incentives to Support the Industrial Adoption of Clean Technologies:

- Expand the Accelerated Capital Cost Allowance Program

Recommendation 4- Educate Carbon Intensive Industries on Potential Carbon Reduction Strategies, Smart Practices, and Clean Technologies:

- Partner with Industry Associations to Produce Jointly-Funded Research Projects

- Educational Forums and Workshop

10.2 Conclusion

As seen in the United States' Acid Rain Program and Regional Greenhouse Gas Initiatives, as well as the European Union's Emission Trading Scheme, cap and trade programs do not significantly impact industries when carbon prices are low. In cases where allowances are freely allocated and low-cost clean technologies are available, these impacts are even less. With the Western Climate Initiatives' carbon prices projected to reach $24 per tonne of CO2E by 2020, it is unlikely that the program will put a significant strain on industry profits and competitiveness while carbon prices are this low.

The local clean technology and renewable energy industry will potentially see modest growth during the initial years of the program associated with increased adoption of such technologies and energies. Growth in the offset and environmental services sectors could be minimal during the initial years of the program due to carbon allowances being sufficient to cover existing emission levels, a potentially small carbon trading market, and minimal demand for environmental services while carbon prices are low. As caps tighten and carbon prices substantially increase, local carbon intensive industries will likely be negatively impacted by cap and trade, albeit the severity of these impacts remains in question based on experiences in other jurisdictions. At the same time, high carbon prices are expected to stimulate additional demand for clean technology, renewable energy, energy efficient products.

As more countries begin implementing stringent, market-based climate policies such as cap and trade, it will become increasingly important for the global community to begin collaborating and coordinating their environmental efforts to ensure that sufficient global emission reductions are achieved and that industries located in different countries are on a level playing field.

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APPENDIXES

Table 1: Cap and Trade Program Comparison

Key Elements	Proposed Western Climate Initiative	European Union Emission Trading Scheme	Regional Greenhouse Gas Initiative	Acid Rain Program
Start Date	**Phase 1:** 2012 **Phase 2:** 2015	**Phase 1:** 2005 **Phase 2:** 2008 **Phase 3:** 2013	2009	**Phase 1:** 1995 **Phase 2:** 2000
Type of Emissions Targeted	CO2, CH4, N2O, Hydro-fluorocarbons, Per-fluorocarbons, Sulfur - hexafluoride	CO2 (Netherlands also includes N2O)	CO2	NOX, SO2
Industries Targeted	**2012:** Industrial process emissions Electricity generation (including imported electricity) **2015:** Fossil fuel combustion from transportation Residential, commercial, and industrial level fossil fuel combustion	Electricity generation Industrial process emissions **2012:** Aviation **2013:** Ammonia and petrochemical production Aluminum manufacturing Capture, transport, and storage	Fossil fuel fired electricity and power plants	Fossil fuel fired and electric power plants
Reduction Targets	15% below 2005 levels by 2020	**Phase 1/2:** 8% below 1990 levels by 2012 **Phase 3:** 21% below 2005 levels by 2020	10% below 2009 levels by 2018	**SO2:** 50% below 1980 levels by the end of 2010 **NOX:** Reduce emissions by 2 million tonnes below 1980 levels by 2000 (15% annual reduction after 2000)
Thresholds (Annually)	25,000 mt of CO2E	**Phase 1/ 2:** 10,000 mt of CO2	25 megawatt output	25 megawatt output

		Phase 3: 25,000 mt of CO2		
Allowance Distribution (Annually)	Auction minimum of 10% in the first compliance period increasing 20% by 2020 Reserve 5% to prevent over-allocation in the initial phase	**Phase 1/2:** Auction minimum of 5% in the first compliance period increasing to 10% in 2008 **Phase 3:** Auction minimum of 30% of non trade exposed industry allowances increasing to 70% in 2020 and 100% in 2027 Auction 100% of electricity generators allowances Trade exposed industries may receive 100% free allowances depending on production costs	Auction minimum of 25% of their allowances (quarterly) Price floor of $1.86 or 80% of current market value	Auction minimum of 2.8% Reserve 300,000 allowances for renewable energy facilities and energy conservation programs
Use of Offsets	Maximum of 49% of total reductions between 2012-2020	**Phase 1:** Unlimited **Phase 2 onwards:** Maximum of 50%	Maximum of 3.3% of total reductions, increasing to 5% and 10% when prices reach $7 and $10 tonne	Not applicable
Bank/Borrow Allowances	Banking allowed	**Phase 1:** Banking and borrowing allowed **Phase 2/3:** Banking allowed	Banking allowed	Banking allowed

Appendix B: Glossary of Terms

Allocation: The process of distributing allowances to specific industries and/or sectors.

Allowances: Permits that allow the allowance holder to emit a specific amount of greenhouse gases. One allowance represents one metric tonne of greenhouse gases. Allowances can be allocated for free by the government or auctioned off to the highest bidder.

Allowance Trading: A process that allows emitters to sell unused allowances to other emitters who have not met their emission reduction requirements.

Auction: The process of selling allowances to the highest bidder. Governments often invest auction revenue into specific climate initiatives or programs.

Banking: The ability for emitters to carry unused allowances into the following compliance forward for future use.

Borrowing: The ability for emitters to use future allowances in the current compliance period.

Carbon Price: A cost put on greenhouse gas emissions to discourage facilities and individuals from emitting greenhouse gases.

Complementary Policies: Policies, regulations, standards, and/or initiatives that assist in reinforcing the cap and trade systems reduction goals. Carbon tax and energy efficiency regulations are examples of complementary policies.

Compliance Period: A specific amount of time in which facilities must submit to the government the amount of allowances equivalent to their number of emissions during that period of time.

Emission Cap: The maximum number of emissions a facility is allowed to emit during a compliance period.

Kyoto Protocol: An international agreement that requires signing parties to decrease emissions by approximately 5.2% below 1990 levels between 2008 and 2012. Thirty-seven industrialized countries and the European Union have signed the Protocol.

Leakage: A situation where a carbon intensive facility or industry relocates to a jurisdiction with less stringent climate policies to avoid incurring additional costs associated the complying with the cap and trade system.

Offsets: A reduction in greenhouse gases by a facility and/or industry outside the cap and trade system which is sold to a facility covered by the program.

Opportunity Cost: The costs associated with not pursuing an alternative action.

Over-Allocation: A situation where a facility has received more allowances than what is required to cover their emission.

Price Cap: A limit on how high an allowance price can be.

Price Floor: A limit on how low an allowance price can be.

Scrubber Technology: A technology used to remove pollutants from industrial waste streams.

Trade Barriers: Any activity that restricts trade with outside jurisdictions.

Trade Intensity: The degree to which an industry exports its goods and services.

United Nations Joint Implementation Projects: Offset projects located in one of the signing parties of the Kyoto Protocol (known as Annex B countries). Offsets from Joint Implementation projects can be bought by parties located in any of the signing countries.

LIST OF FIGURES

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