CLIMATE CHANGE: BC'S PROGRESS TOWARD A LOW-CARBON ECONOMY

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1. Introduction and Overview

Climate change will bring profound change to the BC economy arising from our efforts to reduce greenhouse gas emissions and the impacts of major shifts in the climate – precipitation, temperatures, sea level rise, storm surge, and the frequency and intensity of weather events. The timelines for these changes reach into the future, but now is the time to address them for two reasons. First, changing weather patterns are already having an impact in BC. The mountain pine beetle explosion has decimated thousands of hectares of forests. The lack of a sustained period of cold winter weather allowed these beetle populations to thrive. Southern BC had record summer temperatures in 2009, threatening communities from wild fires, and necessitating the import of electricity from other jurisdictions at a time when we are usually selling BC electricity southward. This paper looks at the impacts of a changing climate on BC business and ways to adjust to these changes. Second, governments from local to international are creating climate policies that will affect British Columbians – our communities and businesses in many ways. Policies range from municipal regulation through to international treaties and potential trade impacts that affect costs, the creation of new products and markets, and competitiveness of our businesses, especially in the natural resource sector. BC has set a target to reduce annual total greenhouse gas emissions by 33% from their 2007 level by 2020, a reduction of 22 million tonnes CO_2 equivalent.[1] While there are no binding greenhouse gas policies at the federal level in Canada, regulations pending in the US Congress are likely to affect BC businesses in the coming years. Decision makers in the both the public and private sector have begun to plan and take actions now to prepare our economy for the changes in climate and greenhouse gas policy that are expected. The time frame to 2020 very much encompasses fundamental decisions and strategies that need to be taken today to best position BC for what comes in the years ahead.

The goal of this report is to provide an overview of the projected impacts of a changing climate on BC's business sectors and the policies designed to reduce greenhouse gas emissions and help reduce the risks that climate change brings. The central question asked is do these policies help move BC toward a resilient, low-carbon economy, one which sustains its economic activity with substantially lower greenhouse gas emissions and is prepared for potential climate impacts. While I believe the goal should be to achieve a low-carbon society in which not only economic, but also social and broader environmental goals are also specified, that broad discussion is outside the scope of this paper. The focus will be on the policies affecting BC that *mitigate* (reduce) greenhouse gas (GHG) emissions and

[1] CO_2equivalent concentration (abbreviated CO_2e) is the concentration of carbon dioxide that would cause the same amount of radiative forcing as a given mixture of carbon dioxide and other greenhouse gases. It is used to have a common unit of measurement for all the different greenhouse gases in terms of their impact in the atmosphere.

promote *adaptation* to the projected changes in our climate. 'Win-win-win' strategies for BC are defined as ones that simultaneously reduce our GHGs, enhance the ability of our economy to thrive, and strengthen our ability to adapt to the increasing threats posed by a changing climate. It will not be easy to achieve these three objectives simultaneously which is all the more reason to inform ourselves of the issues and look for actions our provincial decision makers can take now.

The report highlights the available projections of what a changing climate means for BC industry. What sectors will be affected and what is needed to increase their resiliency? I then provide a snapshot of the regulatory environment in BC and North America that affects BC industry. While there are a number of policies already in place – the BC carbon tax for example, others are still being defined federally and regionally such as a 'cap and trade' carbon market, new energy efficiency building codes, process and fuel standards, and other regulations. Policies to promote adaptation are in the early stages in BC. Finally, I ask, is BC on the right track to a low-carbon resilient economy? Have we set appropriate goals and targets and put in place policies to help sustain our economy in the face of climate change and the need to substantially cut our emissions? The paper concludes with eight recommendations that I offer to help move BC to a low-carbon resilient economy.

2. Our Changing Climate and its Impact on BC Industries

While the entire BC economy is affected by a changing climate and the need to reduce GHG emissions, the following industries are the focus of this paper because they are major drivers of our economy and will incur the largest impacts: forestry, the energy sector (fossil fuel extraction and electricity-generation and networks) mining and smelting, agriculture, fisheries, transportation, and tourism and recreation. As well, public and private infrastructure will be stressed by climate change, impacting all industries. Climate change also provides new opportunities for BC industries through extension of growing seasons in parts of the province to the expansion of markets and creation of new ones created by GHG policies. There is increasing evidence that BC residents want greener, low carbon goods and services. The BC economy can be well positioned to expand its 'green' sectors with associated employment opportunities.

Climate change has two dimensions – a gradual alteration in temperature and patterns of precipitation, but also an increasing frequency and intensity of extreme weather events. The latter can occur at any time; we have already experienced the impacts of extreme wind, rain and snow storms in recent years. The challenge for both public policy and private decision makers is how to plan today to reduce the risks of unfavourable impacts and take advantage of the new opportunities to sustain and grow their industries and enhance the well being of British Columbians.

Climate Changes in BC

What we have already seen over the past century[2]. The climate in BC has been changing over the past century, with warmer average annual temperatures of 1.5°C for BC as a whole and larger increases regionally. For example, minimum temperatures in Northern BC have already risen 3.5°C. Precipitation has increased 22% over the past century, but the variability across the province is pronounced. Over the

[2] This section draws on information from PCIC (2007) and Natural Resources Canada (2004).

past 50 years, the BC interior has had a declining level of precipitation. More profound than annual average temperatures are the variations in climate. These have been associated with two major periodic climactic conditions – the El Niño Southern Oscillation (El Niño/La Niña) and the Pacific Decadal Oscillation. These oscillations lead to temperature swings from +0.5°C to 2.8°C and declines in precipitation of 5%. Snowpack at April 1st of the year has declined by an average of 25% across BC and up to 50% at some sites during a climate cycle. Glaciers are on average receding and there appears to be a now permanent shift in when the spring freshet (spring snowmelt) occurs, having advanced by 10 to 30 days compared to the norm more than 50 years ago. This has significant impacts on agriculture, fisheries, and hydroelectric generation (as well as water supplies for communities). Earlier snowmelts mean more evaporation of surface waters because there is a longer season of open water. Lake and river ice are breaking up earlier in the year, contributing to ice jams such as the one in Prince George in the winter of 2007-2008 that caused massive flooding. All of these factors contribute to the potential for significant changes in vegetation cover, species survival, and impacts on BC industries.

What the models predict over the next 40 years to 2050. By 2050, BC is forecast to have an average annual temperature that is 1.7°C warmer (ranging from 1.2 to 2.5°C) compared to the baseline of 1961-1990 (which is a higher norm than would be the case if the baseline were the past 50 years). Winter temperatures may rise 2° to over 4°C with winter precipitation increasing 3 to 11%, but summer precipitation that ranges from minus 9% to plus 2%. The snowpack is forecast to decline by 55%, with the BC coast hit harder than other regions of the province. Stream flows in parts of BC may decline precipitously, e.g., models show a decline of 90% in the Columbia Basin. Precipitation on the BC coast is forecast to rise which will benefit some sectors (e.g., hydroelectric generation and forestry), and perhaps harm others (e.g., tourism). Averages do not depict what will happen in specific regions of BC at specific points in time. What the models indicate is that the climate will become more variable with higher temperatures, more swings in precipitation with more frequent droughts, floods, and extreme weather events. At a Canadian conference on climate adaptation, experts noted that once-in-50-years storms are now every 3 to 5 years, whether these are rain, snow, or wind (e.g., the extreme windstorm in Greater Vancouver in November 2007).

These projections will have profound effects on BC's industries and of course, our communities as people and companies face higher costs for going about their business, including costs for insurance and post-event clean-up and restoration associated with extreme weather events. A significant challenge for decision makers is that not enough is known about the specific climate impacts across Canada, when they will occur, and how damaging they will be. A first step in taking action is to be cognisant of the threats and to invest more resources studying and preparing for the impacts, whether they are beneficial or damaging. The next section looks in more detail at impacts occurring now and those forecast for vulnerable BC industries.

Impacts of Climate Change on the BC Economy

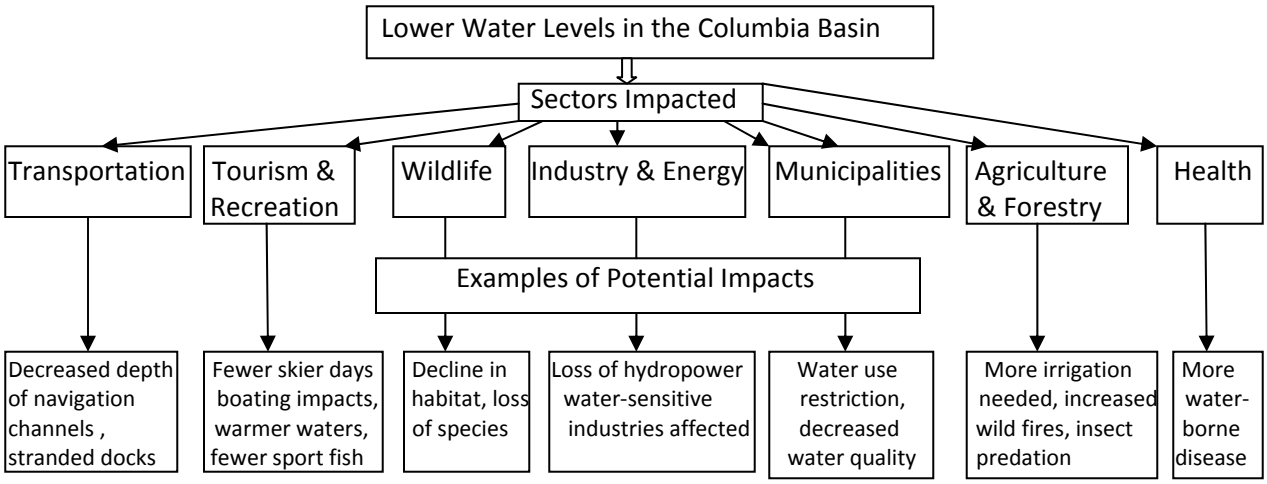
The science of climate change is advancing rapidly, with more data and modeling of the impact of increasing GHG emissions on the planet. One area of research is to downscale the global models that are the norm in climate science to the regional level. A number of Canadian researchers are working on these models, notably many at BC universities and working in conjunction with federal ministries.[3] But

[3] See work by Andrew Weaver, for example Weaver (2008) and the Climate Modelling Lab at the University of Victoria (www.climate.uvic.ca); the Adaptation and Impacts Research Division of Environment Canada at the University of British Columbia, see e.g., Langsdale et al. (2008) and Cohen and Neale (2006); the Pacific Climate

there remains a great deal of uncertainty in the forecasts. The section below presents a snapshot of the information about how climate change will affect BC's key sectors.

Sectors dependent on water resources – BC will experience increasing water shortages that are largely due to early snow melts, meaning more time for surface water to be evaporated and less available over the drier periods of the year. This will affect many sectors especially agriculture, hydro-electricity production (large dams and run of river), pulp and paper, fish hatcheries, food processing, mining, chemical and petrochemical industries, and tourism/recreation. The impact of climate change on water resources affects not only major industries but the water supplies of BC communities. Figure 1 illustrates the complex and cross cutting impacts of climate change on the multitude of users of water.

Figure 1: Potential Impacts of Climate Change on a Water Resource



Source: Adapted from Natural Resources Canada (2004) *Climate Change Impacts and Adaptation: A Canadian Perspective*. Figure 2, p. *x*.

Fisheries – Fish populations are highly vulnerable to changes in water temperatures, water levels, ice conditions, changes in predator populations, and extreme weather events. Increasing water temperatures in the ocean and BC's rivers, lakes, and streams has already affected salmon populations, resulting in significantly lower harvests in recent years. Losses from warmer than average summers in 2002 and 2004 totalled $75million[4], and no doubt the summer of 2009 will bring significant lost revenue due to the extreme temperatures in southern BC. The sockeye salmon spawning in southern rivers are particularly vulnerable to extreme temperatures. In 2004, the Fraser River was 4°C higher than average and lethal to the salmon; resulted in a 90% drop in the early Stuart run. The 2009 sockeye run in the Fraser River was almost non-existent, despite having a very robust age cohort four years ago. While the causes of the failure of this group of sockeye to return are not yet known, rising sea temperature may be

Impacts Consortium (http://pacificclimate.org) and climate related groups at Environment Canada, Natural Resources Canada, Department of Fisheries and Oceans, Agriculture and Agri-Foods Canada.

[4] The information on impacts is taken from Walker, I.J. and Sydneysmith, R. (2008): British Columbia; in "From Impacts to Adaptation: Canada in a Changing Climate 2007", edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON, p. 329-386.

one of the factors.[5] The earlier freshets decrease the salinity of the tidal rivers and other spawning areas, leading salmon hatchings to return to the sea at a younger and more vulnerable age, leading to lower survival rates to adulthood. One of BC's most cherished fish species could be headed to more favourable river systems or even die out. Other salmon species, e.g., pinks, have fared much better. While commercial fisheries do not make up a large share of the total value of BC's economy, they are vital to the survival of many communities along the BC coast and to First Nations communities. Sport fishing is a significant portion of BC's tourism industry. In 2005, there were over 270 thousand freshwater anglers and almost 300 thousand saltwater anglers fishing in BC waters, with sport fishing generating approximately $248 million in provincial GDP.[6]

Forestry – The forest sector is one of BC's most important industries, contributing 30% of the total value of the goods producing sector and supporting many jobs across the province. The impacts of climate change on forestry are both beneficial and highly damaging. On the positive side, over the past century, the higher average temperatures have increased growing seasons, increased plant growth, and changed species hardiness and distribution (Natural Resources Canada (2004). Over the next 50 years, climate change may enhance forest productivity due to the longer growing seasons and higher atmospheric concentration of CO_2. On the negative side, the changes in climate bring increased stresses to our forests in the form of shifting patterns of rainfall and intensity of storms, drought, greater frequency and intensity of wildfires, and as BC has already experienced, massive changes in pest predation and tree pathogens. The mountain pine beetle (MPB) epidemic is the worst insect infestation in North American history. The MPB has destroyed trees worth about $9 billion on nine million hectares - an area five times the size of Vancouver Island.[7] At the current rate of devastation, 80% of BC's mature pine forests will be dead by 2013.[8] Old growth forests are more susceptible to pests and fire than younger stands and BC has proportionately older tree stands than other jurisdictions. Some regions, for example, parts of the southern interior, will see its forests converted to grasslands if no suitable species can be substituted that are more climate and pest tolerant. Forestry experts are concerned that the disturbances exacerbated by climate change may act in a cumulative nature where one disturbance increases the potential for others to occur (Natural Resources Canada, 2004). An example is where the spruce budworm in western boreal forests weakens or kills trees, leading to increased potential for wildfires due to the volume of dead trees. The MPB creates similar conditions. At the same time, forestry may be one of the industries essential to the success of climate mitigation policies with the ability to sequester carbon through net gains in afforestation.[9] While the net impact of climate change is difficult to predict, current indications are that the BC forest industry will have major challenges ahead[10] with the need to adapt by changing forest management practices, for example, by changing the mix of species during reforestation and where they are grown.

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[5] Gayton, Don. 2008. *Impacts of climate change on British Columbia's biodiversity [electronic resource] : a literature review. Forrex.* www.forrex.org/publications/FORREXSeries/fs23.pdf. Rising sea temperatures bring a host of challenges to salmon including new predators, changes in food supply, relocation of the fish to colder regions.

[6] Tourism British Columbia (2009) *Fishing Product Overview*, April 2009. Accessed at http://www.tourismbc.com/Libraries/Research_Water_Based_Sector_Profile/Fishing_Sector_Profile.sflb.ashx.

[7] David Suzuki Foundation (http://www.davidsuzuki.org/Climate_Change/Impacts/British_Columbia/Impacts.asp). The figure presumably is before any value is derived from other uses of the damaged forest such as biofuel.

[8] Natural Resources Canada. http://mpb.cfs.nrcan.gc.ca/index_e.html, accessed 25 August 2009.

[9] See the section on climate policies for challenges created by carbon policy regimes for inclusion of Canadian forests as carbon sinks.

[10] Williamson et al, *Climate Change and Canada's Forests*, *From Impact to Adaptation,* Natural Resources Canada, Sustainable Forest Network (2009, p. *xiv*) cite the following climate impacts for BC's forests: increased fire

Agriculture – Agriculture contributes to approximately 290,000 direct and indirect jobs in BC (14% of the BC labour force), and exports of food were valued at $3.4 billion in recent years.[11] The impact of climate change on agriculture is mixed. Some regions and crops will benefit from a warmer climate and changing patterns of precipitation. Over the last 100 years, there has been a 5 to16% increase in the number of days on average that BC crops can be grown (Green Growing Days).[12] But some regions will no longer be able to produce the same crops or have to abandon agriculture completely. Figure 2 illustrates the projected climate-induced changes and the mixed potential impacts on agriculture. Some of the areas at greatest risk include the Fraser River delta due to rising sea level, storm surges, and flooding from extreme weather events. The Okanagan is threatened by even dryer and hotter conditions than at present, requiring more irrigation, and substitution of drought tolerant species. The Okanagan's wine and fruit economy will need to adapt to these dryer conditions with changes in the mix of species, better water management, and other measures. As noted, increasing scarcity of water resources is forecast to occur in the regions that need them the most, increasing the competition (and likely prices) for this essential input. On the other hand, the growing season in the Peace region will lengthen. While agricultural producers are accustomed to dealing with climate-related risk and have well developed insurance programs (private and public), a key policy question is can these programs survive if there are more years and more regions simultaneously making claims for weather-related crop losses. Water use plans and use by households and industries across the province will need to incorporate these projected climate changes.

Tourism and Recreation – BC's second largest sector next to forestry generated over 118 thousand jobs in 2008 and approximately $9.5 billion in revenues in 2004.[13] As this summer of 2009 illustrates, tourism can be hard hit by wild fires. Lower snow falls and warmer temperatures will threaten the skiing industry. Changing water levels and extreme weather events will affect all aspects of the outdoor recreational activity. Another major impact will come through the impact of climate on wildlife viewing and sport fishing (as noted above) as populations of vulnerable species decline or move to other regions. The impacts on BC's biodiversity may be profound, threatening the survival of many species of plant and animal life and in turn, the quality of our natural environment which is so fundamental to BC's identity.

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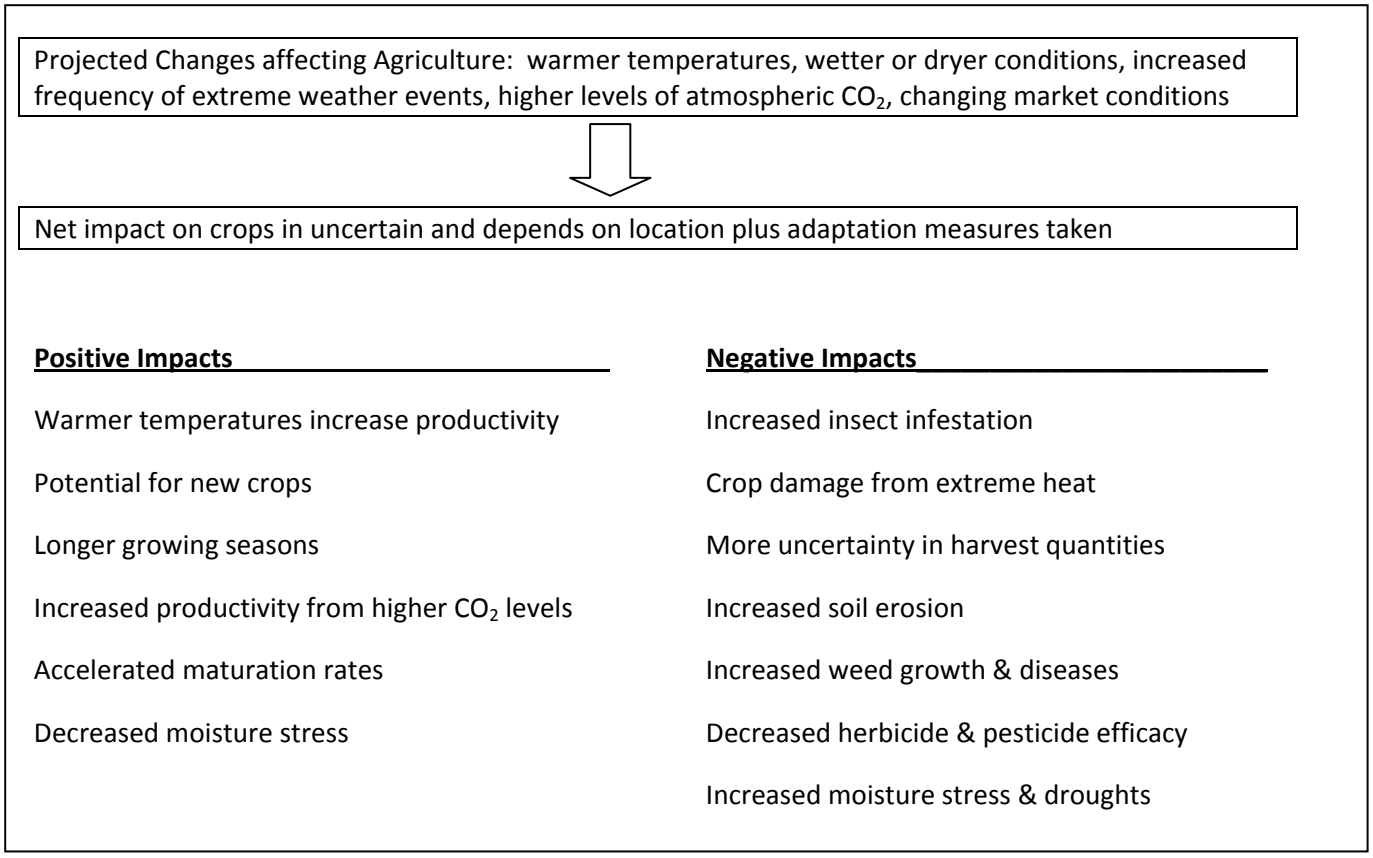
disturbance, losses from insect damage and disease, greater intensity and frequency of droughts in southern BC regions, species migration and changes in forest productivity, and loss of habitat in high-elevation forests.

[11] Walker and Sydneysmith (2008).

[12] Gayton, Don. 2008*. Impacts of climate change on British Columbia's biodiversity [electronic resource] : a literature review. Forrex.* www.forrex.org/publications/FORREXSeries/fs23.pdf.

[13]Walker and Sydneysmith (2008).

Figure 2: Possible Impacts of Climate Change on Agriculture



Source: Adapted from Natural Resources Canada (2004) *Climate Change Impacts and Adaptation: A Canadian Perspective*. Figure 3, p. xii.

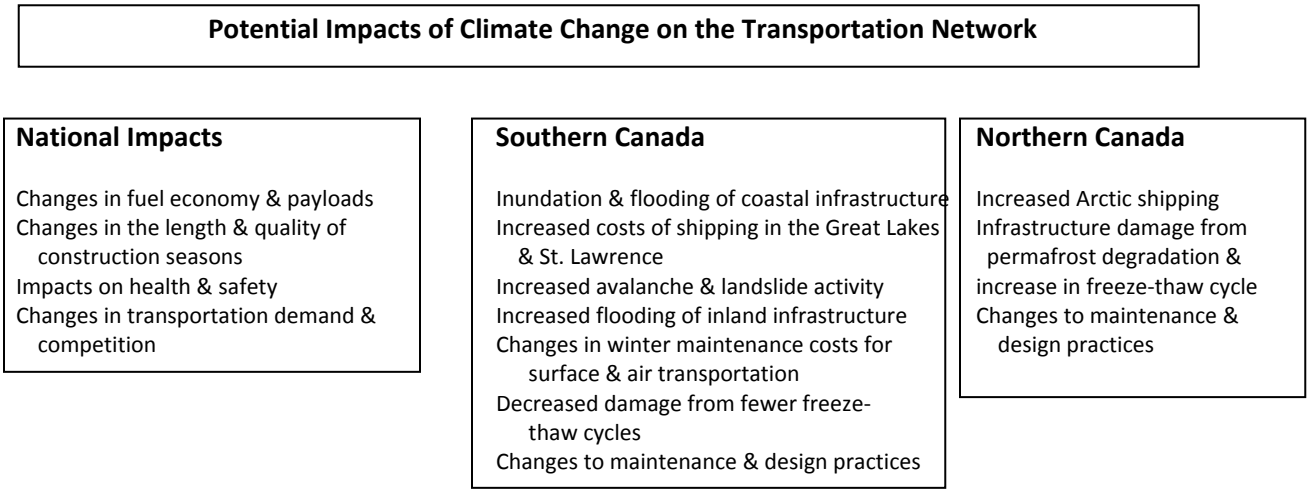
Energy – BC's energy sector includes electricity generation that is predominately hydroelectric plus oil and natural gas extraction and transport. The energy sector is an important driver of economic activity in the province, both as an essential input into the production of goods and services, but also as a source of wealth generation for BC from crown corporations (BC Hydro) and private sector operations ('independent power producers'), and provincial royalties from natural gas extraction. Changes in temperature and precipitation will have the biggest impact on hydroelectric generation. Decreased winter snowfalls and earlier spring runoff, combined with warmer temperatures will have an impact on water levels in the reservoirs of hydro-dams and energy generation from run-of-river operations. Ice flows and break up will also affect operations. Over the longer term, loss of glaciers will have a major impact on inflows to many of BC's key reservoirs. These climate impacts will require modification in the management of reservoirs to ensure power generation and dam safety and the need to plan for a greater diversity of generation capacity to offset the potential reduction in flexibility of reservoir use. The scope for other renewable forms of electricity generation may be enhanced if biomass production

rises, more solar, and wind generation are possible.

Critical Infrastructure – Water infrastructure operations will have to consider the changes in seasonal water flows and the problems associated with a supply peak (spring) vs. demand peak (summer) occurring in different seasons. Pipeline infrastructure will have to deal with permafrost melt in northern regions and disruption due to landslides and floods during extreme weather events. Much of BC's critical infrastructure lies in areas exposed to high risk from climate change, notable pipelines, transmission lines, roads, and other transportation networks, many of which are located in narrow valleys and vulnerable to flooding, slides, and other hazards associated with extreme weather events. All public and private infrastructure along coastal areas are vulnerable to store surge and sea level rise. The parts of the province most at risk include the Fraser Delta, parts of Vancouver and Victoria, as well as the Queen Charlotte Islands. Impacts include flooding, coastal erosion, storm surge, and the breeching of dykes. The dyke system in the Fraser Delta is extensive and parts of the region lie below sea level. There is a tremendous amount of economic activity at risk in addition to residential communities. The region's major airport, YVR, much of its farmland, industrial lands, and natural areas are at or below sea level. Adaptation strategies are crucial to these lands.

Transportation (Road, rail, air and marine) Transportation directly employs over 122 thousand workers (about 6% of BC employment as well as GDP). Extreme weather events could expose design limitations. Warmer summer temperatures can affect the structural integrity of pavement and railway tracks, buckling tracks and causing more rapid deterioration of pavement (Natural Resources Canada, 2004). However, warmer winter temperatures could put less stress on roads if there is a reduction in the freeze/thaw events over the winter. Extreme weather events have already had significant impacts on roadways with structural failures due to insufficient drainage, floods, subsidence and collapse of roads and bridges. Storm water management, if planned for less frequent and less intense precipitation will be inadequate to protect urban areas from intense downpours and flooding. Roads in mountainous areas of the province are at greater risk from landslides and avalanches. Figure 3 presents a comprehensive picture of potential climate impacts on transportation.

Figure 3: Potential Climate Change Impacts on Transportation



Source: Adapted from Natural Resources Canada (2004) *Climate Change Impacts and Adaptation: A Canadian Perspective*. Figure 7, p. *xx*.

Health – Climate change is likely to increase health care costs, putting more pressure on the provincial budget and also affecting productivity in all businesses. Climate change will affect health due to the increased prevalence of extreme weather events (heat, floods) and the more gradual increases in temperature that will introduce new diseases into the province. The risks are greatest for vulnerable populations such as the very young and the elderly who are more sensitive to temperature extremes and less resistant to disease, as well as those with low incomes who have less access to living arrangements with cooling. On the other hand, fewer extreme cold temperatures in winter may reduce cold-weather mortality. Higher summer temperatures will exacerbate ground-level ozone conditions (smog), afflicting populations vulnerable to air contaminants (those with respiratory conditions such as asthma and chronic obstructive lung disorders). Particulate matter from air contaminants including wildfires are also a major health threat. The Lower Fraser Valley is projected to experience some of the most significant climate change impacts in B.C. Warmer, drier summers will include periods of hot, stagnant weather, which will result in more severe smog episodes. A 1995 B.C. Environment study estimated that health care costs of air pollution in the Lower Fraser Valley alone was estimated to be $830 million in 1990 and is projected to rise to $1.5 billion by 2005.[14] Heavy rainfall can increase the levels of pathogens in drinking water. Many parts of greater Vancouver had a boil water advisory in November of 2007 due to a very heavy rainfall event and risks of contamination of the drinking water reservoirs.

[14]David Suzuki Foundation (http://www.davidsuzuki.org/Climate_Change/Impacts/British_Columbia/Impacts.asp).

3. Climate Change Mitigation and Adaptation Policies that Impact BC Industries

Policies to Reduce the Emissions of Greenhouse Gases

Climate change mitigation policies attempt to reduce the emission of greenhouse gases into the atmosphere. They can take a variety of forms from regulation that restricts the use of inputs or dictates what sort of outputs can be produced or directly restricts GHG emissions, to policies in the form of taxes and subsidies or the creation of new markets that explicitly price GHGs. The BC government has set explicit targets for BC's aggregate production of GHGs. By 2020 the goal is to reduce GHG emissions by 33% from their 2007 level of 66 million tonnes (Mt), a reduction to 44Mt. How much of an actual reduction this will be depends on whether GHG emissions continue to grow from their 2007 level. The history of BC's GHG production suggests the target will require a reduction greater than 22 Mt. Table 1 shows BC's GHG emissions from 1990 to 2007 for selected years and its GHG intensity – the ratio of GHG emissions to provincial GDP. The news is mixed. While emissions continue to rise over time, the rate of increase is slowing, with relatively little change from 2000 to 2007, and a falling GHG intensity, showing we are producing our goods and services more efficiently from the standpoint of GHG emissions. Simulations done for the Climate Action Plan[15] project 'business as usual' emission levels for 2020 in the absence of carbon policies. Total BC emissions could range between 74 and 79Mt CO_2e, indicating a possible increaser from 12 to over 19% from their 2007 level of 66Mt. Achieving a 44Mt level of emissions would thus mean over a 40% reduction if emissions rise unchecked to 2020. Forecasts of emission reductions under BC's combined carbon policies described below range from 20 to 22 Mt in 2020, but could still result in emission levels ranging from 52 to 58 Mt/year (depending on the price of fossil fuels and of course aggregate economic activity). BC would thus would not achieve the target unless the policy impact is larger than forecast or additional policies are introduced that affect BC consumers and producers. The forecasted potential impact by sector is shown in Table 2 under the conditions assumed in the model.

Table 1: BC Greenhouse Gas Emissions and Emission Intensity, 1990 to 2007

	1990	1995	2000	2003	2005	2007
Total GHG Emissions (Mt CO2e)	55.7	62.7	66.2	66.1	65.7	67.3
Growth since 1990 (%)	N/A	12.6	18.9	18.7	18	20.8
Emissions Intensity (GHG/$b GDP)	52.1	52.2	49	44.5	40.1	36.9

Sources: GDP in billion $2002 from BC Stats.

GHG emissions from BC Ministry of Environment, accessed at http://www.env.gov.bc.ca/epd/climate/ghg-inventory/index.htm#2.

[15] Government of British Columbia *Climate Action Plan* is accessible at www.livesmartbc.ca and was released in 2008. Simulations were done by M.K. Jaccard and Associates and are shown in Appendix 1 of the plan.

Table 2: 2005 CIMS model forecasts of GHG emissions with and without BC climate policies as a function of the market price of energy.

Sector	2005 GHG Emissions Mt CO2e	Simulated GHG Emissions (Mt CO2e) Business as Usual -- no Carbon Policy		Simulated GHG Emissions (Mt CO2e) BC Carbon Policies - Carbon Action Plan	
		Low Energy Prices	High Energy Prices	Low Energy Prices	High Energy Prices
Residential	4.4	4.8	3.4	4.3	4.3
Commercial	3.2	4.6	3.8	3.7	3.1
Transportation	25.6	32.9	29.2	26.9	24.5
Manufacturing	9.5	9.8	7.6	8.4	6.6
Waste and Agrosystems	6	6.7	6.7	4.6	4.6
Electricity Generation	0.9	5.3	9.3	0.5	0.4
Petroleum Refining	0.5	1.2	0.9	0.6	0.4
Crude Oil	0.7	0.4	0.4	0	0.1
Natural Gas	11.1	10.7	10.4	7.2	6.9
Coal Mining	2.1	2.2	2.5	2	2

Source: BC Climate Action Plan, derived from Tables 8 and 11 of Appendix I.

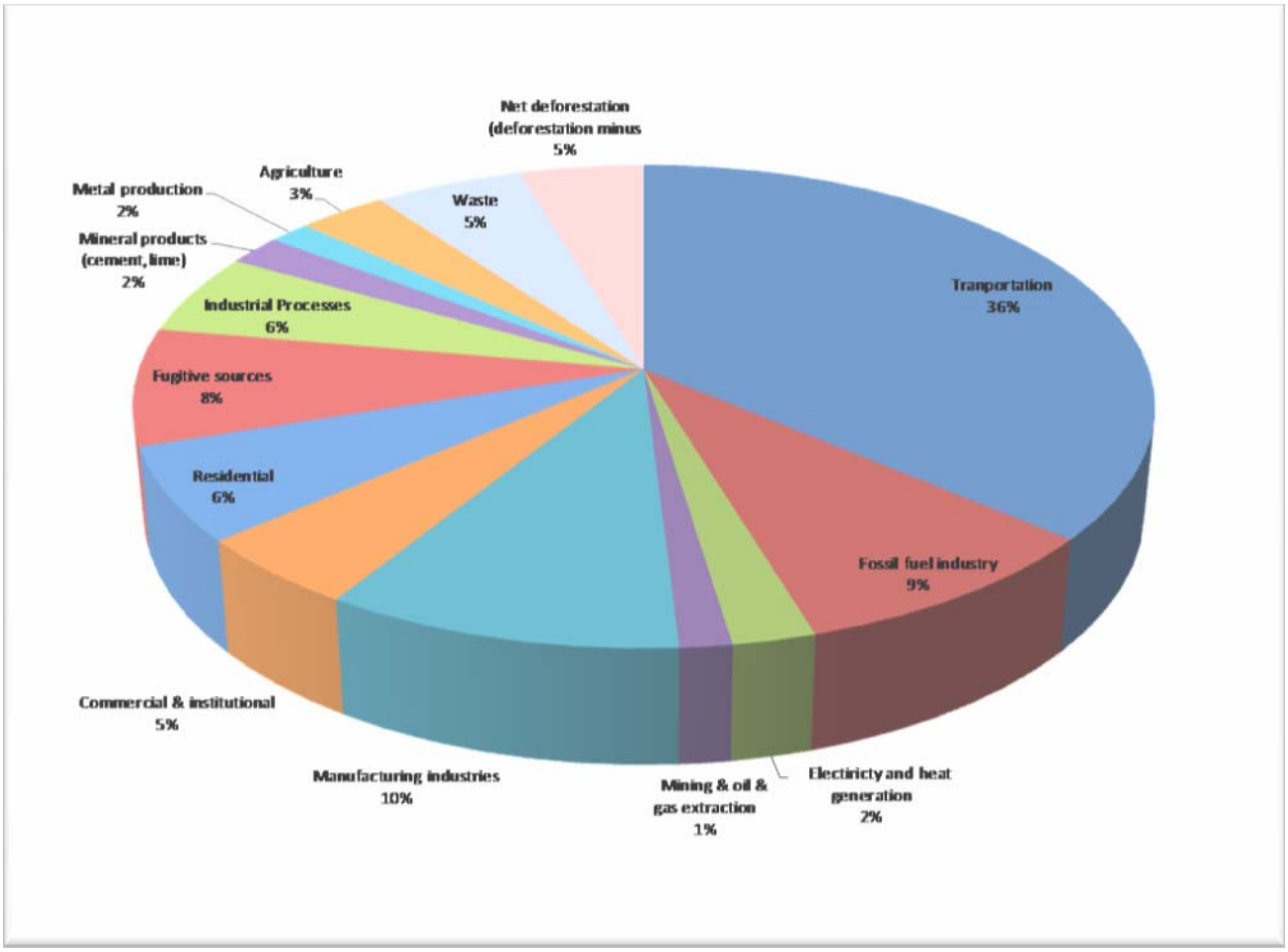
This section provides a brief overview of the existing policies designed to reduce GHG emissions starting with those in BC and moving to the broader regional, national, and international scale. I highlight existing policies and those in various stages of formulation that are likely to come into effect prior to 2020 and note the potential impact of these policies on BC businesses. Figure 4 shows BC's sources of GHGs, their percentage of the total and 2007 emission levels. Approximately 40% of BC's total emissions come from BC businesses.

GHG Policies in British Columbia

The BC Carbon Tax. British Columbia was the first jurisdiction in Canada to introduce a comprehensive carbon tax on the GHGs emitted from the combustion of fossil fuel, a coverage of 77% of the total GHGs emitted in BC in 2007.[16] The tax covers fossil fuels used in BC by individuals and businesses, as well as tires and peat that are combusted for energy. Wood and biomass/biofuels are not taxed as they are viewed as being carbon neutral over their life cycle. Exports are not taxed, nor are emissions on First Nations reserves. The tax rate was initially set at $10 per tonne CO_2 equivalent and scheduled to rise by $5 per tonne each year until 2012 when an assessment of the impact of the tax may lead to a different rising price schedule. The first increase came in as planned on July 1, 2009 of $5/tonne. The tax is payable on the time of purchase or use for fossil fuels and the time of use for peat and tire combustion.

[16] The tax applies to all sources of GHGs from the combustion of fossil fuels. It omits fugitive emissions and those from non-combustion sources that include agriculture, biofuels, wood, industrial processes, and waste. The non-covered sources represent 23% of the total emissions of GHGs from BC in 2007. Information on the BC Carbon tax and its 2008-09 impact is taken from (Armstrong, 2009).

Figure 4: BC Emissions by Sector in Percentage of Total 2007 Emissions



Source: BC Ministry of Environment, accessed at http://www.env.gov.bc.ca/epd/climate/ghg-inventory/index.htm#2.

The carbon tax is still a relatively small share of total BC tax revenue – 1.6% in fiscal 2008-09 and hence its impact generally on most BC tax payers is currently not large. The net impact for many taxpayers is even smaller when taking into account the tax cuts introduced to make the carbon tax revenue neutral; all of the revenue raised is required by law to be returned to BC taxpayers. The burden of the carbon tax will rise over time as the carbon tax rate increases, for example, forecasts are that the province will raise $968 million in carbon taxes by fiscal 2011-12 which represents 4.9% of provincial tax revenue. The impact on tax payers is dependent on the net cost (carbon tax minus the impact of the reduction in taxes). While the carbon tax is revenue neutral when viewed in the aggregate, it is not revenue neutral to every individual or business; some will pay more in carbon taxes than they receive in the form of lower taxes or tax expenditures (e.g., the increment to the GST credit for low income individuals). Businesses that are more carbon intensive will likely pay more in carbon taxes than they get returned in lower corporate income tax liabilities. In the first year of the carbon tax, all BC residents received a cheque for $100 as their 'carbon dividend' to help cover the costs of the new tax, paid for out of the

government's surplus at that time. This meant that most individuals were net 'winners' under the carbon tax. Those who had the lowest use of fossil fuels would be the biggest winners.

In the first year of the tax, businesses paid 70% of the total carbon tax. Table 3 shows the forecast carbon tax revenues and tax cuts to individuals and businesses for 2008/09 and forecast to 2011/12. For the next two years, the share of the tax cuts will be equal for the two groups and will exceed the carbon tax revenues collected. However, by 2011/12, revenues and tax cuts will be equal. These forecasts no doubt represent the impact of the current recession and planned recovery. The reason the tax cuts exceed carbon tax revenues is that the tax cuts are already legislated in percentage terms (e.g., the corporate income tax rate was cut to 11% from 12% on July 1, 2008, small business rates from 3.5 to 2.5% at the same time, and now in the September 2009 BC budget, cut to 0), whereas the carbon tax revenue is based on projections of fossil fuel consumption, a function of economic activity and household use.

Table 3: Forecast and Planned Carbon Tax Revenues and Tax Cuts, 2008/09 to 2011/12

	$ millions 2008-09		$ millions forecast 2009-10	2010-11	2011-12
Carbon Tax Revenue	**300**	**Carbon Tax Revenue**	**546**	**754**	**968**
Reduction in provincial revenues due to:		Reduction in provincial revenues due to:			
Low income tax credit (from July 1, 2008)	106	Increase low income tax credit 10% (July 1, 2011)	145	146	158
Reduction of 2% in first two personal		Reduction of 5% in first two income brackets	220	231	246
income tax brackets (from Jan 1, 2008)	114	Northern & rural homeowner benefit (2011)		21	83
Total reduction in personal taxes	**220**	**Total reduction in personal taxes**	**365**	**398**	**487**
Business tax measures		Business tax measures			
Corporate income tax rate cut from 12%		General corporate income tax rate cut to 10.5%			
to 11% (from July 1, 2008)	76	in 2010 and 10% in 2011	150	200	270
Small business corporate income tax cut		Small business corporate income tax cut to			
from 4.5% to 3.5% (from July 1, 2008)	42	2.5% December 1, 2008	170	142	144
		Industrial property tax credit (50% school tax 2009, 60% 2010)	50	52	54
		Reduce school tax by 50% for farm land (2010)		1	2
Total reduction in business taxes	**118**	**Total reduction in business taxes**	**370**	**398**	**481**
Total reductions in taxes	**338**	**Total reductions in taxes**	**735**	**796**	**968**

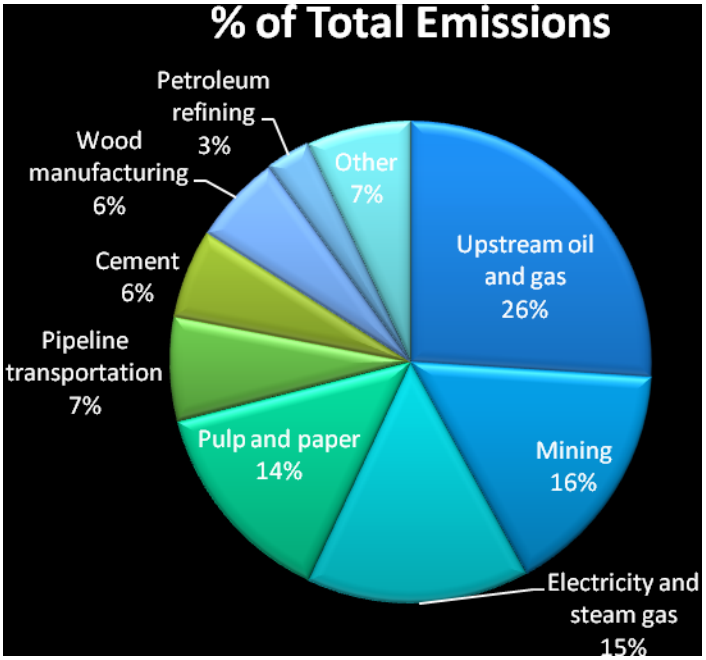
Source: Glen Armstrong (2009). "British Columbia's Revenue Neutral Carbon Tax" Presentation to Pacific Institute for Climate Solutions conference, "Decoding Carbon Pricing", June 2009. Available on PICS website: www.picsuvic.ca.

When we turn to individual business sectors, the impact of the carbon tax can be gauged more fully. Figure 5 shows the share of emissions by sector in 2007 and Figure 6, the emissions levels by process in 2005. In total over the three years to 2011, cuts in business taxes are forecast to be almost $1.25 billion, with $173 million in reductions in industrial and farm property taxes, $415 million in lower corporate income tax rates, and $456 million in the reduction in the small business tax rate.[17] A key point is that

[17] These forecasts are from the BC Ministry of Finance (Armstrong, 2009). The BC September 2009 Budget Update has actual carbon tax revenues for 2008/09 and forecasts for the balance of the period. The 2008/09 actual

the carbon tax covers emissions from fossil fuel combustion, so any fossil fuels exported from BC do not incur the tax. As noted, fugitive emissions from the extraction of oil and gas are not covered by this policy (but will be by other regulations). At present, there are approximately 210 facilities that produce at least 25,000 tonnes of CO_2e per year and thus pay the carbon tax.[18] They represent the sectors shown in Figure 5.

Figure 5: Emissions of GHGS by Industrial Sector, 2007



Note: excludes emissions attributable to transportation and space heating;

Source: Armstrong (2009).

The difficulty of predicting net impacts by business sector is that each firm will be in a different income-tax paying situation, thus whether the cuts in CIT rates offset the carbon tax will differ by company. A problem with using the income tax system is that net income per year can fluctuate depending on a host of factors that affect business activity. However, if production is low in a given year, so likely are GHG emissions and hence, carbon tax payments. In the early years of the carbon tax, net impacts are likely to be small. Once we know the carbon tax schedule beyond 2012, it will be easier to gauge the impact to 2020.

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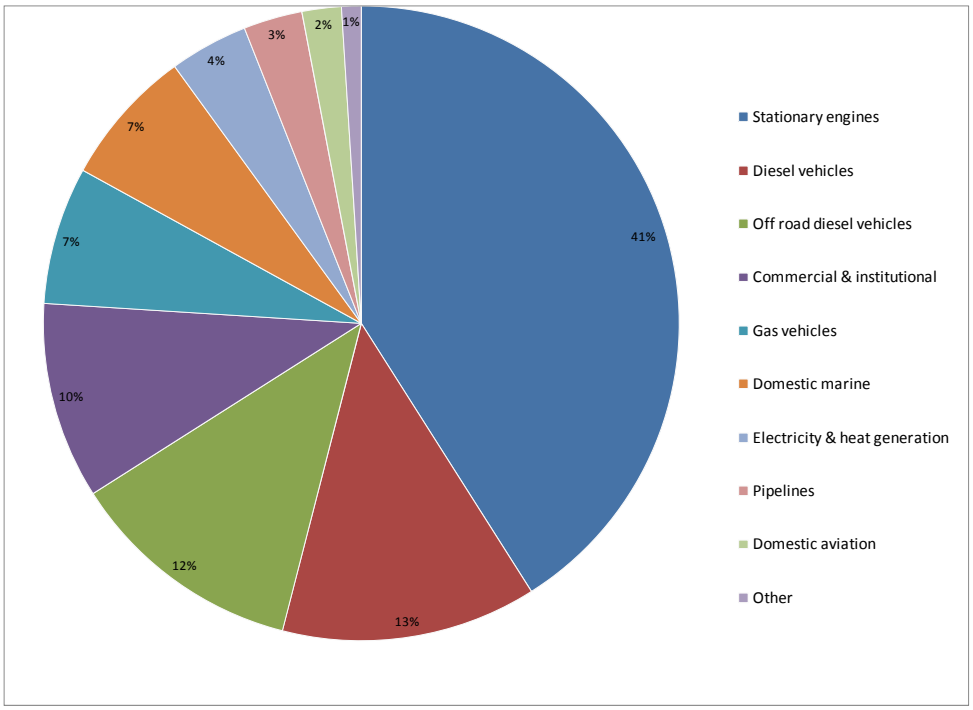
revenues were 306 million and the forecasts for the next three years are $557, $748 and $955 million; not very different from the February 2009 budget numbers. The September Budget Update also announced that there would be a reduction in the small business tax rate to zero plus increase in the annual revenue threshold for designation of a small business from $400,000 to $500,000. In principle, the carbon tax is still 'paying' for a 1 percentage point cut in the small business tax rate, with other revenues to cover the balance of the 2.5 percentage points after this budget.

[18] Finlayson (2009).

Figure 6: BC Business Combustion Emissions in 2005



Source: Natural Resources Canada (2007) as cited by Glen Armstrong (2009.

Carbon Neutrality for Public Sector. While not a compliance issue for the private sector, the Climate Action Plan also introduced the requirement that all public sector entities – provincial ministries, health authorities and their hospitals, school districts, universities and colleges, crown corporations, and other government agencies are to be carbon neutral starting in 2010. Because none of these entities can reduce their use of fossil fuels to zero, this regulation means that they will have to purchase what are called 'offsets'. An offset is an investment in a project or activity that reduces GHG emissions or sequesters carbon from the atmosphere. The offset thus prevents GHGs from being released into the atmosphere. The offsets must be BC-based, and hence represent a major opportunity for BC businesses to supply these carbon reduction credits to public sector, and perhaps later to individuals and the private sector. A new market is being created. The offsets will be purchased by a crown corporation called the Pacific Carbon Trust who is charged with the task of ensuring, with the help of third party verification, that the offset represents a real reduction in carbon that would not otherwise occur. The Carbon Trust will in turn sell the offsets to the public sector entities. Examples of the type of activities that have already qualified as offset providers include renewable energy projects, energy efficiency initiatives, and afforestation projects.[19] Contracts have already been signed for offsets achieved by increases in energy efficiency from greenhouses, a cement plant, and hybrid heating systems in hotels. The goal is to acquire 700,000 tonnes of offsets by 2011.

An offset policy is very controversial as its success depends on whether or not the emission reductions actually are additional to what would have occurred without the creation of this market. It is analogous to demand side management policies in for example, transportation or electricity consumption. Offsets

[19] See www.pacificcarbontrust.ca.

created in developing countries under the Clean Development Mechanism of the Kyoto Protocol have been sold to entities facing binding carbon policies (such as countries in the European Union) or to those who voluntarily want to 'negate' their carbon emissions. These include afforestation projects. The EU BC's forests are not yet eligible to earn offsets under the Kyoto Protocol or policies in the EU. Canadian governments have been pushing for recognition of Canada's tremendous potential for carbon sequestration, but to date, to no avail. The upcoming Copenhagen conference provides another opportunity as does the developing carbon policy in the United States for BC's leaders to continue to make the case for inclusion of verifiable and additional offsets that include our forest industry so that there is a market that goes beyond BC for offsets.

The carbon neutrality policy does provide new business opportunities in BC for both the providers of the offsets and the intermediaries/consolidators who have emerged to purchase, package, and sell the offsets to the Pacific Carbon Trust. Over time, the transfer of income from the public to the private sector may be large. We don't yet know what the price of offsets will be, but using the carbon tax rate in 2011 as an estimate, the sale of offsets at the target level of 700 thousand would raise $14 million in revenue. Revenues will rise over time as more businesses and individuals are covered by carbon pricing policies both in BC and other jurisdictions.

Other tax incentives. The BC *Climate Action Plan*[20] introduced a number of tax incentives that largely focused on reductions in the PST, including energy efficient appliances, alternative fuel and fuel-efficient vehicles, energy conservation materials and alternative energy equipment.These incentives will disappear with the introduction of the HST in July 2010. The impact on BC businesses with or without these incentives is likely negligible. The manufacturers of the energy efficient equipment were largely outside of BC, so the benefit to BC business would be to the retail sector assuming the PST cost savings stimulated total purchases rather than simply brand shifting. The evidence from other jurisdictions is that the overall impact of sales tax incentives (or other retail rebates) is small. Consumers may accelerate their purchases of an appliance or energy efficient home improvement, or would have made the investment even without the incentive. The net impact on business may be a time shifting of purchases, but no change in total purchases. Thus the removal of these incentives is unlikely to have any significant impact on the revenues of BC businesses over the period to 2020.

Tax incentives that do not involve the PST include tax credits for 'Clean Tech Innovation Venture Capital' and refunds of the CIT for patents related to wastewater treatment and fuel cell technology. These represent additional areas where BC business can benefit from the province's climate policies.

Other Incentive Programs. The Climate Action Plan includes a number of programs that bring funding and research initiatives for specific climate friendly activities of BC businesses. These include:

- $25 million for the Innovation Clean Energy Fund whose mandate is to make BC a world leader in alternative energy technology;
- $25 million for the BioEnergy Network to promote research and development of environmentally friendly uses of wood waste including co-generation projects, biofuel production, and wood pellet production. BC produced 900,000 tonnes of wood pellets in 2007, 90% of which was exported for energy production (Climate Action Plan);

[20] Government of British Columbia *Climate Action Plan* is accessible at www.livesmartbc.ca and was released in 2008.

- $94.5 million to endow the BC-university-based Pacific Institute for Climate Solutions – for research and policy development on all aspects of climate change;

- $16 million over 4 years for Forests for Tomorrow, a program to invest in reforestation and address risks to forest production including climate change impacts;

- $10 million program to incent biodiesel production;

- $3 million to support the study of carbon capture and storage technology.

The funding levels of these programs are less significant than the signals they provide for growth areas in the BC economy.

Regulatory Policies. These policies will affect BC businesses in several ways.

- *Policies that change the relative costs of fuel inputs/increase the cost of fossil fuels*. These include the introduction of renewable and low-carbon fuel requirements.

- *Policies that require shifts in production techniques*. These include new building codes and standards that have greater emphasis on energy efficiency and 'green' technologies that affect BC's construction industry and create the potential for new sectors of that industry. There are also new regulations regarding the management of landfill gases.

The 2007 Energy Plan has a number of components that affect the way energy can be produced. It includes a ban on routine flaring from oil and gas wells by 2016, with a requirement to cut emissions from flaring by 50% by 2011. All new electricity generation in BC must have net zero GHG emissions. This means that any incremental emissions must be captured (for example, a coal-fired electricity generator must sequester all of its GHG emissions) or offset as in the case of any natural areas inundated by a dam or water diversion. The Energy Plan also calls for BC to be self sufficient in electricity generation by 2016. Combined with the other regulations, this means that virtually all of the incremental electricity produced in BC will have to come from renewable sources such as run-of-the-river hydro, biofuels, solar, wind, and geothermal. The 2002 BC Energy Plan announced that with the exception of new hydro-electric dams on BC's heritage rivers (the Peace and Columbia) and refurbishment or capacity expansion at BC Hydro's existing dams, BC's incremental electricity would come from the private sector – the independent power producers (IPPs). The government followed these policies with directives to the BC Utilities Commission to incorporate environmental attributes into the pricing of power purchased from IPPS. This allows technologies such as wind power that have higher costs of production than might a large hydro dam to become part of BC's electricity supply. The 2007 Energy Plan also called for 50% of BC's incremental demand for electricity to be met by demand side management (DSM) policies that are cost effective compared to increasing generation capacity. DSM subsidies from BC Hydro have provided considerable funding support to a number of BC industries to modify production techniques and introduce other energy saving (and often cost effective) technologies.

Transportation policy. BC announced its transportation plan in the fall of 2007. At that time, the province committed to a $14 billion program of infrastructure spending, devoted to construction of

more rapid transit (e.g., the Evergreen line, bus rapid transit), major roads and bridges (e.g., new Port Mann bridge), and other investments. A major part of the rationale for the policy was to help reduce GHGs by providing alternatives to passenger vehicles (more public transit), plus reducing congestion and hence total gasoline consumption per trip. The policy is now in jeopardy at least in terms of timing due to the provincial budget deficit and lack of funding for transportation infrastructure investments. Costs to businesses for transportation services may thus rise due to greater congestion costs. The Gateway project (e.g., Port Mann bridge redevelopment, other major roads improvement, construction of the Golden Ears Bridge) was designed to improve vehicle flows and hence reduce the costs of goods shipment and time costs for individuals.

Regional and National GHG Policies

There are no binding regional or national GHG policies in Canada of significance to BC in place today. Following the election of Obama, Canada's federal government has announced its intention to introduce some form of cap and trade system that would operate within North America, but the details of any Canadian proposal are not yet know. A tentative target of a 20% reduction in GHG emissions from their 2007 levels by 2020 was announced in 2007, but to date, no policy exists to limit GHGs. Federal policies have centred around expenditure programs such as the subsidies to ethanol (now widely discredited because they are expensive transfers and have had little impact to no impact on GHGs) and its focus on clean energy technology with the $1 billion over 5 years Green Infrastructure Fund announced in the 2009 federal budget. This fund is for sustainable energy infrastructure and research into 'promising' technologies such as carbon capture and storage and other sequestration projects. I expect that once a climate policy bill is passed in the US Congress that contains a cap and trade system, Canada will act to adopt its own system that may be compatible with that of the US.

The focus of this section is on the policy furthest along in development – the cap and trade system of the Western Climate Initiative (WCI) to illustrate the sort of issues that BC businesses may face with a cap and trade system. A number of other Canadian provinces have introduced GHG policies – Alberta's intensity-based cap and trade, a modest carbon tax in Quebec and one proposed for Ontario are examples, but they only impact BC businesses indirectly through any compliance provisions for goods sold in those provinces or BC entities with operations across Canada. Policy fragmentation typically adds costs to business, but to date these policies have had implicit or explicit carbon prices that are low and thus, likely of little concern. What happens over time to Canadian and North American GHG policy is however of great concern, a topic addressed next.

Cap and Trade and the WCI. A cap and trade system establishes a market in the right to emit GHGs. The 'cap' is the limit on emissions; the 'trade' is the right to buy and sell permits in the marketplace. A cap is typically placed on total emissions from a jurisdiction, and then depending on the way the permits are distributed, may involve a cap for individual emitters or not. Every tonne of carbon released into the atmosphere by entities covered by the cap and trade regulations will need to possess a permit (called an allowance) for that tonne. Beyond this simple description lies a host of complex issues for any jurisdiction that wishes to implement or participate in trading carbon rights.

Under the Greenhouse Gas Reduction (Cap and Trade) Act of 2008, BC committed to the implementation of a cap and trade system to begin in 2012 as a signatory to the multi-state and province WCI. The cap was set in aggregate for all WCI members at a 15% reduction by 2020 from 2005 levels. Each jurisdiction then gets a share of the overall target cap and then decides how it will allocate its share among the covered parties in its jurisdiction. The choices are to auction permits to emitters or

provide some initial allocation based on past emissions or other criteria. If the WCI is implemented[21], it is slated to initially cover large stationary sources emitting 25,000 tonnes of CO_2e per year. The sectors covered include combustion at industrial and commercial facilities, industrial process emission sources including oil and gas process emissions, and electricity generation. In 2015, GHGs from residential, commercial and industrial fuel combustion at facilities with emissions below the threshold as well as fuel combustion from gasoline and diesel will come into the system where the distributors of these fuels will have to have the requisite number of permits to cover the ultimate emissions when the fuel is burned.

The impact on BC business is highly dependent on how the WCI system is implemented here. Each member jurisdiction has autonomy over a number of crucial design and operation issues that will determine total compliance costs and how they are allocated across the emitters. The main issues are:

- How will the allowances be distributed? Will they be auctioned or distributed without charge?
- What activities, located where, will be eligible for offsets?
- How to integrate the myriad of carbon policies, in particular the carbon tax with a cap and trade system?

Distribution of allowances. If the GHG cap for a jurisdiction yields a large reduction in total emissions, significant wealth will be generated by the creation of the allowances. The analogy is agricultural quotas. The question is who will acquire that wealth – the government or the regulated entities. The greater the share of allowances auctioned initially; the bigger the government's share and vice versa. If 100% of allowances are auctioned, the costs to business will be higher than if some percentage is allocated without charge. The WCI calls for a minimum of 10% of all allowances to be auctioned in each jurisdiction when the system opens, with the percentage rising to 25 by 2020. The higher the percentage auctioned, the greater the upfront costs for businesses, but the lower the revenues to government, revenues that might be used to mitigate any adverse impacts on business from the policy or to support the development of cleaner technologies. The impact on individual companies will depend on factors such as whether companies can shift the costs of the permits to their consumers, and the cost of altering fuel use or processes to reduce GHG emissions. The ability to pass along costs to consumers will be a function of the nature of supply chains, product markets, and regulations. In studies done for other countries on the degree and direction of shifting, consumers are found to bear most of the costs of GHG allowances. Exceptions would be for sectors that face world prices for their products and have few mechanisms to adjust their GHG emissions, for example the oil producers. Thus impacts can vary substantially among the regulated sectors. The policy question for BC should the WCI be implemented (or another system where provinces have some autonomy in the design) is then what share of allowances to auction. This question has been addressed by several US economists who estimate that somewhere between 15 and 20 percent of allowances should be distributed without charge. This amount would help protect vulnerable industries. [22]

Offsets. The impact of a cap and trade system on businesses will depend on not only the way allowances are distributed, but also the extent of any offset system. If entities have the option of purchasing an offset and an emission allowance, the decision will be based on the relative price of the two instruments. The presence of an offset system is like adding more allowances for sale in the market

[21] Whether or not the WCI begins allocating and auctioning carbon permits (called allowances) depends on if the US federal government brings in a national cap and trade system that supersedes the regional systems. One regional system, the Regional Greenhouse Gas Initiative already operates in the New England states.
[22] See Goulder (2001), Morgenstern et al. (2007), and Stavins (2007).

and thus acts to keep the price of carbon lower. Offsets could be quite a bit cheaper than emission allowances, thus reducing significantly the cost of meeting the GHG cap.

Integration of multiple carbon policies. This is the area that is least well formulated within any jurisdiction. The provincial government has said that when the cap and trade policy comes into effect, there will be adjustments made in the carbon tax for entities that will be covered by both. Exactly what these adjustments will entail is not yet known, but presumably will be some form of tax credit. The introduction of a cap and trade policy will thus substitute one way to price carbon (through the allowance and offset markets) for another (the carbon tax). The difference will be that the price of GHGs will be known with certainty under the carbon tax; with a cap and trade system, the markets determine the price and hence, there is uncertainty about the price of GHGs. Depending on supply and demand, the allowance markets could be very volatile. Other cap and trade markets such as the US sulphur dioxide market and European Trading System for GHGs have experienced periods of high volatility. Volatility increases complexity of decision making, the need for futures and derivative markets. The impact on business will be mixed – more opportunities for financial institutions versus higher compliance costs for businesses.

Regardless of the mechanics of a cap and trade system, each covered entity will incur compliance costs in the form of the cost of any allowances they must purchase and to understand the regulations and how the markets will work. Some will lose market share because their products will cost more than comparable businesses in regions not facing carbon pricing. Capital costs may rise if equipment is retired prematurely to bring in newer vintage, more energy-efficient infrastructure. Labour shedding may occur if technologies become more capital intensive or if output contracts. On the other hand, whole new industries associated with carbon trading and offset development will emerge. The new industries are in both market services and the potential for the manufacture of energy saving equipment, alternative technologies, and the know-how that comes with them. The net effect on BC businesses could be on positive or negative depending on a host of factors including the responsiveness of the businesses to new opportunities.

International Greenhouse Gas Policies

Renewable Portfolio Standards. A number of Canada's trading partners have implemented a range of GHG policies. While many of these policies target businesses within their jurisdictions, some of the policies may open up opportunity for the export of 'clean' energy that produces no GHGs or technology and products from BC businesses. The most immediate opportunities are from 'renewable portfolio standards' (RPS). An RPS is a regulation that prescribes a minimum content of renewable energy (typically for electricity) in the total supply available to consumers in the jurisdiction. The State of California's RPS requirements[23] are an example. Under California law,[24] electric utilities operating in the state must have a minimum of 33% of the electricity they sell to consumers come from renewable energy sources by the year 2020. . Renewable energy includes: wind, solar (thermal and photovoltaic,

[23] Municipalities may also have their own RPSs for electricity and other 'green' product purchases.

[24] The 'law' in the case of California is executive orders from the Governor. The operative one is S-14-08, augmented by an executive order signed September 15, 2009. See http:gov.ca.gov/press-release/13273, accessed September 16, 2009. The executive order stipulates that the California Air Resources Board, the regulator, must adopt regulations to require the33% RPS no later than July 31, 2010. The recent executive order increased the target of 20% by 2020 to 30% by that date. This is the most ambitious RPS in the United States and critics of the policy argue it will increase electricity costs substantially, if it is even possible given the need to build more transmission capacity to accommodate shipments of the renewable electricity from a wide geographical area.

geothermal, small hydro (no more than 30 megawatts of capacity), ocean wave and thermal, biomass, biodiesel, landfill gas, and tidal. BC has already taken advantage of the RPSs, selling renewable electricity to California utilities and electricity aggregators. The price received for RECs will vary with the term of the contract and other market forces, but may be a significant source of potential revenue to the renewable electricity sector, allowing it to expand beyond the needs of BC electricity consumers.

RPSs are not limited to electricity. Some US states also have an RPS for biofuels used in transportation. To the extent that BC can capitalize on our rich resource base and adjust processes to meet the standards imposed under these regulations, companies will find new and growing markets. There is however a dark side to renewable portfolio standards if they become too prescriptive, for example by specifying the product must be sourced in the jurisdiction. The RPS can then become a major barrier to trade. For example, the Ontario government has just announced a 'Buy Ontario' policy in its renewable power sector that that requires 25% of wind projects and 50% of large solar projects to contain Ontario goods and labour.

The United States. The Obama administration has signalled that it will take concrete action on significantly reducing GHG emissions. The Waxman-Markey bill passed the House of Representatives and is currently in Senate committees. The over 1000 page document proposes a cap and trade system, along with a host of other energy provisions, including ones that would make it more difficult for Canadian producers to access US markets.[25] On September 30, 2009, Senators Kerry and Boxer introduced their own version of an omnibus climate and energy bill into the Senate. The Kerry-Boxer bill has features similar to Waxman-Markey (cap and trade, green jobs, building codes and standards), but with more ambitious targets for GHG reductions and more regulation over any cap and trade system (e.g., stronger price ceilings). Whether the current legislation is passed by Congress and what final form it will take during its trip through Congress remains to be seen; bets are now that nothing will be passed until 2010 at the earliest due to the Obama health care legislation now pending. What is relevant for Canada and BC businesses is that some form of national climate policy is likely to emerge in the US and if so, the WCI will be overtaken by US federal regulation and BC will not implement a cap and trade policy unless actions are taken nationally in Canada. Nonetheless, BC may be in a favourable competitive position because of its GHG policies, particularly if the US imposes tariffs or other measures to ensure there is a level playing field for its domestic industries. BC can adjust its carbon tax rate to be equivalent to the price of carbon on any US market. BC industries may have another advantage in that they will have had several years with the carbon tax and other regulations and may be further along in adopting less GHG-intensive processes; their products should have a lower carbon content and be more competitive with US producers.

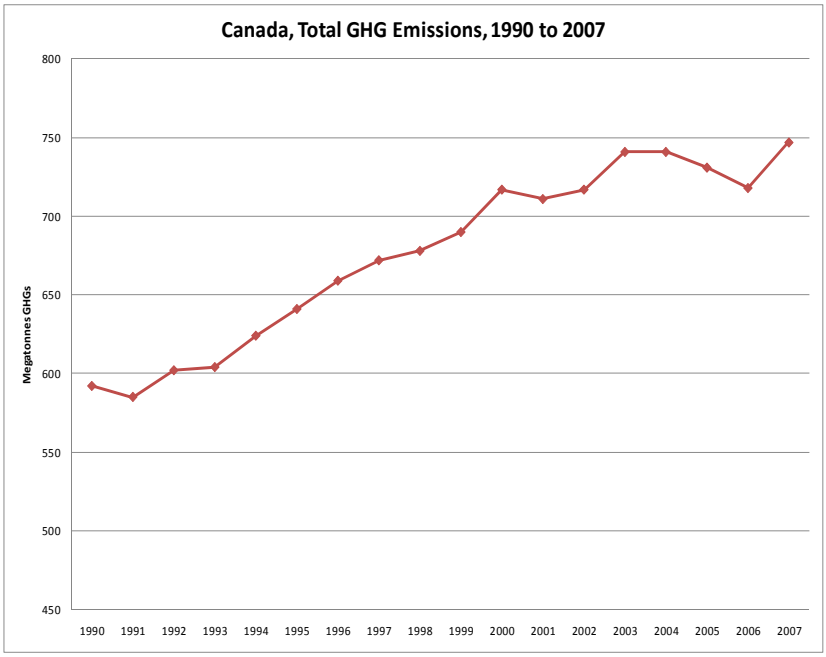
International Treaties and Agreements. Canada is a signatory to the Kyoto Protocol and committed to a 6% reduction in its GHG emissions from their 1990 level by 2010. As Figure 7 illustrates, there is no chance that Canada will meet its Kyoto target. GHGs have grown by over 26% since 1990. Two hundred countries meet again in Copenhagen this December to try to negotiate a successor to Kyoto that leads to reductions, not just promises. To date, we don't know Canada's strategy for the negotiations, so it is difficult to ascertain what the implications are for BC. While there is hope for an international

[25] The legislation is loaded with special interest provisions, many of which could disadvantage Canadian producers.

agreement, many observers think the chances are slim.[26] Even if there is an agreement, it may have the same problems as the Kyoto Protocol – no means of enforcing commitments to reduce emissions.

The European Union is way ahead of Canada in terms of implementing GHG policies that actually restrict emissions. The impact of their policies on BC is not large and would be mostly confined to product standards that could affect for example, timber and other forest product exports as well as energy exports. Again, the presence of a binding carbon tax and other policies in BC may benefit our industries to the extent that other countries view BC as providing some form of carbon pricing. One potential growth area is the provision of offsets from e.g., BC forests and agriculture, should the market expand internationally.

Figure 7: Canadian GHG Emissions, 1990 to 2007



Source: Environment Canada, National Greenhouse Gas Emissions, accessed at www.ec.gc.ca. Canadian Environmental Sustainability Indicators

Policies to Assist BC Industries Adapt to Climate Change

BC Policies

The Climate Action Plan is short on specific policies to enhance the adaptive capacity of communities and businesses, but there are areas where information on adaptation is consolidated and made available to the public. Many local governments across BC have added climate adaptation to their initiatives and staffing and are actively planning for the threats they face. However, there are not yet a

[26] See, for example, Michael Levi (2009). "Copenhagen's Inconvenient Truth, How to Salvage the Climate Conference" *Foreign Affairs* 88(5): 92-104.

comprehensive set of climate adaptation policies across the province, nor widespread planning for climate adaptation in public and private infrastructure and production. There are threats to all the provincial programs due to budget cuts underway in 2009-2010. Provincial policies that have adaptation components include the following.

Forests for Tomorrow. The program is dedicated to improving the capacity of BC's forest industry to withstand climate impacts and help achieve a low-carbon economy. The program focuses on the development of adaptive management practices, a strategy to address the mountain pine beetle epidemic, afforestation, a strategy of net-zero deforestation, wood waste to energy, cellulosic ethanol, and funding for eco-friendly investments in the pulp and paper industry that improve energy efficiency.

BC Energy Plan. The 2007 plan requires all incremental electricity generation in the province to have zero GHG emissions and 90% of all electricity generated to come from renewable sources. The Energy Plan also calls for the implementation of a provincial Bioenergy Strategy and proposals to use the MBP-killed wood for electricity generation. It creates the Innovative Clean Energy Fund to support the development of clean power and energy efficiency technologies in the electricity, alternative energy, transportation and oil and gas sectors. These policies may help increase climate resiliency by diversifying methods of generating electricity and efficiently using. Additional features of the plan include promises to implement Energy Efficiency Standards for Buildings by 2010 and introduce other policies to improve building design to reduce GHG emissions and promote efficient water use. These policies are consistent with actions that would help BC adapt to increasing climate variability.

Water Smart. Announced in 2008, the goals are to use water more efficiently and effectively, protect water supplies and ecosystems and provide information and policy to help communities and business adapt to climate change. A number of initiatives are in formulation and the Water Smart webpage (www.livingwatersmartbc.ca) provides information and reports on a wide range of water quantity and quality topics. More guidelines and regulation for water use, pricing, and adaptation to droughts and floods is expected.

LiveSmart BC. The Live Smart campaign is to help 'green' British Columbia. The webpage, www.livesmartbc.ca has a number of climate related entries designed to help individuals reduce their carbon emissions and provide information on how a changing climate will affect British Columbians. An example of the latter is a report on the impacts of sea level rise on BC, conferences held, and initiatives taken by local and regional governments in BC.

Research Networks: These include the Bioenergy Network, Pacific Institute for Climate Solutions, Pacific Climate Impacts Consortium and others at BC universities. Provincial government funding was instrumental in the creation of many of these research centres.

Local Motion. A $40 million fund for capital projects that promote healthy living. While nothing is mentioned about adaptation, portions of this fund might have categories that would increase resiliency to climate changes.

Crown Corporations, NGOs and Private Sector. Units within crown corporations that are directly affected by climate change (e.g., BC Hydro, BCTC) have divisions dedicated to developing strategies to increase resiliency to climate changes. Similar units exist in many of BC's businesses and their business associations that are directly affected by climate change such as forestry and agriculture.

National Policies

This section is short because there are no comprehensive policies or strategies for climate adaptation at the federal level in Canada. Activities are underway in specific sectors for particular issues such as federal support for research on strategies to deal with the mountain pine beetle infestation and forest and agriculture management practices to improve adaptation. There are adaptation groups within the federal ministries that deal with climate related issues (Natural Resources Canada, Environment Canada, Agriculture and Agri-foods Canada, Transport Canada, National Round Table on the Environment and Economy, etc.) but these are primarily in the business of providing research and information or funding to specific projects. One reason for the federal government's low profile is the Canadian constitution gives the provinces control over its natural resources, so there is limited federal jurisdiction for climate adaptation policy. The other reason is that climate change mitigation and adaptation has simply been a very low priority for the federal government.

4. Helping BC Attain a Low-Carbon and Resilient Economy?

The preceding sections have illustrated the challenges and opportunities facing BC industry from a changing climate and GHG policies ranging from local to international. BC's economy continues to draw considerable wealth from its resource sectors – those sectors most affected by climate change and GHG policies. The focus of this section is on recommendations to improve our economy's resilience to climate changes while it responds to a policy arena in which the price of carbon-based fuels and technologies dependent on these fuels will be rising over time. The goal is to transition to a thriving low-carbon economy that has taken actions to reduce the adverse impacts of a changing climate and takes advantage of the positive ones.

BC has set GHG emission reduction targets, established a carbon tax with an escalating rate over time where the tax revenue is returned to businesses and individuals, signed on to a cap and trade system (but one that may not ever operate), and introduced policies to enhance investment in energy efficiency and low-carbon technology. On mitigation policies, BC is a leader in Canada, with one of the most progressive GHG policy agenda in North America. In the following areas BC policies and actions rank as best practices in terms of moving toward a low-carbon economy efficiently and effectively.

1. BC has set quantitative long-term targets for reducing GHG emissions by specific dates.

2. Carbon pricing has begun with the introduction of the BC carbon tax that covers approximately 70% of GHG emissions in the province. Other complementary policies to stimulate the reduction in GHG emissions/increase in energy efficiency have been introduced and/or strengthened. These include policies the demand-side management targets for electricity in the 2007 Energy Plan.

3. Revenues from the carbon tax are returned to the economy by cutting distortionary taxes and hence help to both reduce the distributive impacts of the carbon tax on individuals and businesses but also reduce the adverse incentives taxes have on investment and labour supply. The revenue neutrality

of the carbon tax helps sustain economic growth, while the tax makes actions that degrade the environment more costly. BC policy reduces taxes on activities that create economic growth and income and moves them to activities that damage the environment.

While BC's Climate Action Plan is a good start on the path to a low-carbon economy, it doesn't go far enough. There are at least four significant gaps in BC's climate policy that inhibit its ability to be well on the way to achieving a low carbon, resilient economy by 2020.

1. The overarching goal is not comprehensive enough. While there is a clear mitigation goal, there are few plans, targets and policies addressing adaptation. As indicated in section 2, changes in the climate are a significant and growing risk to BC businesses and our communities.

2. While the Climate Action Plan lays out many policies, there is little in the way of a concrete road map or strategic plan that shows how and when these policies will begin to deliver the GHG reductions needed and from what sectors.

3. We don't have sufficient examination of whether we have the right policies or stringency of the policies to reach the targets. Examples are inconsistencies in energy and transportation policy that promote fossil fuel extraction and use while trying to reduce GHG emissions.

4. Too little attention has been paid by government and influential BC leaders to the need to get BC businesses and communities aligned with climate policies. Public opinion polls (and the May 2009 provincial election) suggest that British Columbians are broadly supportive of the Climate Action Plan and all its attendant components, but some of the public and business community remain sceptical that BC is on the right path. There are the climate deniers (although fewer in BC than elsewhere) who reject the science behind climate predictions. There are others who argue that the cost of controlling GHG emissions is too high and that it will damage the BC economy. On the other side, there are those who think BC isn't going far enough, or that while the goals are appropriate, they don't trust that government will deliver on its agenda. The recession and resulting large reduction in provincial revenues illustrates that the trust issues may be valid. BC climate policy has taken a back seat to deficit reduction and some of the policies noted above have been attenuated either with cuts to the budgets supporting programs or the introduction of new policies such as the HST that eliminates some climate-related subsidies.

I offer eight recommendations to help address the four gaps identified above. Most are directed at the BC government.

Recommendation #1: The provincial government should 'stay the path' on its Climate Action Plan, and augment that plan to explicitly include adaptation targets and policies to help reach the targets.

The Climate Action Plan lays out many policies designed to reduce GHG emissions. The current recession, planned introduction of the HST, and other threats to climate policy should not deter the provincial government from its plans. Economic analysis of the costs of reducing GHG emissions show that the longer the delay in starting down a path of real emission reductions, not just reductions in emission intensity, the higher the present value of total costs of meeting any meaningful target.[27] This result occurs because carbon emissions will continue to grow over time if meaningful policies are not

[27] Examples of studies that show the costs of meeting climate change targets versus delay are Stern (2007) for the UK and National Round Table on the Environment and Economy (2008) for Canada.

implemented, necessitating higher prices (or more stringent regulations) to reach the target. Refer back to Figure 7 for the past history of emissions in BC.

Figure 8 shows what the price path (of e.g., a carbon tax or the market price of a carbon allowance in a cap and trade system) needs to be to reach the Canadian GHG targets depending on when and how the policies are introduced. The more gradual the policy and fewer sectors covered, the higher the prices. For example, the slow and shallow policy assumes that federal climate policy allows GHG emissions continue to rise unabated until 2020, but then must increase in stringency significantly to reach a target of a 45% reduction from 2005 levels by 2050. The fast and shallow policy achieves a 20% reduction in GHG emissions by 2020, with the same 45% target reduction by 2050. The deep policy has a target reduction of 65% of 2005 levels by 2050. Note that the difference between the fast and slow policies is in the ultimate price increases as well as the timing of when they occur.

Figure 8: GHG Price Scenarios for Different Pathways to 2050

Source: National Round Table on the Environment and Economy (2007), *Getting to 2050: Canada's Transition to a Low-Emission Future.* Figure 3, p. 17.

As section 3 indicated, there are few policies at the provincial or federal level to assist businesses and communities adapt to climate change. Many BC municipalities are very aware of the threats that face their residents and businesses, but these governments often lack the resources (dollars and expertise) or policy levers to implement adaptation strategies. The goal is to reduce the barriers to adaptation. These barriers include lack of knowledge of viable climate adaptations solutions, funding, and lack of technology to address certain climate risks. The BC government could show leadership by raising the profile of the need to plan and act now for the largely inevitable changes in our climate. The following

are suggested steps for how the province could help all sectors by developing and implementing an adaptation plan.[28]

- Scope climate change risks and impacts for major sectors of the economy and communities.
- Conduct an assessment of climate change vulnerability. The estimation of risks identifies what might happen; vulnerability establishes to whom and when and how bad. As noted, not all climate changes are adverse, so adaptation encompasses knowledge of what areas of the economy and society may benefit.
- Assemble a cross-disciplinary, cross-ministry climate change preparedness team that also includes business sectors highly vulnerable to climate change who identify areas for focus.
- Develop and communicate a plan for how to prepare for climate change. Facilitate the transfer of adaptation know-how to businesses and communities to augment their own initiatives.
- Implement the plan.
- Measure the impacts of the plan and update.

BC has begun this process, but its efforts need to be accelerated and integrated across sectors. Key sectors – forestry, agriculture, energy are moving ahead as noted in section 3, but more could be done to accelerate the development of concrete plans and policies and to integrate these across sectors. Adaptation initiatives should be a partner in climate change actions, not a second thought. Once a plan is in place (and this should be done as quickly as possible), policy development to assist industry and communities increase their resiliency to climate change should proceed.

Areas for policy development for both mitigation and adaptation include:

- Provincial land use and other regulations over resource management that reduce GHG emissions while increasing adaptation capacity. An example would be to ensure reforestation is done with species that will be more resilient to threats from climate change such as insect infestations and drought.[29]The goal here is not to increase costs to businesses and communities but to ensure that decisions on resource and land use increase resiliency.
- All provincial infrastructure planning for both new facilities and on-going maintenance of existing facilities.
- Transportation infrastructure and policies to enhance and incent low-carbon options for individuals and businesses (e.g., vehicle charges based on kilometres traveled and fuel used)
- Greater focus on fugitive emissions and non-prices carbon sources

[28] See, as an example of how to map out a climate adaptation strategy, Centre for Science in the Earth System et al. (2007) *Preparing for Climate Change: A Guidebook for Local, Regional, and State Governments.* King County, Washington. Also see Burton, I. (2008): *Moving Forward on Adaptation; in From Impacts to Adaptation: Canada in a Changing Climate 2007,* edited by D.S. Lemmen, F.J.Warren, J. Lacroix and E. Bush; Government of Canada, Ottawa, ON.

[29] See Cohen (200x) for an example of policies and practices designed for the Okanagan region. O'Riodan (2009) examines the role of biodiversity in improving adaptation and provides a list of recommendations to policy makers.

- Improve provincial building codes and standards that incorporate best practices for energy efficiency and climate adaptation. The analogy here is to earthquake standards.

- Assistance to local governments to help them include climate threats in their Official Community Plans (OCPs), with the goal to introducing requirements to include adaptation planning in their OCPs.

- Assistance to BC businesses in making investments that increase resiliency to climate changes through knowledge transfer and perhaps, investment tax credits or other fiscal incentives to ensure as new infrastructure is built or old replaced, that they have best practices to reduce risks.

- Removal of policies that allow business and individuals to locate in areas highly vulnerable to adverse climate impacts.

Recommendation #2: The BC government should produce as soon as possible a road map that lays out the plan annually from now to 2020 of who its climate policies will affect, how much emission reduction will occur, what additional policies need to be introduced. The plan will need to specify how the GHGs not currently covered in the carbon tax will be regulated. Key performance indicators for the low-carbon, resilient economy should be specified and reported on at least every two years.

Establish a roadmap to reach climate targets. The first step is to ensure that BC has a clear roadmap from now to 2020 that lays out how the province will achieve its carbon targets.[30] The Climate Action Plan announces a large list of policies designed to reduce GHGs and move BC to a low carbon economy, but not how these policies will be used to attain the target. The Climate Action Plan provides a snapshot of the policies, but does not lay out intermediate targets, nor how progress toward the plan's goals will be measured and reported, or how policies may be modified over time contingent on interim results. In short, it is not a strategic plan. Appendix A of the Plan lists all the policy measures and indicates the 'progress' for that initiative. But progress stops when a policy is part of a government action or policy. For example, under the heading of Energy, the goal is "all electricity produced in BC will be required to have net-zero greenhouse gas emissions by 2016. Under progress for this goal, we find the information, "Completed February 2007 with launch of the Energy Plan". The definition of 'completed' is thus when the goal becomes part of a policy. This information is just the first step in how to plan for and report progress toward low-carbon goals. The Climate Action Plan models the share of GHG reduction expected from the main sectors (see Table 2), but doesn't yet give us a picture of what to expect by policy by year (or every few years) by sector. This sort of information would be useful for everyone to see the expectations and whether the policy measures are effective and how to plan for the future.

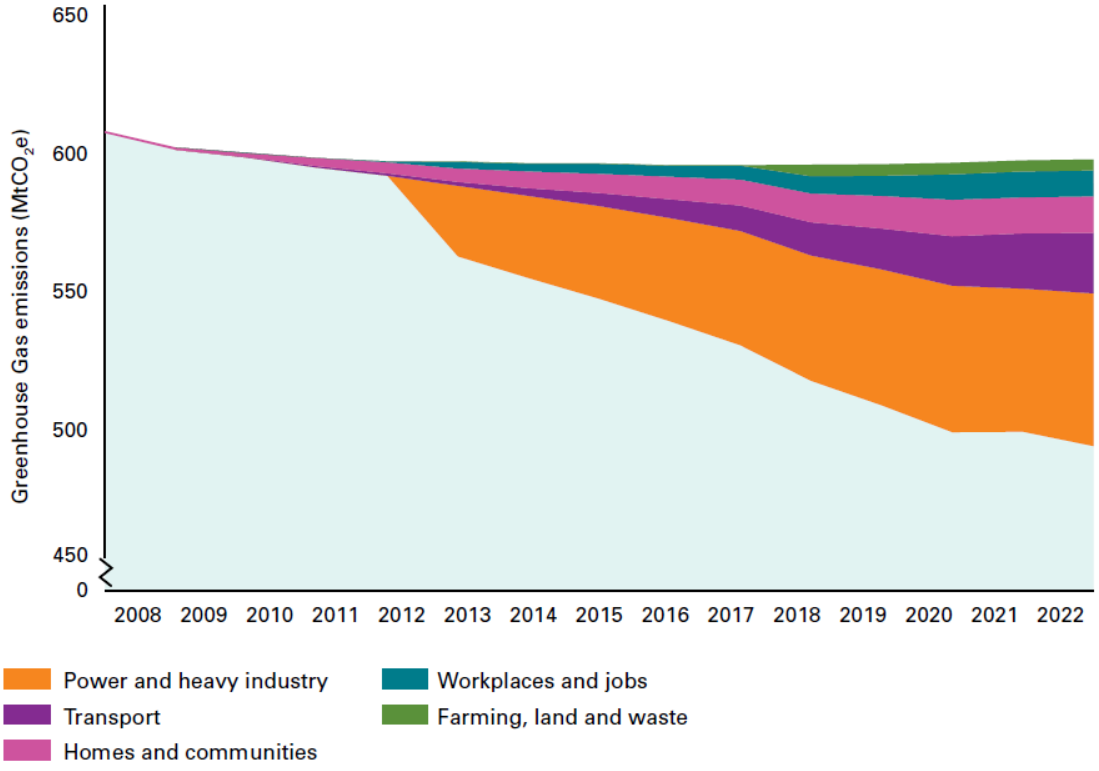
The UK is an example of a country that has specified and laid out its transition plan to a low-carbon society.[31] There are five goals of the plan: (1) Protect the public from immediate risk; (2) Prepare for the future by factoring climate change risk into decision making by both the private and public sector; (3) Promote a new international agreement at Copenhagen to reduce worldwide GHG emissions; (4) Build a

[30] See the Committee on Climate Change, *Building a Low-Carbon Economy – the UK's Contribution to Tackling Climate Change,* December 2008. In the UK, they call their roadmap the 'carbon budget' and it shows, in four-year tranches, the GHG emission reduction targets by sector and the expected means of reaching the targets.

[31] *The UK Low Carbon Transition Plan, National Strategy for Climate and Energy*. Presented to Parliament pursuant to Sections 12 and 14 of the Climate Change Act of 2008. July 20, 2009.

low-carbon UK; and (5) Support individuals, communities, and businesses to do their part to achieve the plan. The UK transition plan has specific targets for GHG reductions from each sector as illustrated in Figure 9. It then takes these same sectors and describes the emission reductions designed to come from each of the policy instruments it has introduced. Figure 10 illustrates this relationship. A road map is then presented for each year, showing the expected targets and actions to be taken to reach the goals. This is the sort of presentation needed for the BC Climate Action Plan and if not already in the works, I recommend its creation. It improves accountability and also provides businesses with a clear picture of the expectations of their contribution to reducing GHGs and adapting to climate change.

Figure 9: UK Emission Reduction Targets by Sector, 2007 – 2022.

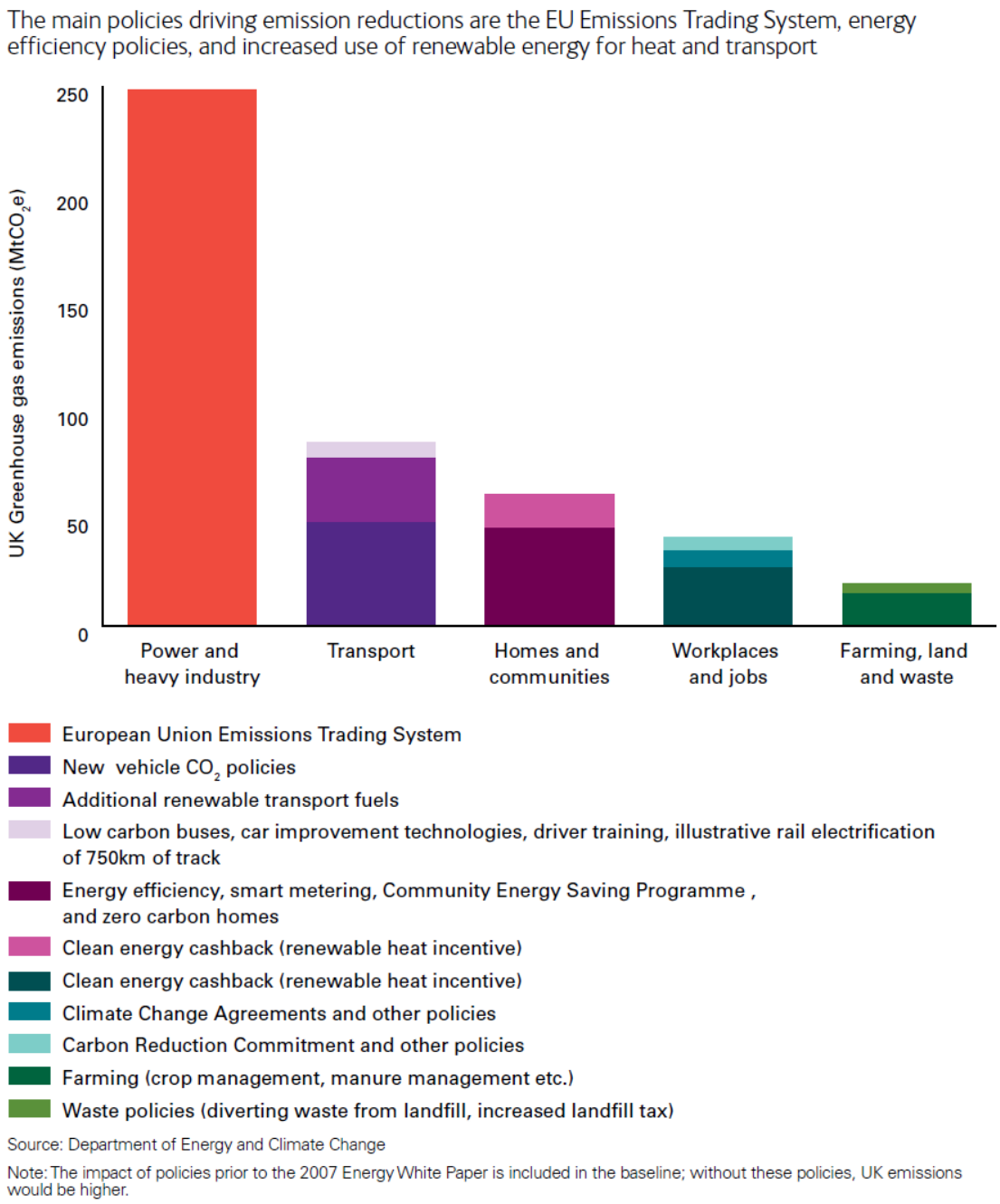


Source: Department of Energy and Climate Change

Note: The impact of policies prior to the 2007 Energy White Paper is included in the baseline; without these policies, UK emissions would be higher.

Source: *The UK Low Carbon Transition Plan, National Strategy for Climate and Energy* (2009), Chart 1, Page 6.

Figure 10: The Link between the UK Policy Suite and Emission Reduction by Sector in 2022.



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ource: *The UK Low Carbon Transition Plan, National Strategy for Climate and Energy* (2009), Chart 2, Page 8.

Table 4 then shows how the UK translates these policies in more detail into GHG reductions. A similar approach could be taken for BC.

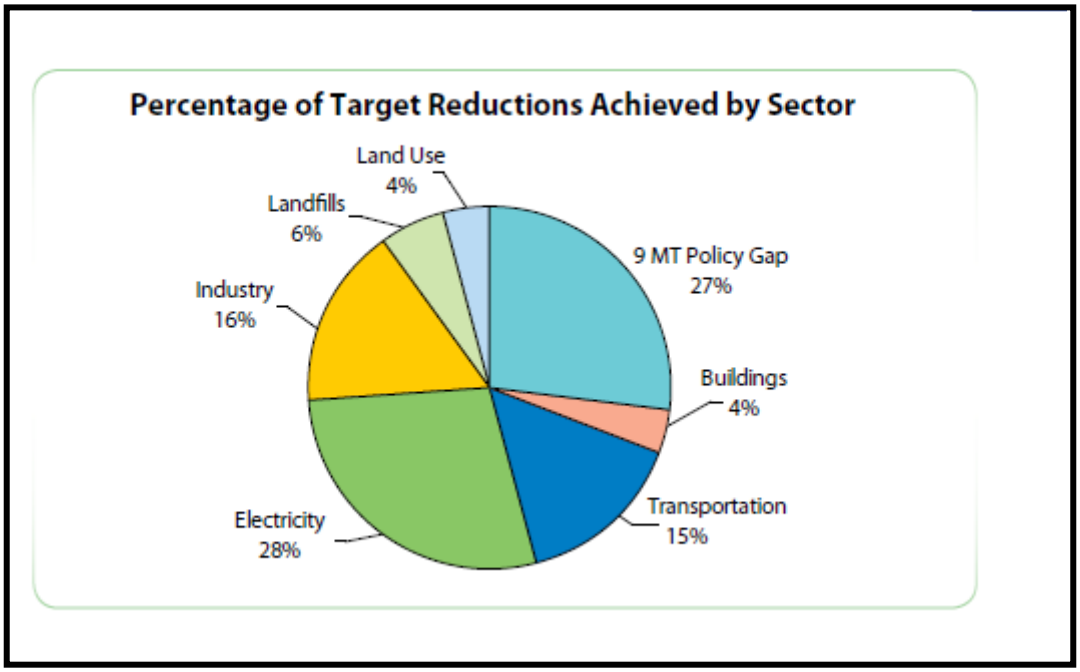
Table 4: UK Policies by Sector and Targets for GHG Emission Reductions

Policy Measures by Sector	CO2 savings in 2010 (million tonnes)	CO2 savings in 2020 (million tonnes)
Energy Supply		
Expansion of renewables	9.2	12.8
Cap & trade (ETS) phase 2	29.3	29.3
Subsidy for biomass heat	0.4	0.7
Businesses		
Climate change levy (tax)	13.6	13.6
UK emissions trading scheme	1.1	0
Carbon trust	4	8.1
Building regulations (2002 and 2005)	2.2	7
Climate change agreements	10.6	1
Investment in energy efficiency	0.4	1.1
Assistance to SMEs for energy saving	0.4	0.4
Transport		
Voluntary agreements on car fleets	8.4	12.8
Other transport measures	2.9	0
Measures in Scotland & Wales	0.4	0
Fuel duty escalator	7	5.5
Renewable transport regulations	5.9	5.9
Households		
Energy efficiency commitments	7.7	7.7
Building regulations (2002 & 2005)	5.5	16.5
Fuel poverty programs	1.5	1.5
Market transformation (e.g., appliance standards)	0.7	3.7
Replace inefficient boilers	0.7	0.7
Agriculture		
Woodlands grants scheme	0.7	1.1
Afforestation	1.8	2.6
Strategy for non-food crops	0.4	0.4
Public Sector		
Government, schools, university actions	2.5	1.4
Loan fund for the public sector	0.4	1.8
Solid waste policies	0.7	0.7
Other measures	0.4	0.4
TOTAL	**105.2**	**122.5**

Source: UK Climate Change Program, 2008, as cited in Committee on Climate Change, *Building a Low-Carbon Economy – the UK's Contribution to Tackling Climate Change,* December 2008, adapted from Table 3.1, p. 103.

The UK has a different industrial structure and GHG intensity by sector than in BC, but while the specific percentages differ, the sectors that we will be most focused on for GHG reductions are basically in the same order of importance with electricity and industry contributing the largest share of reduction, followed by transportation. Figure 11 shows the forecast emission reduction by sector for BC. Note that there is yet no sector identified to provide over ¼ of BC's emission reductions. The 9 Mt 'policy gap' thus requires the identification of additional means of reducing GHG emissions.

Figure 11: Forecast Reductions in GHG Emissions by Sector for BC in 2020.



Source: *Climate Action Plan (2008), p. 57.*

Need KPIs at regular intervals: How do we know if we are making progress? The first step is to establish the specific goals for climate policy, convert these to specific targets, and then find key performance indicators (KPIs) that are quantitative or qualitative measures that indicate progress toward the targets. Below is a sample taken from the literature and frameworks in place in other countries that might be applied to BC.

Potential goals for BC's progress to a low-carbon economy that is resilient to climate changes might be as follows:

- Achieves a high level of energy efficiency, use low-carbon energy inputs and technologies
- Makes a significant contribution (relative to a meaningful provincial baseline) to reducing global GHG emissions
- Has and supports a policy regime that is cost effective, sustained over time, and provides GHG emission price certainty
- Encourages investment, consumption, production, and land use patterns that minimize GHG emissions and improve resilience to climate changes
- Provides market conditions that promote investment in low-carbon technologies and investments

- Benchmarks itself against 'best-in-the-world' practices for mitigating GHGs and adapting to climate change

- Removes any barriers to industries that inhibit conversion to low-carbon practices or discourage low-carbon investments

A 'scorecard' of BC's progress toward a low-carbon economy can be derived from these goals. A set of key performance indicators correlated with the goals is then developed and data collected to indicate either quantitative levels or qualitative information. The scorecard is produced at regular intervals (I suggest at least every two years) and evaluated periodically to ensure compatibility with goals. Table 5 provides a sample of the indicators the BC government could use in its scorecard. Note that I focus on the low-carbon economy. The broader target of a low-carbon society would include a much larger list of indicators and goals to include community attributes, more environmental and social indicators. Those considerations are outside the scope of this paper.

Table 5: A Scorecard for BC's Progress to a Low-Carbon Economy

Measure	Units	Progress toward goals
GHG emissions by sector	Million tonnes CO2e	
Transportation		Qualitative or quantitative
Industrial sectors (total & individual)		(e.g, directional arrows or
Households		actual measures)
Energy consumption by sector and fuel	Gigajoules	
Energy production		
Renewables	Gigajoules of capacity and energy produced/year/fuel type	
Transportation		
Low carbon share	% alternative fuels compared to fossil fuels	
Climate policies, programs and projects		
Status of climate policies	Measures commensurate with the policy goals (qualitative and quantitative)	
Policy/program is enacted	yes/no and what type (taxes, subsidies, regulations)	
	yes/no and progress made (e.g., changes in codes & standards)	
Key agreements/partnerships in place	Progress toward goals of policy, could include:	
Measures of policy effectiveness	funding of R&D, support for market developments, pilot projects in place (& outcomes), adaptation initiatives and consultations, measure of carbon literacy	
	Report on programs and progress	
Information and stakeholder engagement	Key positions: areas and coverage	
Staffing capacity	Budget allocation in $ and % GDP	
Funding by program	E.g., carbon capture & storage	
Technology development	E.g., adaptation in OCPs, Water Use Plans, Agriculture &	
Planning capacity and program	forestry practices	

Recommendation #3: BC Businesses should incorporate climate progress in their Corporate Social Responsibility Reporting

Analogous to reporting on the province's progress to a low carbon economy, businesses should also track their efforts and achievements to reduce their carbon footprint and increase their resiliency to climate change. Setting goals, KPIs, and monitoring these will help not only achieve emission and

adaptation targets (at low cost), but inform the buyers of their goods and services that the business is committed to being a partner in achieving a low-carbon economy. Table 6 illustrates a very simple template that can be adapted to BC businesses.

Table 6: Sample of KPIs for Business: Progress toward a Low-Carbon Business

Measure	Potential Progress Indicator in fiscal year	Future Actions
Carbon emissions	Tonnes per year per business unit	Directional indicators & coverage
Buildings and transport energy efficiency	Energy consumption and savings, # of vehicles by fuel type	
Adaptation initiatives	Qualitative and how increase resiliency	
Innovation	Types, degree of development, market opportunities	
New low-carbon products	Types, degree of development, market opportunities, sales	
Employee engagement	Degree of engagement with employees, specific policies	
Customer relations	Advertising about low-carbon initiatives, carbon labeling to improve carbon literacy	

Recommendation #4: More modeling and examination of policy efficacy, including costs and benefits of reaching targets should be undertaken with results publicly available.

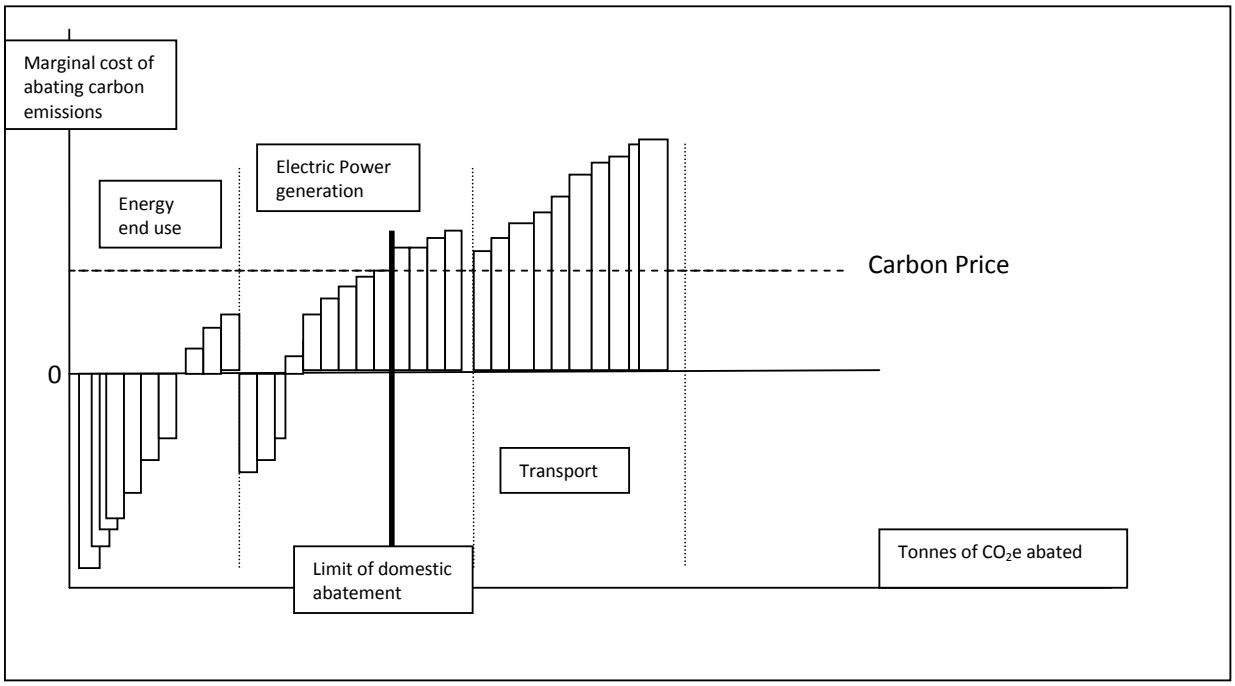
A key to cost efficient policy to achieve GHG targets is to estimate the costs, ideally marginal costs, of the policy instruments, given available and forecast technologies and assumptions about how sectors respond to climate mitigation policies. These estimates should then be updated over time as real events unfold.

A sample of the theoretical marginal costs of carbon pricing to reduce GHG emissions is shown in Figure 12.[32] Figure 12 illustrates that some form of pricing policy instrument (e.g., continent-wide cap and trade or a carbon tax) will reduce emissions of CO_2 up to the point where the carbon price equals the marginal costs of abatement. In Figure 12, this point is shown as the `limit of domestic abatement`. If the target reduction in emissions exceeds that level, then offsets will have to be purchased to reach the target. The hypothetical marginal costs illustrate that all the energy efficiency investments will be adopted, some for the electric power sector, and none for transportation, given the carbon price. New technology developments could change the costs of abatement substantially, e.g., the mass production of electric vehicles. The point of the exercise is to help assess the reasonableness of the emission targets over time in terms of their net costs on the economy. A caution is that the benefit side should be measured as well. This is rarely done, but there are benefits to reducing GHG emissions that are in addition to the impact on global GHG emissions which is small. Reduction in fossil fuel combustion also reduces the release of air contaminants – sulphur dioxide, nitrogen oxides, particulate matter, carbon monoxide and other compounds. These contaminants reduce air quality, a problem especially for urban areas and the Fraser and Okanagan valleys, but also in regional municipalities such as Prince George. Air pollution has adverse effects on health, agriculture, materials damage and soiling, as well as visual

[32] See N. Hoffman and J. Twining (2009) "Profits from the Low-Carbon Economy", in McKinsey-Quarterly, August 2009 for a similar graph showing abatement costs using known technology for reducing GHG emissions from the lowest to the highest. The graph is similar to Figure 11, but has abatement costs by technology, rather than by sector. For example, switching from incandescent to LED lighting saves $200 per tonne carbon reduced, but only reduces GHG emissions by a small amount. It is the first action any sector should take to meet a carbon target. The highest cost technology costing around $80 per tonne CO_2e reduced in carbon capture and storage retrofits to a gas-fired power plant.

pollution. Improvements in air quality are an immediate benefit to individuals and businesses. Changes in agriculture and forestry practices to reduce GHG emissions and improve resiliency to climate change will also have auxiliary benefits that need to be estimated and expressed.

Figure 12: Theoretical cost of meeting GHG emission reduction targets



Source: Adapted from UK Climate Change Program, 2008, as cited in Committee on Climate Change, *Building a Low-Carbon Economy – the UK's Contribution to Tackling Climate Change,* December 2008, adapted from Figure 4.6, p. 159.

Recommendation #5: The tax rates for the BC carbon tax beyond 2012 should be announced as soon as possible. If no cap and trade market emerges before 2015, the carbon tax rate would need to be adjusted.

This is good policy practice; the greater the certainty of the tax stringency, the sooner and more cost effectively business can plan to meet the target. A significant advantage of a carbon tax over cap and trade is that the escalation in its rate can be announced by government and made binding by legislation as in the BC carbon tax. Under a cap and trade system, the market determines the price and historically, cap and trade systems have exhibited significant price volatility making planning and investment decisions more difficult and potentially more costly. If BC comes under a cap and trade system, there are mechanisms to reduce price uncertainty, for example, price ceilings, a large international offset market, banking of permits, etc. See Olewiler (2008) for a discussion of how BC could moderate adverse impacts on BC businesses under the WCI cap and trade system.

If there is no cap and trade system by 2012 or shortly thereafter, BC needs to come up with other policies or strategies for the emissions not covered by the carbon tax. These could include regulations or some form of financial incentives. The carbon tax rate would likely also have to be adjusted. It is not advisable for BC to initiate a provincial cap and trade system as the market would simply be too thin to achieve a cost effective reduction in emissions and prices may be much higher than would an equivalent carbon tax.

Recommendation #6: If a cap and trade market is introduced federally in Canada, BC should strongly lobby the federal government for autonomy in setting its own GHG targets and how it allocates permits. Under the WCI, BC has these rights, but nothing is yet known about a potential federal policy. Without this autonomy, BC businesses may be a competitive disadvantage relative to other Canadian provinces and businesses in the US.

It looks like some form of cap and trade system will be implemented in Canada and the United States; when, what exact provisions it has, we do not know. There are many risks to BC businesses depending on who decides what the system entails. BC should be actively promoting its interests in the design and implementation of any Canadian system, especially in the setting of targets and allocation of allowances. For example, it would be in BC's interest to promote a system that auctions a relatively large number of allowances, rather than a distribution based on some equal sharing of emission reduction targets because we will face different marginal costs of reducing emissions than other provinces. For example, due to our large share of existing hydroelectricity generation, increases in renewable generation in BC will represent a much smaller percentage reduction in GHG emissions than would occur in Alberta, Saskatchewan, or Ontario. Auctioning a relatively large share of the permits and allowing each province to keep the proceeds from allowance buyers in its jurisdiction would help level playing fields, prevent market manipulation and ensure efficiency in the market's operation. Government revenues from the auction can be used to assist sectors who have significant challenges in reducing their GHG emissions, for example, those facing world prices for their products that cannot pass cost increases along to consumers. Government revenues from the auction could be earmarked to support clean technology development and thus might help stimulate new businesses in BC. It is imperative that BC has a voice in the design of a Canada-wide cap and trade system.[33]

Recommendation #7: Offset policy and the role of financial intermediaries needs to be clarified for the public and private sectors.

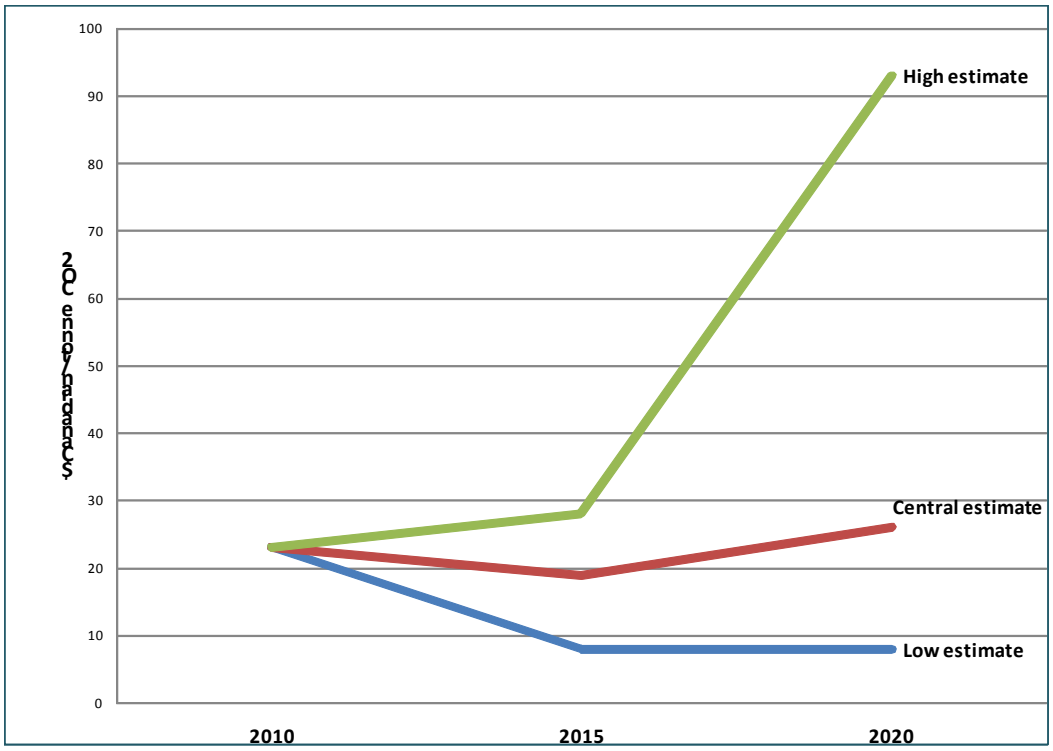
A well structured offset market can significantly reduce the cost to businesses and consumers of meeting GHG targets because they effectively increase the options entities under GHG regulation have to meet their obligations. Under a cap and trade system, offsets effectively increase the number of allowances in the market and hence tend to reduce the price of allowances. Offsets also can provide very significant new business opportunities in BC by allowing sectors to augment their product lines. What is needed very quickly is a complete guide to all sectors on what qualifies as an offset to allow suppliers to bid into the market and those buying (which will be the public sector in 2010) an ample supply. For example, what type of agricultural and forestry practices that reduce GHGs will be allowed? To ignore these issues would likely increase the costs of meeting GHG targets and not realize all the business opportunities that may exist.

When the rules for offset coverage are fully articulated, it would also be helpful to the public sector now and to businesses if and when a cap and trade system is implemented to start forecasting offset prices. As with the price of allowances or the carbon tax rate, the greater the certainty over prices, the easier to plan and meet GHG targets at the lowest possible cost. The UK already forecasts offset prices based on the rules governing the European Union's cap and trade system. Figure 13 presents a graph of a range

[33] Note that a federal carbon tax with the revenues from the tax share of each province flowing back to that province (for redistribution or further tax cuts) would be a much simpler carbon pricing scheme and represent less risk to businesses.

of offset price predictions to 2020. Note the significant differences among the high to low projections. This is based on what activities will be allowed as offsets and where they can be purchased (e.g., which countries and activities count).

Figure 13: Offset price projections to the year 2020



Note: Prices in the original figure were in Euros. These have been converted to Canadian dollars using the October 2009 exchange rate. Values are in current dollars.

Source: Committee on Climate Change, *Building a Low-Carbon Economy – the UK's Contribution to Tackling Climate Change,* December 2008, adapted from Table 4.7, p. 163.

There also needs to be clear regulation and oversight of financial intermediaries in the offset market also needs to be clarified. The value of carbon markets (both emissions and offsets) is anticipated to be very large, giving intermediaries the potential to earn significant amounts of income. McKinsey estimates the global market for carbon trading is already worth $145 and is expected to grow $3 trillion by 2020. There are a lot of 'rents' at stake and it would be wise to ensure that GHG emitters do not pay more than they need for offsets or emission permits due to capture of these rents by the financial intermediaries, many of whom are already located in other jurisdictions.

Recommendation #8: The provincial government needs to engage in far more consultation and dialogue on its Carbon Action plans not only with key stakeholders, but the public. The government needs to communicate its plans and directly involve the sectors most affected by climate change.

Climate policy is too important to be made only in Victoria. The BC government was off to a good start with its Climate Action Plan and attendant policies, but has not followed up with a communication campaign as to why the need for the policies, how they will work and help BC become a world leader in sustainability, and what opportunities they create for BC business and communities. The current economic downturn has been a significant challenge for climate policy, with provincial budget cuts to the Climate Action Secretariat and other ministries who deal with climate related issues. There is simply too much at stake to put this on the back burner. The Climate Action Team that advised the government in policy design should be expanded with larger business, NGO, and regional representation so that business, government, and communities can work together to achieve the climate goals, both in mitigation and adaptation. This has to be more than a superficial consultation; it requires the creation of working groups to help modify and adapt policy as the data on impacts flows in. There is considerable divisiveness in the province over climate policy and a poor understanding of the issues and role of policy. If BC is to meet the challenges of climate change in a low cost and equitable way, it is imperative to get beyond the politics and rhetoric to a deeper understanding of the issues and options. We cannot afford the continued polarization of our political parties, the public, and businesses on an issue that so greatly affects our future.

Conclusion

The report highlights the potential impacts of climate change on vulnerable sectors of the BC economy. While prudent policy indicates that BC should be taking steps now to reduce the deleterious effects of climate change, most societies have been poor at long-term planning, especially when it comes to environmental issues. Policy for environmental issues is fraught with all the challenges noted already – uncertainty about the extent of the threats faced, whether remediation will make things better (or improved enough to outweigh the costs of doing so), and when to act. But there are other factors that make planning even more difficult. Governments are used to responding to more acute environment disasters; they typically have little management experience for dealing with long-term, protracted, global disturbances; this is perhaps part of the reason why there is so much uncertainty surrounding all aspects of climate change (Gayton, 2008).

Section 3 covered policies to reduce GHG emissions that will affect BC businesses. Major environmental problems such as climate change affect the entire planet, so on the mitigation side, there is reluctance to act unless the rest of the world does similarly. No one wants to pay for the 'free' services the environment has long supplied to sustain life and provide us with natural resources. BC has taken the first steps on GHG mitigation by bringing in policies that put a price on carbon and introducing regulation to reduce our GHG emissions. But it is even more imperative now to think long term or our economy will suffer more than it needs to from climate change and forego opportunities to create new businesses in the move to a lower-carbon intensive world. It is also good business to plan for and take steps to achieve a low-carbon economy. Section 3 highlighted some of the potential growth areas for BC business as its trading partners begin to also introduce policies to reduce GHG emissions. We are now more quickly turning from a world where business in regimes with GHG policies worried about competitiveness to one in which those regions without GHG policies and actions taken to change their

industrial structure will be less competitive. This won't happen overnight, but we seem to be at the tipping point and there is a lot of money to be made if business is ready to compete in a lower-carbon world.

We need to start now in all sectors of our economy because investments take time to plan, fund, and build. For example, energy efficiency investments in all our structures and processes reduce GHGs by lowering energy consumption and can increase communities' resilience to climate change. BC has already missed the opportunity in one of the major building booms in the past decades to design and build to reduce GHG emissions and increase resiliency to climate change. Condos built in Vancouver with floor to ceiling windows that don't provide enough ventilation were uncomfortable during the summer heat wave of 2009. It is typically more expensive to retrofit buildings to improve energy efficiency than to start with that in mind, but by waiting to take action, we lose the benefits that could be realized and make it that much harder to achieve the cuts in GHGs needed. Section 4 provided examples of how to move the BC economy to lower carbon emissions while decreasing its vulnerability to climate changes.

An economy that cuts its own GHG emissions and invests in infrastructure, land use planning, and other policies that reduce vulnerability to climate change will be competitive in a low-carbon world. BC has great potential to be a leader among the low-carbon jurisdictions; we need to realize that potential with political will to stay the course put in place and business to embrace the concept that environmental policies can be a benefit, not just a cost. A low-carbon economy is achievable but not without effort on the part of decision makers in the public and private sector along with buy-in from the public to get on and stay on the path that takes us there. Improving the conversation among all these parties by discussing the benefits (and costs) of carbon policies is essential to keep BC on track. There is still distrust among the parties, the love of controversy and opposition to policy based on which political party promotes the policy, and a reluctance to pay for the changes that are necessary to get our economy on a sustainable path. These barriers will have to be overcome or BC will be stuck in the fossil-fuel intensive era, lose businesses and jobs to regions that are more progressive, and suffer greater harm from the changes in our climate.

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