Are Voluntary Greenhouse Gas Reductions Enough? An Assessment of BC's Industrial Emitters

by

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Abstract

British Columbia has taken specific policy action to reduce greenhouse gas (GHG) emissions in order to meet its legislated target: a 33% reduction in GHG emissions below 2007 levels by 2020. This study evaluates whether voluntary actions by emission-intensive firms in combination with the preliminary effects of BC's carbon tax can potentially reduce industrial GHG emissions in line with the 2020 target. While findings are tentative due to limited time elapsed and data available for a comprehensive assessment, my analysis indicates that current policy and actions are not sufficient to reach BC's fast-approaching GHG reduction target. Corporate approaches to manage emissions are assessed alongside facility GHG performance from 2004 to 2010. In order to put industrial GHG reductions on track to meet BC's 2020 target, two policy directions are explored: an increase in the price per unit of carbon through a higher level of BC's carbon tax, or performance standard regulations.

Keywords: climate change; GHG reduction; industrial emissions; policy; targets; voluntary action

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List of Acronyms and Abbreviations

CO_2e	Carbon dioxide equivalent
CDP	Climate Disclosure Project
CSR	Corporate social responsibility
GHG	Greenhouse gas
GHGRP	Greenhouse Gas Emissions Reporting Program
GRI	Global Reporting Initiative
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
kt	Kilotonne (thousand tonnes)
Mt	Megatonne (million tonnes)
NRTEE	National Round Table on the Environment and the Economy
PPGTP	Pulp and Paper Green Transformations Program

Executive Summary

To meet BC's legislated greenhouse gas (GHG) target of a 33% reduction of emissions below 2007 levels by 2020, trends from all sectors need to be considered. The GHG contribution from industry represents more than one-third (37%) of British Columbia's total GHG inventory for 2009. Despite the fact that industrial emissions are a significant proportion, the current state of climate policy in BC does not encourage companies to take the level of action necessary to significantly reduce emissions in their industrial operations. While minor reductions have been realized in the most recent years, it appears likely that these gains have resulted in large part from production declines due to the economic recession. The potential that economic recovery may undermine reductions and even increase industrial emissions needs to be addressed in BC climate policy.

Several companies that operate emissions-intensives facilities in BC acknowledge that climate policy is part of the global economic environment and identify carbon pricing as a preferred method for moving forward. The current uncertainty where there is a 'hold' on any further scheduled carbon tax rate increases and a government review of the tax makes it difficult to plan for the future and may undermine the efforts that companies have already put into emission reductions.

Based on my analysis, voluntary corporate action appears to have only a minor impact in terms of emissions reductions. The status quo – with BC's current carbon tax in place – does not seem to fare much better. Though tentative due to data limitations and the short amount of time elapsed, these findings cannot refute that an economic recovery would spur industrial emissions increases despite the carbon tax. GHG outputs from industrial sectors in BC come mostly from extractive sectors that are highly emissions-intensive, such as oil and gas, and metals and mining. Increased production in these sectors, without greater incentive from government to invest in emission reduction measures and technology, could severely undermine BC's potential to meet its 2020 GHG target.

The resultant policy recommendation is that an increase in the carbon tax is necessary to ensure that industrial emission reductions continue. BC has an opportunity to maintain the momentum created by companies that have voluntarily taken climate action, and to spur on those who are less committed with further scheduled increases in the carbon tax rate. Such policy can be implemented quickly and effectively, and help keep BC on track to meet its GHG target

1. Introduction

Industrial emissions make up a substantial proportion of BC's greenhouse gas (GHG) inventory – over one-third of total emissions. The provincial government has committed to GHG reduction targets and need to ensure that its climate change policy framework addresses industrial emissions effectively in order to meet these targets. Corporations have taken some initiative over the past decade to reduce emission outputs from their operations voluntarily. However, the overarching problem is that industrial GHG emissions have not fallen BC over the past decade[1].

British Columbia is the focus for this study due to its explicit policy action to reduce GHG emissions. Despite the fact that industrial emissions contribute 37% to overall emissions, BC's current climate policy approach does not specifically target these emissions. The question asked is whether the combination of voluntary actions on the part of BC industrial emitters plus incentives from the current stance of BC climate policies are enough to reduce emissions from these industries, sufficient to help BC meet its GHG targets. While the results are largely tentative due to the relatively few years since the introduction of BC's climate policies, my analysis indicates the answer appears to be 'no'. The policy problem is thus that the current level of BC climate policy is too low to meet the province's 2020 GHG target. I compare two policy directions that could be used to help meet the target – an increase in the price per unit of carbon through a higher level of carbon tax or performance standard regulations.

[1] For the purposes of this research, industrial GHG emissions include those from manufacturing as well as the oil and gas sector. From 2000 to 2009 (the last year of data available to date), BC's industrial emissions have represented between 33 to 37% of total emissions, reaching the high end of this range in the most recent years.

1.1. Uncertainty in GHG Reduction Policies for Industry

British Columbia sought to become a low-carbon leader by way of its Climate Action Plan policy framework. The province legislated a 33% reduction in GHG emissions below 2007 levels by 2020. While there are many areas of BC's economy that require substantial adjustments in order to meet the 2020 target, one challenge is motivating the industrial sector to decrease their level of emissions. BC's carbon tax has been one aspect of the policy suite, though there is uncertainty in future rates and even the continuation of the carbon tax. Legislation was also put in place to allow for a cap and trade system for industrial emissions, but there has been little movement on this policy in recent years (BC, 2008).

Some firms have instigated their own plans of action to address climate change, including company targets for energy efficiency and emission reductions. However, the lack of further carbon tax increases or government policies that specifically target industrial emissions does not send a strong signal to industry that major efforts must be undertaken to mitigate climate change impacts. In the face of uncertain climate policy from government, too much emphasis has been put on voluntary measures to reduce industrial emissions. An analysis of how active and effective firms have been in corporate effort to reduce emissions identifies that most companies in BC have little incentive to take further action without an increase in the price on carbon or regulatory constraints.

1.2. Reduction of Industrial GHG Emissions is Critical

A reduction in global GHG emissions is essential to reduce the likelihood of devastating climate change that would "exceed the capacity of natural, managed and human systems to adapt" (IPCC, 2007, p. 51). While BC has been proactive in setting significant GHG reduction targets, the most important step now is to meet these targets

with well-designed policy tools. In 2009, 24.8 Mt of carbon dioxide equivalents (or CO_2e, the measure for GHGs) of BC's overall emissions (66.9 Mt) came from industrial sources. These include emissions from fossil fuel combustion in manufacturing, the oil and gas sector (including fugitive sources), and industrial processes[2]. And despite the effects of the economic recession, there have only been minor reductions in overall industrial emission from 2007 to 2009 (-2.2%).

To contribute to the mitigation of climate change impacts and BC's GHG goals, industrial emissions need to be reduced quickly and efficiently. Voluntary measures play a part in this shift, and corporate climate performance offers some insight as to the capacity and limitations of firms to realize emission reductions. While firms are unlikely to take drastic steps to curb emissions on their own, performance in voluntary reductions can inform the level of regulatory constraint needed to encourage further action.

This study contributes to the extensive scholarship on the impacts of policy and other determinants on industrial environmental performance. It provides evidence on the impact of voluntary climate action and the current climate tax on emission performance for BC's emission-intensive facilities, aligning information from corporate sustainability reports and GHG data from government monitoring programs. The analysis investigates how robust and effective company emission reduction strategies are in relation to GHG outputs. I look at the activities and emissions of BC firms from the 2004 to 2010 – a period that encompasses the period before and after the introduction of the carbon tax.

Insufficient time has passed to precisely determine the impact of BC's carbon tax relative to other factors that influence emissions. (Other factors include macroeconomic impacts such as the 2008 recession, changing market conditions for individual industries, the impact climate change is having on BC's forest industry with the mountain pine beetle, as well as firm-specific variables.) Nonetheless, it is informative to examine

[2] Emissions from industrial processes refers to GHGs released in the production of specific products, such as the cement, aluminum and natural gas sector. These emissions are intrinsic to the process and are reported separately from industrial emissions that result from the combustion of fossil fuels in national and provincial GHG inventories.

the emissions and environmental commitment of BC's carbon-intensive sectors to determine the extent of policy change that needs to be undertaken in a timely manner to prevent future increases in industrial emissions that could undermine BC's climate action goals. Continued (and even enhanced) reductions in BC's industrial emissions are critical to ensure that BC meets its GHG target, as they make up a significant proportion of BC's overall emissions.

The paper is organized as follows. Section 2 provides background literature. Section 3 defines the methodological approach. Sections 4 through 6 provide analysis results on emission performance, corporate policies, and the relationship between them. Policy instruments to reduce emissions are reviewed in Section 7 and assessed in Section 8. Section 9 offers recommendations, and Section 10 concludes.

2. Background

This section begins with a look at factors that encourage companies to take action to reduce emissions, either on a voluntary basis or through government policy. A review of the research literature identifies opportunities and barriers that can play some role in affecting industrial emission performance. Understanding the motivations and limitations to voluntary action and the strengths and weaknesses of government policy is essential to the analysis of options to further industrial GHG reductions. The section ends with an overview of current industrial emissions performance in BC.

GHG emissions are what economists call a negative externality – an unintended side effect of production or consumption that does not come at a cost to producers or consumers that is detrimental to society (Sterner & Coria, 2012). To correct this market failure, government policy is deemed necessary to oblige firms to reduce the environmental impacts of their operations. However, there are other factors that motivate businesses to improve their environmental performance, such as public pressure, competitive advantage, or the recognition of climate change as a business risk (Gunningham, Kagan, & Thornton, 2004; Lyon & Maxwell, 2008; Reinhardt & Stavins, 2010). Some businesses have taken it upon themselves to improve their environmental performance – including GHG emission reductions – without stringent government policy in place. An overview of non-government influences on the development of corporate environmental strategies begins below, followed by a summary of government policies that seek to right the market failure of unrestricted industrial GHG emissions.

2.1. Non-Government Drivers for Corporate Action on Climate Change

Climate change has moved from a topic of minor importance in business to a key area of corporate planning (Clarkson, Li, Richardson, & Vasvari, 2011; Sullivan, 2010).

This shift has resulted from the growing global consensus on the potential impacts of climate change, spurring expectations for environmental responsibility and GHG emission mitigation from corporations. Pressure from various stakeholders has built up in recent years for a number of reasons. Some motivating factors include the escalating economic cost of climate change impacts, investor interest in corporate response to climate change risks, and public demand for corporate social responsibility (NRTEE, 2011; CDP, 2011; Lyon & Maxwell, 2008). One additional impetus for action on climate change is the concept that environmental management can result in financial gains for companies, potentially representing a 'win-win' opportunity for corporations and society (Clarkson et al., 2011; Reinhardt & Stavins, 2010).

2.1.1. Economic Costs of Climate Change

Numerous valuations of the economic cost of climate change have been conducted over the past five years, fostered by the Stern Review on the Economics of Climate Change and reports from the Intergovernmental Panel on Climate Change (Stern, 2006; IPCC, 2007). These assessments, alongside the work of environmental non-government organizations and climate experts, have helped identify and stimulate public debate on the enormous potential impacts of unmitigated climate change (Sullivan, 2010).

Recent estimates from the National Round Table on the Environment and the Economy (NRTEE) identify that the impacts of climate change could cost Canada $5 billion per year by 2020, and reach $21 billion to $43 billion annually by 2050. One highlighted area of impact that is already apparent in BC is the effect on timber supply. It is anticipated that changes in pests, fire, and inhibited growth activity resultant from climate change will cost the Canadian economy from $2 billion to $17 billion annually by 2050 (NRTEE, 2011). The mounting economic case for reducing GHG emissions to help forestall the effects of climate change has made mitigation efforts an important issue for consumers, investors, governments, and corporations themselves.

2.1.2. Investor Concern for Climate Change Risk

Investor groups have an interest in corporate climate change policies to monitor the material risk of potential impacts, from increased commodity prices to adaptation costs (CDP, 2011a). Climate change mitigation has also been highlighted as an opportunity for economic gain through investments in companies (and countries) that foster technological innovation and a shift to cleaner and renewable energy (Ceres, 2011). A number of programs and services that measure the social and environmental performance of companies have emerged in the past decade to inform investors, such as the Dow Jones Sustainability Index.

The largest global initiative that focuses on corporate GHG emission data and strategies, the Carbon Disclosure Project (CDP), is investor focused. For the 2011 report cycle, investor signatories included 551 financial institutions globally with assets of $71 trillion US (CDP, 2011b). In Canada, 108 of the top 200 companies participated in the national 2011 CDP report, representing 76% of the total market capitalization of the top 200 companies, or $1.2 trillion (CDP, 2011a).

While CDP participation levels point to interest of both investors and companies in disclosure, the impact of disclosed information on either group is more difficult to discern. Past studies in the Canadian context have found that capital markets did not provide a significant source of pressure for improved environmental performance, compared to regulations and other pressures. (Harrison & Antweiler, 2003; Doonan, Lanoie, & Laplante, 2005)

2.1.3. Corporate Social Responsibility

Most companies have been motivated to acknowledge the social and environmental impacts of their operations in a commitment to corporate social responsibility (CSR). A multitude of factors aside from altruism have been aligned with company's CSR activities. Some see pollution as an identification of production inefficiencies that, once reduced, could save money for the firm. Consumers have shown some willingness to pay for products that have less environmental impact. Companies also react to the threat of governments and non-government organizations monitoring of their environmental performance by pre-emptively improving their operations to avoid

strict regulations or boycotts (Harrison & Antweiler, 2003; Gunningham et al., 2004; Lyon & Maxwell, 2008).

There is little evidence that companies engage in CSR measures purely for social welfare (Lyon & Maxwell, 2008; Reinhardt & Stavins, 2010). Even where the financial implications of environmental improvements are high, companies may be compelled to act in order to maintain their social license to operate (Gunningham et al., 2004). To highlight their CSR commitments, many corporations present environmental indicators and strategies in annual sustainability reports. How robust and effective these strategies are in affecting environmental performance, especially when they conflict with economic goals, is a major focus of this study

2.1.4. "Win-Win" Opportunity in Voluntary Environmental Action?

Investors, governments, non-government organizations and companies themselves have occasionally alluded to the opportunity for financial gain from environmental action. An overview of the literature that examines cost reductions, product differentiation and productivity improvements that companies can gain through environmentalism, however, is inconclusive (Press, 2007). Studies that do establish a link between improved environmental performance and financial gain often find that positive economic outcomes are contingent on initial financial resources and management capacity; in other words, companies that are more profitable to begin with tend to engage in more environmental activities than others (Clarkson et al., 2011; Reinhardt & Stavins, 2010). There are also indications that reductions in energy intensity and per unit pollution output from manufacturing operations have started to plateau; therefore further energy savings may not remain a strong incentive if industries have hit a "best practices frontier" (Press, 2007, p. 335).

Ultimately, it seems that corporations are willing to undertake environmental improvements up to the point where there is not additional economic advantage anticipated. While voluntary measures allow firms to make gains via energy efficiencies, social license to operate, and even averting regulatory threats, the impact of voluntary action does necessarily benefit society to the same extent as government intervention (Lyon & Maxwell, 2008; Reinhardt & Stavins, 2010). Studies on two of Canada's

voluntary programs, the National Pollutant Release Inventory and the GHG Voluntary Challenge and Registry, found that the impact of voluntary action was not significant in either case (Harrison & Antweiler, 2003; Takahashi, Nakamura, van Kooten, & Vertinsky, 2001). These studies add to mounting evidence that voluntary actions alone are not sufficient to significantly improve industrial environmental performance (Doonan et al., 2005; Lyon & Maxwell, 2008; Nakamura et al., 2001; OECD, 2003; Press, 2007; Sullivan, 2010).

2.2. Government Approach to Corporate Action on Climate Change

Pressure from the public and shareholders for corporations to reduce GHG emissions does not appear adequate to overcome the market failure of climate change. Government policy can play a role by either instituting a cost for emissions, or regulating companies to ensure reductions. A number of policy instruments have been proposed to help encourage emission reductions in order to meet national and provincial targets. One instrument already employed by the federal and BC government is reporting requirement, which generate a potential cost to firms through public exposure of their emission levels. Carbon pricing measures induce an actual cost for industrial GHG emissions. One method, a carbon tax, has been implemented in BC. Another form of carbon pricing is a cap and trade system. The other major policy approach to reduce emissions, contemplated at the federal level, is government regulation of industrial emissions.

2.2.1. Required Facility Reporting

Mandatory disclosure of facility emissions has several benefits as a policy approach. In some cases, mandatory disclosure programs have been shown to encourage improvements in environmental performance. Such programs also satisfy public demand for information on industrial pollution, and prove more feasible politically and economically than the enforcement of strict regulations (Cohen & Santhakumar, 2007). However, corporate responsiveness to disclosure programs is mixed, and the literature generally finds that standards or regulations are significantly more effective

when it comes to improving environmental performance (Reinhardt & Stavins, 2010; Lyon & Maxwell, 2008; Melkonyan, 2008). While mandatory GHG reporting enables all audiences to identify changes in facility performance, taking action to decrease emissions remains the prerogative of the firms that operate them.

Both the federal and BC governments have begun systematically collecting data on industrial emissions. Since 2004, facilities in Canada that emit more than 100 kilotonnes (kt or thousand tonnes) of CO_2e annually have been obliged to report their emissions to Environment Canada. (Starting in 2009, the threshold has been decreased to 50 kt.) The Greenhouse Gas Emissions Reporting Program (GHGRP) serves federal purposes in that it validates estimates used in national inventories and modelling and also informs regulation development. Facility emission data are made publically available for provincial requirements and public information as well, streamlining reporting for governments and industry (Environment Canada, 2010a). In BC, the Reporting Regulations under the Greenhouse Gas Reduction (Cap and Trade) Act began in 2010 and includes facilities with 10,000 kt of CO_2e or more annually. Similar to the GHGRP, its purpose is to validate inventories and contribute to policy development, implementation and evaluation (BC Ministry of Environment, n.d.).

2.2.2. Carbon Pricing

Carbon pricing is a market approach to deal with the externality of GHG emissions. Policy instruments impose a cost on companies for their emissions. Carbon pricing provides incentives to reduce emissions with flexibility and efficiency. Companies are able to choose how to alter their operations to balance the costs of reducing emissions with the price of carbon imposed through a tax or carbon market. The outcome will be cost effective in that it achieves emission reductions at the lowest cost to companies (British Columbia, 2008; Rivers & Jaccard, 2010; Sterner & Coria, 2012).

Under a carbon tax, the government sets the tax rate levied per tonne of GHG emissions and leaves it to companies and consumers to react to the increased cost of fossil fuel combustion. The tax needs to be set high enough to encourage behavioural or operational changes that reduce overall emissions. In a cap and trade system, the government sets a limit on the total allowable amount of emissions and companies that

emit GHGs must hold a permit for those emissions. Companies obtain these permits (known as 'allowances') either from endowments made by government or purchase them in a market that develops for their exchange.

BC's carbon tax was implemented in order to send a price signal intended to encourage emission reductions to meet legislated targets (British Columbia, 2008). The tax was enacted with the Carbon Tax Act and put into effect July 1, 2008. As of July 1, 2011, the tax rate was set at $25 per tonne of CO_2e, and will increase to $30 per tonne in 2012 (BC Ministry of Finance, n.d.). No further increases have been specified.

Conclusive economic analysis on the impact of BC's tax has not been possible as the time elapsed and data available since implementation is not yet sufficient. Models that simulate the impact of differing levels of carbon taxes can predict the impact on industries and also the level of the tax needed to reach targeted emission reductions. Analysis conducted by M.K. Jaccard and Associates Inc. for the Pembina Institute and the David Suzuki Foundation found that a carbon price of $40 per tonne of CO_2e in 2011 that rises to $100 per tonne by 2020 would be necessary to meet the federal emissions target (Pembina, 2009).[3] Using a similar model, NRTEE also reports that a national carbon price of $100 per tonne is necessary by 2020 based on modelling results, and goes further to suggest that carbon will need to be priced upwards of $300 per tonne by 2050 to achieve deep reductions (2009).[4] These findings suggest that the current BC carbon tax may not be high enough to change behaviours and operations to the extent necessary to realize the necessary GHG emission reductions.

BC's carbon tax applies to industrial emissions that are generated from stationary combustion of fossil fuel in manufacturing. It does not cover the 15% of industrial

[3] This analysis was conducted using the previous federal commitment of 20% below 2006 GHG emissions levels by 2020, equivalent to 575.2 Mt. (The current target is 17% below 2005 level by 2020, or 606.7 Mt.) The Pembina report also determined a carbon price for Canada's contribution to not exceeding 2°C of average global warming (or 25% below 1990 emissions level by 2020): $50 per tonne in 2010 and needs to rise to $200 per tonne by 2020.

[4] NRTEE's modelling also used the previous target, as well as a target suggested by the federal government in 2007 for mid-century: GHG emissions 65% below 2006 levels by 2050.

emissions that result directly from industrial processes, such as in the production of cement and aluminum[5]. The Greenhouse Gas Reduction (Cap and Trade) Act was passed in 2008 to enable the regulation of industrial GHG emissions output, which would include emissions from sources other than fossil fuel combustion. This Act allows the government to establish a market-based emissions trading system. Similar to a carbon tax, a cap and trade system establishes a price for carbon. However, rather than setting a rate for the cost per tonne of CO_2e, the government establishes the amount of emissions that are allowable for the entire economy, and then lets the market to determine the price for carbon emissions. While a cap and trade system can be more complex to set up than a carbon tax, it ensures that absolute emission targets are met and enables the market to determine the most economically efficient reductions to meet the targets (BC, 2008).

There is a general consensus that market-driven mechanisms, cap and trade systems and carbon taxation in particular, represent the most efficient tools for emissions reductions (NRTEE, 2009; Pembina, 2009; Press, 2007). These policy instruments provide flexibility in that they enable firms to determine how best to reduce industrial emissions in the most cost effective manner. The context, design and implementation of market-based climate policy, however, have a large impact on economic outcomes and need to be carefully assessed to produce optimal results.

2.2.3. Command-and-Control Regulation

Regulations are the traditional policy approach to industrial pollution and have been highly successful in reductions of many substances previously released into air, water, and soil (Harrison & Antweiler, 2003). Command-and-control regulations, though criticised for stifling technological innovation and insufficient economic incentives, continue to have positive outcomes on environmental performance. Econometric studies

[5] As the carbon tax is applied to fossil fuels, it can only impact those emissions that result from fossil fuel inputs that are combusted for energy in industrial operations. It does not encompass emission outputs that are specific to industrial processes themselves.

of environmental and economic performance measures tend to find that more stringent regulations produce greater reductions in pollution, but also reduce the competitiveness of firms (Press, 2007).

Similar to carbon pricing, the focus and design of a regulatory policy has a significant impact on its effectiveness in meeting targets. While some regulations focus on inputs, such as the technology requirements, others focus on outputs or performance. A performance standard can be more flexible than other regulatory approaches, as it allows the firm to determine its preferred technology and course of action necessary to meet a specified target (Hueth & Melkonyan, 2008).

In 2008 the federal government released a report, *Turning the Corner,* that described an intensity-based regulatory framework for Canada. The plan called for existing facilities to improve emissions-intensity level by 18% from 2006 levels by 2010, with 2% improvements each following year (Government of Canada, 2008). Though the plan has not been implemented, the federal government has indicated that some kind of regulatory program is pending with "regulated GHG performance standards being developed for the remaining major sources of emissions with priority on the oil and gas sector and emissions-intensive trade exposed sectors" (Government of Canada, 2011, p. 12). One major criticism of the emission-intensity regulatory approach is that it can still allow for growth in the total amount of GHG emissions as output increases (Rivers and Jaccard, 2010). Proposed intensity regulations do not set a limit for industrial emitters, therefore even as they decrease the amount of GHG emissions per unit of output, such reductions can be offset by a high enough increase in output overall.

2.3. Industrial Emissions in the BC Context

BC has many advantages that aid in the transition to a low carbon economy. The province's substantial hydro-electricity resources as well as its large proportion of jobs based in the service sector (which tend to be less emissions-intensive) keep BC's total emissions low compared to other provinces. While manufacturing is the second largest employer in the goods sector, it represents only 7% of workers in BC. The oil and gas sector accounts for only 1% of BC employment (BC Stats, 2011c). And yet GHG

emissions produced by these sectors make up almost 40% of BC's annual emissions. BC is a jurisdiction of particular interest for the study of industrial emissions policies and performance due to its current climate action commitments. The implementation of a carbon tax in BC, as well as its sizeable legislated emissions target, creates a valuable opportunity to analyze corporate climate change practices and response.

2.3.1. BC's Industrial Emission Performance

There have been only minor fluctuations in the amount and share of industrial emissions in BC's GHG inventory in the last several years, despite the recession and other effects. Industrial emissions were only reduced by 2% from 2007 and 2009, despite economic decline in most sectors. The use of fossil fuels in sectors such as manufacturing, oil and gas, and mining contributes most of the GHGs from industry. Of the 24.8 Mt of CO_2e from industrial sources in 2009, 59% resulted from stationary combustion. Additionally, pipelines and fugitive sources contributed 26%, and the remaining 15% came from industrial processes (BC Ministry of Environment, 2011).

The realization of BC's climate target – to reduce of total provincial GHG emission by 33% below 2007 levels by 2020 – will require cooperation from industry. Emissions from industrial sources make up over a third of BC's GHG total; therefore ensuring that climate policy encourages industry to reduce its emissions is essential to meet BC's legislated target by 2020.

Strong government policy is needed to motivate corporations to make the necessary investments to reduce emissions in their operations (Hueth & Melkonyan, 2008; Lyon & Maxwell, 2008; Reinhardt & Stavins, 2010). Improvements in industrial energy emissions require action such as fuel switching to renewable sources and upgrading operations for improved energy efficiency. Improvements for industrial process and solvent emissions require firms to invest in new, advanced technologies with lesser GHG outputs.

2.3.2. High Intensity GHG Emitters in the BC Economy

BC has thirty-eight facilities that emit over 100 kt of CO_2e annually, which make up only 5.0% of the emissions from high-intensity facilities nationally in 2009

(Environment Canada, 2010a). For BC, however, these high-intensity emitters represent 16.6% of overall emissions, and are indicative of the total industrial sector that accounts for more than one-third of BC's emissions. In 2009, these facilities contributed a total of 11.8 Mt of CO_2e, most of which came from resource extraction. Figure 1 breaks down emission-intensive facility GHGs by sector.

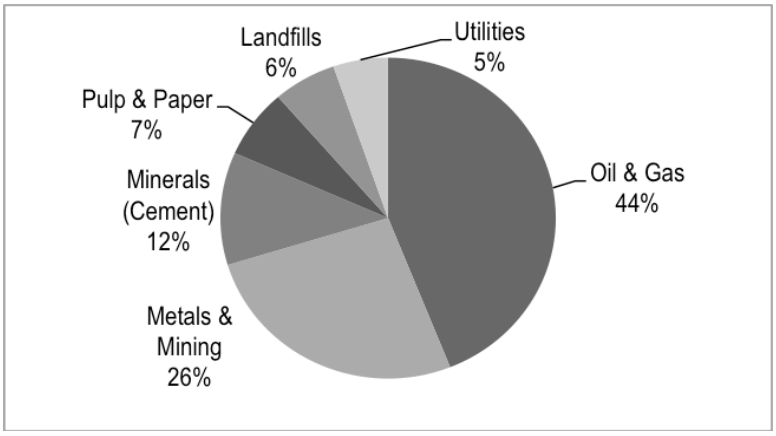

Figure 1. Facility (over 100 kt) GHG emission by sector

This study will focus on the companies that operate GHG intensive facilities to investigate how emissions reductions have been impacted by voluntary measures, climate policy and production decline with the recession. Analysis of the performance of emission-intensive facilities in regard to GHG reductions is important for meeting BC 2020 target and the mitigation of climate change in general.

3. Methodology

This study first surveys the current trends in industrial emission in BC to examine how the most emission-intensive facilities have performed – in terms of emission reductions – from 2004 to 2010. The trends for each sector as well as overall findings highlight how important it will be to have increased policy intervention to sustain reductions in industrial emissions for the near future. Secondly, an assessment of corporate approaches to climate change is conducted to determine which companies and/or sectors have taken the most significant action to reduce emissions. Finally, these two sets of findings are compared to determine whether the quality of the corporate response to climate change correlates with actual facility performance. The comparison provides insight as to what policy interventions could be most effective to support further industrial emission reductions.

3.1. Approach

This study analyzes and compares GHG outputs from BC's highest industrial emitters alongside the climate change policies of the companies who operate them. The approach utilizes an assessment framework from a 2007 project carried out by Insight Investments, one of the largest asset management companies in the UK. The framework was obtained from R. Sullivan's 2010 article, *An assessment of the climate change policies and performance of large European companies*. The aim of Insight Investment's project was to "develop a systematic understanding of how large companies are managing their GHG emissions, as a subset of their broader approach to managing the risks and opportunities presented by climate change" (Sullivan, 2010, p. 41).

The approach of this study adds value in that it evaluates the quality of corporate action on climate change in comparison to actual GHG emission performance in a particular jurisdiction. It provides an alternate analysis in comparison to the work of the

Carbon Disclosure Project, which measures the quality of information companies disclosed in regards to climate change. It also differs from the original study by Insight Investments, which compared to corporate action to company targets. Additionally, this study considers the implications for meeting provincial GHG targets based on the current action taken by corporations, and suggest government policy options to further industrial emission reductions.

3.2. Selection of Companies

Companies assessed in this study operate some of the most emission-intensive facilities in BC. Facilities that produce more than 100 kt of GHG emissions are required to submit annual emission data to the federal government. In BC, there are twenty-six facilities that have near-complete data for the six years of GHGRP records available (from 2004 to 2009), with 2010 data provided by BC's facility inventory. These facilities are owned by fifteen different companies, as listed in Table 1, from multinational corporations to local businesses. (See Appendix A for further details on each of the companies.)

Table 1. Companies by sector

Sector	**Companies (# of facilities**)
Pulp and Paper	Canfor Pulp (2); Catalyst (1); Domtar (1); West Fraser (1)
Oil and Gas	Chevron (1); Husky (1); Penn West (1); Spectra (5); TransCanada (1)
Minerals (Cement)	Graymont (1); Heidelberg (1); Lafarge (2)
Metals and Mining	Rio Tinto Alcan (1); Teck (5)
Utilities	BC Hydro (2)

The facilities in the census account for over 9.2 Mt of GHG in 2009, or 13.8% of BC's total emissions. In that same year (2009), GHG by sectors for these facilities breaks down as follows: pulp and paper – 0.6 Mt; oil and gas – 4.4 Mt; minerals (cement) – 1.3 Mt; mining and metal manufacturing – 2.7 Mt; and utilities – 0.2 Mt.

3.3. Assessment Framework

The framework addressed seven areas of company performance pertaining to climate change (Table 2). These areas provide a comprehensive look at measures a company has taken to address climate change, in particularly GHG emission reductions. As in the original survey conducted by Insight Investments, companies were rated according to best practices in each area to determine the level of importance climate change holds in each organization.

Table 2. Assessment framework from Insight Investment

Policy	• Has the company a clear policy statement on climate change? • What is the scope and content of the policy? • Does the policy state that the company sees climate change as a key business concern? • Does the policy include a commitment to emission reductions?
Governance	• Has the company assigned board or senior executive responsibility for climate change-related issues?
Risk assessment	• Has the company conducted a detailed analysis of climate change risks and opportunities for the business? • Is the company aware of the financial and strategic significance of climate change for its business?
Inventory	• What is the quality of the GHG emissions data provided by the company? • Are the data sufficiently robust to allow investors to properly assess the financial implications of these emissions for the business?
Targets	• What target(s) have been set by the company? • What proportion of the company's total emissions is covered by the target? • Are the target(s) expressed in relative or absolute terms? • How far forward are the target(s) set?
Implementation	• Has the company explained how it proposes to reduce its GHG emissions? • Has it provided information on the expected emissions reductions and costs associated with these actions?
Leadership	• Has the company participated in any climate change leadership initiatives?

(Sullivan, 2010, p. 41-42)

3.4. Data Sources

Two key types of data were used to evaluate companies for this study: facility GHG emissions from the GHGRP and BC Climate Secretariat, and online company reports and information. All data obtained for analysis was collected from public documents and sources. Analysis of corporate policy is based on my own interpretations

of public material. It is acknowledged that there may be information that was missed or misinterpreted due to this data collection approach.

3.4.1. Facility GHGRP Data

Data collected for facilities that emit over 100 kt of CO_2e annually are available for 2004 to 2010 from federal and provincial reporting programs. For the twenty-six BC facilities reviewed in this study, there are only three occasions of missing data (presumably because these facilities dropped below the threshold of 100 kt for a year). While the performance of specific facilities in one jurisdiction (BC) may not fully reflect actions taken by a company in their operations overall (particularly for the multinational corporations in the sample), BC facility GHG data is a useful indicator to measure performance relative to a company's stated commitments to climate change mitigation.

3.4.2. Company Reports and Policies

There are limitations to the amount and quality of policy and performance information posted on a company website. However, the current emphasis on disclosure from the public, investors, government and non-governmental organizations puts the onus on companies to be forthcoming on their climate change strategies. Most companies in the sample have produced annual sustainability reports since the mid-2000s. Information was also drawn from annual report, annual information forms, investor information and websites, as well as initiatives that companies subscribe to such as the Carbon Disclosure Project.

4. Facility GHG Emissions in BC

Corporate climate change policies need to result in a reduction of industrial emissions if BC is to meet its targets. Analysis focuses primarily from 2007 onward; the rationale being that 2007 is the baseline year for legislated provincial emissions targets. The performance of emission-intensive facilities in BC over this short time period provide an initial look at the effects climate policies may be having on emissions, recognizing other economic factors also play a role.

Looking at the entire period from 2004 to 2010, twelve of the companies in the sample achieved reductions greater than 10% over the six year period, and only two company's reported an increase in emissions by more than 10% (Husky and Domtar, though 2010 GHG data for the latter is questionable – to be covered in section 4.2.1). I searched for data on output by facility to examine emissions intensity as well as emission levels, but was only able to obtain information for several pulp and paper mills as well as both oil refineries (to be examined in Sections 6.1.1 and 6.1.2). While data connected to production and other impacts were not available for most facilities, it appears that companies have been able to reduce emissions since mandatory reporting has been introduced.

4.1. Trends in BC Facility Emissions

Table 3 presents the data on emissions of BC facilities for select years from 2004 to 2010. (Annual emissions for each year are available in Appendix D.) Eleven of the fifteen companies have been successful in making substantial GHG emissions reductions from 2007 to 2010 (with a reduction of 10% or more). Only two companies had substantial increases (greater than 10%), and two companies have not made notable gains or losses in emissions output over this period.

Table 3. GHG emissions and change by company for BC facilities, select years

Company (# of facilities)	**2004**	**2007**	**2010**	**Emissions Change 2004-2007**	**Emissions Change 2007-2010**
Lafarge (2)	1,033	1,156	640	11.9%	-44.7%
Graymont (1)	139	196	122	40.5%	-37.9%
Penn West (1)	240	142	99	-40.8%	-30.8%
Heidelberg (1)	1,034	1,047	727	1.2%	-30.5%
Teck (5)	1,580	1,682	1,288	6.5%	-23.5%
West Fraser (1)	120	104	81	-13.6%	-22.0%
TransCanada (1)	254	312	246	22.7%	-21.1%
Rio Tinto (1)	1,472	1,137	924	-22.7%	-18.8%
Chevron (1)	456	476	408	4.3%	-14.2%
BC Hydro (2)	400	232	202	-42.1%	-12.8%
Catalyst (1)	155	149	132	-3.8%	-11.4%
Canfor Pulp (2)	168*	249	233	-12.7%	-6.1%
Husky Energy (1)	101	120	128	18.9%	6.7%
Spectra Energy (5)	4,534	3,133	3,473	-30.9%	10.9%
Domtar (1)	103	112	204	8.1%	82.6%

Overall, most companies have shown significant emission reductions in recent years. Emission reductions can result from factors that are not part of climate change policy, particularly drops in production. The recent economic recession and other market influences are important to consider in analysis of facility emission data. The comparison of emissions reduction changes from 2004 to 2007 and 2007 to 2010 highlight some performance differences. A few facilities have slowed in their pace of improvement. This result can occur when firms have already employed strategies that were most cost-effective to reduce their emissions, and further reductions that will require more substantial changes at a greater cost to the company are not taken up as quickly, or until a higher price of carbon makes the rate of return on emission-reducing investments positive. For these companies, the marginal abatement cost is currently too high to proceed with further projects to reduce GHG emissions.

4.2. Emissions by Sector

Analyses of particular sectors provide some insight as to the opportunities and challenges faced in different industries. This can also hold constant some of the impacts accounted for by the recession, as companies in the same sector are expected to be impacted somewhat equally. Emissions reduction leaders in each sector can point to some of the opportunities that might be applied to others, or at least identify what is possible in terms of reduction outcomes. Two specific sectors have made production values available, and allow for investigation of emission intensity rates in these cases.

4.2.1. Pulp and Paper

The pulp and paper sector has put a great deal of effort into reducing emissions over the past couple of decades. Since 1990, there has been a concerted effort to reduce emission intensity in the sector. For example, Canfor reports a 46% reduction in GHG emissions across its mills in BC since 1990. Catalyst has gone even further with an 85% reduction in emissions from their BC operations since 1990. One innovation that contributed to such Improvements is on-site cogeneration projects that enable facilities to meet more than one-third of electricity needs (BC, 2008).

Production data was obtained for three of four pulp and paper companies through their annual information forms. Decreases in production explain some of the reduction in emissions. The global economic recession has meant lower prices and diminished demand for BC's pulp and paper industry (BC Stats, 2009). There have been several closures and mills operated at less than capacity in recent years. From 2007 to 2010, BC's pulp and paper sector overall experienced a 23.4% decline in GDP (BC Stats, 2011b).

Table 4. BC pulp and paper mill emissions, production and intensities, 2007 to 2010

Company	**Outputs**	**2007**	**2008**	**2009**	**2010**	**% Change** 2007-2010
Canfor Pulp (2)	Emissions (kt CO_2e)	249	243	256	233	-6.1%
	Production (kt pulp or paper)	869	794	828	860	-1.1%
	Intensity (t CO_2e/ t product)	0.29	0.31	0.31	0.27	-5.1%
Catalyst (1)	Emissions (kt CO_2e)	149	162	112	132	-11.4%
	Production (kt pulp or paper)	705	669	446	562	-20.3%
	Intensity (t CO_2e/ t product)	0.21	0.24	0.25	0.24	11.1%
West Fraser (1)	Emissions (kt CO_2e)	104	103	90	81	-22.1%
	Production (kt pulp or paper)	328	316	324	342	4.3%
	Intensity (t CO_2e/ t product)	0.32	0.32	0.28	0.24	-25.2%
Domtar[a] (1)	Emissions (kt CO_2e)	112	108	110	204	82.6 %

(#) Number of facilities that emit over 100 kt of CO_2e

[a] Domtar does not provide exact production amounts, therefore emission intensity cannot be calculated for its mill.

From 2007 to 2010, Table 4 shows that not all of the companies have seen reductions in their intensities. The downturn makes it a difficult time for companies to invest in innovations to improve environmental performance when economic performance is at stake. Funding made available from the federal government to upgrade pulp and paper operations for environmental benefit has stimulated some projects. Most of the companies with plans to invest in additional technology have drawn support from the Pulp and Paper Green Transformations Program (PPGTP), which provides subsidies for projects that will advance emission reductions. However, the impacts of these investments will not be appreciated for several years.

Emission intensity rates indicate that of the group, two companies have successfully reduced the amount of GHG emissions per tonne of pulp or paper produced. Catalyst has seen a notable rise in its intensity rate, while their mill has cut back production quite starkly in the past three years. It is possible that emissions intensities become distorted when a mill operates far below capacity. By comparison, other mills have seen little change in production while Catalyst's production dropped more than 20% over this period. (While Canfor and West Fraser operated mills at 90% of capacity or more throughout 2007-2010, Catalyst dropped from 88% of capacity in 2007

to 55% in 2009, then rose again to 75% of capacity in 2010.) Domtar's 2010 GHG data are extremely inconsistent (particularly CH_4 and N_2O amounts), therefore it will be included in overall amounts but not considered for specific analysis on its own.

4.2.2. Oil and Gas

There is little consistency across emission history of the energy companies included in the survey. This could be for a number of reasons, including changes in collection methodology, reductions or increases in production, or relate to the diverse nature of the companies represented (from an oil refinery to natural gas pipeline systems). Of all the sectors, the oil and gas sector – in general – presented the most difficulty for obtaining detailed information on individual operations. However, there were production amounts available from the two companies that operate oil refineries in the province.

Table 5. BC oil refinery emissions, production and intensities, 2007 to 2010

Company	**Outputs**	**2007**	**2008**	**2009**	**2010**	**% Change** 2007-2010
Chevron (1)	Emissions (kt CO_2e)	476	341	466	408	-14.2%
	Production (thousands of barrels)	17,885	13,140	17,885	14,600	-18.4%
	Intensity (t CO_2e/thousand barrels)	26.6	25.9	26.1	28.0	5.1%
Husky (1)	Emissions (kt CO_2e)	120	128	133	128	6.7%
	Production (thousands of barrels)	3,833	3,687	3,760	3,650	-4.8%
	Intensity (t CO_2e/thousand barrels)	31.3	34.8	35.3	35.1[6]	12.1%

Chevron has not publicized any measures to improve GHG emissions from its Burnaby refinery, although investments have been made to improve other environmental aspects including sulphur emissions (Environment Canada, 2010b). Emission intensity

[6] Although Husky has realized emission reductions from 2007 to 2010, consider the situation if it had the same production level as 2007 at its 2010 intensity level = 135 kt of emissions. This would have instead resulted in a 12.5% increase in emissions output from 2007 to 2010. Though counterfactual, this exercies identifies that even returns to recent production levels could have implications for industrial emissions, potentially causing them to rise.

measures from 2007 to 2010 do not suggest any efforts from either company to reduce emissions, as both have experienced a rise in their emission intensity rates (Table 5).

Table 6. Other BC oil and gas sector facility emissions, 2007 to 2010

Company	# of facilities	Emissions (kt of CO_2e)				Emissions change 2007-2010
		2007	2008	2009	2010	
Penn West Petroleum	1	142	151	118	99	-30.8%
Spectra Energy Corp	5	3,133	3,729	3,457	3,473	10.9%
TransCanada	1	312	224	231	246	-21.1%

Public records from Penn West as well TransCanada did not provide any indication of actions that might have contributed to significant reduction in GHG emissions, as shown in Table 6. Spectra Energy likewise does not provide information that links to increases in emissions from its two gas plants and power generation facility. It seems likely this outcome links to production increases, as natural gas exports from BC rose from 2008 to 2010 despite a decline in the market price (BC Stats, 2011a). In terms of GDP, oil and gas extraction experienced only a minor drop (-3.3%) from 2007 to 2010 (BC Stats, 2011b).

4.2.3. Minerals (Cement)

Table 7 illustrates that emission reductions have been realized by all three mineral companies in the study, which includes plants that produce both lime and clinker (used in cement). One reason would likely be reductions in demand during the recent economic slowdown. Mineral product manufacturing in BC saw a 41.7% decline in GDP from 2007 to 2010 (BC Stats, 2011b).

Table 7. BC Mineral (cement) sector facility emissions, 2007 to 2010

Company	# of facilities	Emissions (kt of CO_2e)				Emissions change 2007-2010
		2007	2008	2009	2010	
Graymont Limited	1	196	117	124	122	-37.9%
Heidelberg Cement	1	1,156	1,052	594	640	-44.7%
Lafarge	2	1,047	963	591	727	-30.5%

Innovations that reportedly contributed to emission reductions have been identified by the cement industry. Lafarge's Richmond Plant has begun the use of biomass fuel made up of wood waste from construction and demolitions and small quantities of non-recyclable plastics. The resultant GHG reductions have been qualified as offsets by a third party auditor and purchased by Pacific Carbon Trust (Concrete Association of Canada, 2010).

4.2.4. Metals and Mining

Rio Tinto Alcan operates an aluminum smelting plant in Kitimat that has reduced emissions by nearly 19% from 2007, as indicated in Table 8. The plant has a plan to modernize operations that should reduce emissions up to 50 per cent annually. The modernization project was delayed when the recession hit in 2008, but started to move forward again in 2011 (Rio Tinto Alcan, 2011). From 2007 to 2010, primary metal manufacturing in BC experienced a decline of 18.9% in GDP (BC Stats, 2011b).

Table 8. BC metals and mining facility emissions, 2007 to 2010

Company	**# of facilities**	**Emissions** (kt of CO_2e)				**Emissions change** 2007-2010
		2007	**2008**	**2009**	**2010**	
Rio Tinto	1	1,137	1,205	1,196	924	-18.8%
Teck Resources	5	1,682	1,647	1,493	1,288	-23.5%

Teck Resources reports emissions from several coal operations as well as metallurgical operations that produce lead and zinc. While Teck Resources intends to improve energy efficiency to bring down emissions in the future, reductions demonstrated in Table 8 over the 2007 to 2010 period do not seem to be associated with successful efforts to reduce GHG emissions. Teck is the only company that publishes GHG intensity rates for each of its operations, which show minimal gains and some deterioration from 2007 to 2010. Unfortunately there is no production data for similar operations to compare intensity rates. Mining is one of the few sectors in BC that saw an increase (16.3%) in GDP from 2007 to 2010 (BC Stats, 2011b).

4.2.5. Utilities

As a crown corporation, BC Hydro has taken measures to decrease GHG emissions as required by the Carbon Neutral Government Regulation (enacted December 2008). Through a combination of emission reduction efforts and offsets, BC Hydro achieved carbon neutrality for the 2010 fiscal year. However, the scope of the carbon neutral program only includes emissions from the vehicle fleet, buildings (heating, cooling and lighting) and paper consumption (BC Hydro, 2011a).

Table 9. BC utilities sector facility emissions, 2007 to 2010

Company	# of facilities	Emissions (kt of CO_2e)				Emissions change 2007-2010
		2007	2008	2009	2010	
BC Hydro	2	232	335	299	202	-12.8%

Table 9 shows the two emission-intensive operations owned by BC Hydro did realize reductions in 2010 compared to 2007. The Fort Nelson Generating Station has undergone a recent upgrade project that increases capacity while it reduces the amount of GHG emissions per megawatt by 15 to 20% (BC Hydro, 2011b). The Burrard Generating Station, a backup resource dependent on natural gas, is being phased out of operation as part of a greenhouse gas reduction strategy (BC Hydro, 2011a). From 2007 to 2010 the entire BC utilities sector experienced a 9.9% drop in GDP (BC Stats, 2011b).

4.3. Overall Company Performance of BC's High Emitters

While the sector breakdowns provide an incomplete picture due to limited years of data available, confounding impact of the recession and incomplete production information, they seem to point to a positive trend in GHG emission reductions. It is promising that nine companies (60%, with representation from all sectors) have seen reductions from 2009 to 2010 alongside economic growth in manufacturing (3.9%) as well as oil and gas (7.0%) (BC Stats, 2011d). All but two of BC's highest emitting facilities have decreased absolute GHG emissions since 2004, and many (80%) have seen decreases from 2007 to 2010 as well. Overall, BC's highest emitting facilities have reduced absolute emissions by nearly 13% from 2007 to 2010.

In 2010, however, BC was still 17% below the level of economic activity in manufacturing in 2007 (BC Stats, 2011b). In fact, a comparison of economic declines to emission reductions from 2007 to 2010 in almost all sectors indicates that drops in GDP were much more dramatic than emission reduction rates. This raises the concern that GHG mitigation achievements might be undermined were economic activity to return to (or rise above) 2007 levels, to be explored in more depth in Section 6.4.

5. Assessment Results

The assessment provides a comparative overview of the extent of corporate responses to climate change from BC's highest industrial emitters. Companies were judged against each other in terms of best practices for each aspect of the assessment, and also assigned an overall corporate climate change policy rating. For a summary and scoring information, see Appendix B; for assessment details by firm, see Appendix G.

5.1. Corporate Policies

Few companies in the sample have policies that focus explicitly on climate change. Most address climate change under a broad environmental policy or sustainable growth strategy. Figure 2 shows how many companies in the study cover key aspects of climate change response in their environmental policies.

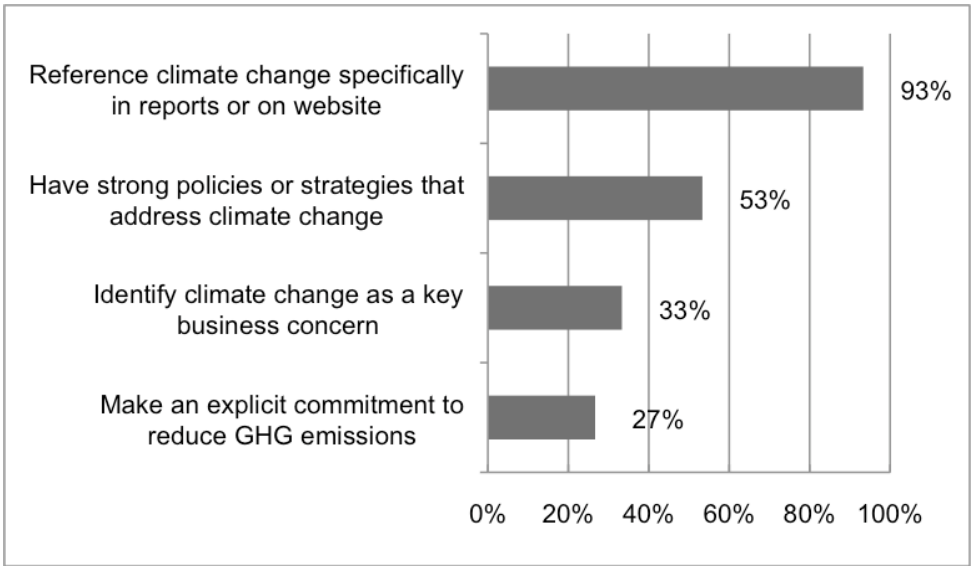

Figure 2. Content of corporate climate change policies

Climate change policies and strategies rated as high include at least three of four key elements: 1) an intent to reduce impacts, 2) references to targets and goals, 3) commitment to transparency and monitoring, and 4) accompanied by action plans or other approaches to meet emissions reduction goals. Just over half of the companies (eight of fifteen) cover all of these aspects in their policies and strategies. Others make only the lowest-level commitment to meet or exceed laws, regulations and standards pertaining to the environment. Table 10 provides some examples for each level of policy quality from the companies in the study.

Table 10. Policy examples with ratings

HIGH	MEDIUM	LOW
"Catalyst commits to: Meet the requirements of relevant environmental legislation and other voluntary programs; Be fully transparent in publicly disclosing our environmental performance; Reduce pollution at its source; Set objectives and targets to support continual improvement of our environmental performance."	"[Our] GHG strategy includes improving the energy efficiency of existing operations, providing customers with environmentally responsible fuels and identifying, developing and adopting new technologies."	"The Company's continuing policy is to meet or exceed all provincial and federal laws, regulations and standards pertaining to the environment."
Catalyst (n.d., p. 1)	Husky (n.d., p. 1)	Penn West (n.d., p. 1)

Table 10 highlights Catalyst as an example of a high-quality environmental policy in that it pledges reductions, sets objectives and targets for continual improvement, and references transparency. Catalyst also has several other approaches for GHG reductions that accompany this policy. Policies ranked as medium tend to be less specific in reduction commitments and often focus on energy efficiency, as Husky's policy exemplifies. Penn West's policy is representative of low-quality climate change responses in that it makes no environmental commitment beyond government regulations. Table 11 below identifies how each company rated on climate policy.

Table 11. Corporate policy rankings[a]

	Policy & approach	Key business concern	Reduction commitment
Canfor	High	Yes	Yes
Catalyst	High	Yes	Yes
Domtar	High	Yes	Partial
West Fraser	High	Partial	Partial
Chevron	Medium	No	Partial
Husky	Medium	No	No
Penn West	Low	No	No
Spectra	Low	No	No
TransCan	Low	No	No
Graymont	Low	Partial	Partial
Heidelberg	Medium	Partial	Partial
Lafarge	High	Yes	Yes
Rio Tinto	High	Yes	Yes
Teck	High	Partial	Partial
BC Hydro	High	Yes	Yes

[a] See Appendix G for scoring rationale for each company.

Only 40% of companies regard climate change as a key business concern, with sustainability or environmental conduct among the business principles or priorities for their company, identified in Table 11. Four companies receive partial scores as environmental concern is referenced in combination with economic performance, where the latter appears to take precedence. Some of these companies connect the need to satisfy communities and customers with their environmental performance to their long-term economic success.

Table 11 shows that one-third of the companies in the census make strong commitments to GHG emissions reductions. Instead of commitments, the majority of companies specify that they strive for or work towards reductions. Best practices are exemplified by a few companies that provide concrete, action-oriented statements of long-term commitment to climate change mitigation.

5.2. Governance and Management

Most companies have taken some measures to manage the environmental impact of their operations. Companies cite concern for future government climate policy, regulation and resultant cost, as well as sustainability and access to necessary resources as motivating factors. Table 12 indicates that eleven of the fifteen companies in the sample have executive members assigned to environmental and/or sustainability affairs. Twelve of the companies (80%) have a board committee responsible for environmental oversight.

Table 12. Governance and management rankings[a]

	Executive	Board committee	Risk identified	GHG history
Canfor	Yes	No	No	Long
Catalyst	Yes	Yes	No	Long
Domtar	Yes	Yes	No	Medium
West Fraser	No	Yes	No	Medium
Chevron	Yes	Yes	No	Medium
Husky	Yes	Yes	No	Short
Penn West	No	Yes	No	Long
Spectra	Yes	No	No	Short
TransCan	No	Yes	Partial	Medium
Graymont	Yes	Yes	No	Medium
Heidelberg	Yes	No	No	Medium
Lafarge	Yes	Yes	Yes	Medium
Rio Tinto	No	Yes	Yes	Long
Teck	Yes	Yes	No	Long
BC Hydro	Yes	Yes	Yes	Long

[a] See Appendix G for scoring rationale for each company.

Risk assessment of climate change is an area of weakness in the published documents for the companies in the survey, as Table 12 shows. Most companies identify regulatory risks associated with future government policy on emissions. Only a few

(20%) also identify the financial and strategic risks that climate change may cause their business in the future, in terms of vulnerabilities in operations and other climate hazards.

Emissions inventories are another important aspect of corporate climate change management. Table 12 indicates the six companies (40%) that present GHG emissions data back to the 1990s, while the rest have started in the past decade. All but four companies confirm that their GHG emissions calculations meet international reporting standards and sector protocols.

5.3. Targets and Implementation

Table 13 below highlights that not quite half (seven of fifteen) of the companies reviewed have published GHG emissions targets. Four have set absolute targets (a reduction in total emissions) while three have set relative targets (a reduction of emissions per unit of production). Five companies (one-third) have set GHG emissions targets since the early 2000s. Two companies are in the process of establishing targets, and six companies make no reference to GHG targets in their public documents.

Table 13. Targets and implementation rankings[a]

	Recent GHG target	Absolute/ relative	Reduction plan
Canfor	In process	Relative	Partial
Catalyst	Yes	Absolute	Yes
Domtar	In process	n.d.a.	Partial
West Fraser	No	n/a	Partial
Chevron	Yes	Absolute	Partial
Husky	No	n/a	Partial
Penn West	No	n/a	Partial
Spectra	No	n/a	No
TransCan	No	n/a	Partial
Graymont	No	n/a	Partial
Heidelberg	Yes	Relative	Yes
Lafarge	Yes	Relative	Yes
Rio Tinto	Yes	Relative	Yes
Teck	Yes	Absolute	Partial
BC Hydro	Yes	Absolute	Yes

[a] See Appendix G for scoring rationale for each company.

Implementation plans to reduce emissions are presented by all but one of the companies – including the five companies that have not set emissions targets – as Table 13 indicates. Most received only partial scores for their plans as they only identify a project or two to improve efficiencies or take other minor cost-effective action to reduce emissions. The publication of such projects indicates that companies are aware there is an audience that looks for them to take GHG reduction measures, but most action is limited. One-third of the companies have abatement plans that earn full credits as they provide a cohesive strategy to make significant reductions across their operations, and include monitoring systems and research in innovation.

There are other important aspects that are not included in any of the implementation plans, such as the amount of emission abatements estimated for particular actions. Some companies are upfront in acknowledging how difficult further emissions reductions will be. The marginal abatement cost for GHG emissions can

increase substantially once companies have “picked the low-hanging fruit” that were of benefit to the company; in other words, completed those projects that offered economic savings. For example, Canfor indicates that they will continue with projects and monitor progress but expect reductions to continue to level off as they have addressed the major opportunities they deem financially possible to reduce emissions (2011c). Lafarge states that they have reached the technical limits for reductions in their operations and further reduction will require innovation (2011b). A commitment of funds for research and development to find new emission reduction opportunities represents a best practice for implementation planning, set by Lafarge.

5.4. Leadership

Many opportunities are available for companies to join in initiatives and receive certification for their sustainability performance. There are numerous global, regional and sector-based projects that encourage and coordinate corporate climate change mitigation. There are varying levels of participation and often rankings are involved to help distinguish companies that are leaders in climate change action. Table 14 identifies the number of companies from the study involved in some of the most prominent corporate climate change initiatives.

Table 14. Key climate change initiatives and certifications[a]

Initiatives/ Certifications	Leaders	Participants
Carbon Disclosure Project	3 (20%)	6 (40%)
Global Reporting Initiative	3 (20%)	9 (60%)
International Organization for Standards – 14001		12 (80%)
Dow Jones Sustainability Index		5 (33%)
United Nations Global Compact		4 (27%)
World Business Council for Sustainable Development		4 (27%)
World Wildlife Fund Climate Savers		2 (13%)

[a] See Appendix C for brief description of each initiative and list of participant companies.

The Carbon Disclosure Project (CDP) is the most prominent global carbon reporting initiative; it collects corporate climate change strategies and GHG emissions in

a standard format to provide to investors, corporations, governments and the public through numerous reports and other resources. CDP scores companies on their disclosure and risk identification, though not on their actual performance in terms of emissions mitigation. Only companies that meet a market capitalization threshold receive scores. Table 15 indicates which companies participated; those with partial marks were not included or complete questionnaires but received scores below 50. Top-ranked companies make up the Carbon Disclosure Leadership Index, which in 2011 included Chevron, Lafarge and Spectra Energy (CDP, 2011a, 2011b, 2011c).

Table 15. Leadership rankings[a]

	Initiatives (overall)	**CDP**	**GRI**	**ISO 14001**
Canfor	Medium	Partial	No	Yes
Catalyst	High	Yes	Partial	Yes
Domtar	Medium	Partial	Yes	Yes
West Fraser	Medium	Partial	No	Yes
Chevron	Medium	Yes	Partial	Yes
Husky	Low	Partial	No	n.d.a.
Penn West	Low	Partial	No	n.d.a.
Spectra	Medium	Yes	Partial	Yes
TransCan	Medium	Partial	No	Yes
Graymont	Low	Partial	No	n.d.a.
Heidelberg	Medium	Partial	Partial	Yes
Lafarge	High	Yes	Yes	Yes
Rio Tinto	High	Yes	Yes	Yes
Teck	High	Partial	Yes	Yes
BC Hydro	Medium	Partial	Partial	Yes

[a] See Appendix G for scoring rationale for each company.

Global Reporting Initiative (GRI) sets the standard for corporate social responsibility reporting. GRI's Reporting Framework rates the level of transparency and coverage of information in corporate sustainability reports. Required environmental performance indicators include total direct and indirect GHG emissions by weight, and additional points for listing initiatives to reduce GHG emissions and reductions achieved

(GRI, 2006). Those categorized as leaders in Table 14 received the highest application level score (A+) on their most recent sustainability report, certified by GRI. The three companies that received this score are Lafarge, Rio Tinto and Teck Resources (GRI, n.d.). Table 15 gives full credit to all companies that have their declarations certified by GRI, and partial credit to those that self-declare how they rate according to GRI guidelines.

The International Organization for Standardization (ISO) establishes the standard for environmental management that most companies in the census use in their operations. ISO 14001 is referenced by twelve of the companies as the benchmark for their environmental management programs (see Table 15). A few companies also mention certification from Canadian Standards Association (CSA) for their environmental management systems.

Of the companies based in Canada, five of eleven appeared on the 2011 50 Best Corporate Citizens conducted by Corporate Knights. As part of their scoring, companies are measured on carbon productivity (US$/tonne of CO_2e emitted). See Appendix C for the listing of companies in the survey that have received this distinction, along with other key environmental accolades. In most cases, participation and high scores in major climate change initiatives align with policy assessment results in this study. Six of the nine companies that participate in both CDP and GRI also have strong polices on climate change, and are most likely to have set emissions targets and developed suitable reduction plans.

5.5. Trends in Corporate Responses to Climate Change

While there are some obvious leaders in corporate responses to climate change, 53% of the companies (eight of fifteen) that operate emission-intensive facilities in BC have not presented strong responses to reduce emissions. The fact that most of companies have started to monitor GHG emissions is encouraging, though four companies only started publishing emissions after reporting regulations were introduced. As well, the reporting of emissions is not directly related to efforts to reduce emissions. This lack of commitment is evident in the number of companies have not yet set

emissions targets (eight), published a cohesive emission reduction implementation plans (ten) and do not clearly identify climate change as a key business concern (five). These omissions occur in two-thirds of firms covered in this study; four companies are missing all three elements.

Risk assessment is another area with inadequate response. Companies are predominantly concerned with regulatory risk when it comes to climate change. Recognition of the business impacts climate change will pose comes from only two major multinationals that are based in Europe (Lafarge, Rio Tinto) and a crown corporation (BC Hydro). None of the companies have provided a detailed analysis of the effects of climate change on their business in terms of risk, adaptation or even opportunities.

Corporate climate change responses show some consistency when grouped by sector, size and region of operation. The oil and gas sector in general has taken the least action of the BC companies that operate high emission facilities. The pulp and paper sector in BC, as well as companies involved in metals and mining, show substantial action to reduce emissions. Leadership is exemplified by companies with corporate headquarters based in Europe, likely spurred by the European Union's advanced policies for climate change mitigation. There is also an increased likelihood of efforts to address climate change from companies that have greater earnings and global operations, aspects that increase both capacity and public scrutiny.

The major outcome of this assessment is similar to the main finding from Sullivan's initial European study: companies have not made considerable efforts overall to reduce GHG emissions voluntarily. There is strong evidence, particularly in the emphasis on the regulatory risks posed by climate change, that companies anticipate further government policy on climate change. This expectation has spurred some companies to act pre-emptively to bring down emissions, but few appear willing to take substantial measures until policy directions from government are clearly stated and acted upon. Sullivan asserts that uncertainty in climate policy provides a strong incentive for companies to 'wait and see' what approach government will take, and in the meantime carry out mitigation action only where it aligns with economic gain (2010, p. 46).

For BC, the carbon tax has provided some indication of the path forward on climate policy, but the lack of planned increases past 2012 does not send a strong signal to corporations. Even more disruptive in the BC context, the current Premier and Minister of Finance have recently announced a review of the carbon tax, and there have been allusions to its potential elimination (Bailey, 2012). The slow development of regulatory legislation for industrial emissions by both federal and provincial governments creates further uncertainty for corporations.

6. Analysis of Corporate Climate Change Action

Comparison of the quality of corporate climate change response to actual emission performance in BC provides insight as to the depth and effectiveness of voluntary measures by corporations. The relationship between corporate policies for climate change mitigation and performance outlines one aspect of effectiveness. Another consideration is the tension between financial and environmental goals. How companies deal with pressure to perform well in both respects, and how they relate this to shareholders and the wider public in corporate reports, is informative. Some companies have commented on their preferred government climate policy approach, while a few have even indicated their preparations for further government action to reduce corporate emissions. This information points to the extent to which companies have started to make changes in anticipation of further climate policy from government. This analysis section culminates with some rough calculations estimating how GHG outputs may be impacted by economic recovery in BC's industrial sectors.

6.1. Relationship between Policies and Performance?

To determine whether a relationship exists between corporate policies and performance on climate change mitigation, companies were cross-tabulated by the quality of their policies and emission performance. Although the small number of companies is quite limiting, comparisons across different time periods seems to show some effects of policy. Note that 'stabilized' mean that companies have not seen GHG emissions increase or decrease by more than 10% over the specified period. Table 16 compares emission reductions from 2007 to 2010 with corporate climate change policy assessment results. Based on the findings from Sullivan (2010), it would be expected that those companies with high quality climate change policies would perform better in emission reductions, while those with weaker policies would perform worse.

Table 16. Corporate climate change policies and emissions performance, 2007 to 2010

Quality of policy (# of companies)	**Absolute emissions,** 2007 to 2010		
	Increased	**Stabilized**	**Reduced**
High (7)	1 (14%)[a]	1 (14%)	5 (71%)
Medium (3)	0	0	3 (100%)
Low (5)	1 (20%)	1 (20%)	3 (60%)

[a] Domtar is the one company with high quality climate change policies and increased GHG emissions for 2010, amounts that are inconsistent compared to previous years.

Contrary to expectations, low quality corporate climate change policies do not seem to be correlated with emission increases from 2007 to 2010. It seems that most companies are converging towards emission reductions in this period regardless of the strength of their corporate climate change policies. To investigate the relationship further, the same data was drawn for the period before BC began instituting provincial climate policy (legislated targets and the carbon tax). Table 17 presents emission reductions from 2004 to 2007 to see if the quality of corporate policy might show more of an effect before provincial climate policy was implemented. Though far from definitive, the cross-tabulation results from 2004 to 2007 closer resemble the expected relationship where companies with low quality corporate climate change policies are more likely to register emission increases and vice versa. This effect is not evident after government measures to encourage all companies to make reductions were put in place (Table 16).

Table 17. Corporate climate change policies and emissions performance, 2004 to 2007

Quality of policy (# of companies)	**Absolute emissions,** 2004 to 2007		
	Increased	**Stabilized**	**Reduced**
High (7)	1 (14%)	3 (43%)	3 (43%)
Medium (3)	0	2 (66%)	1 (33%)
Low (5)	3 (60%)	0	2 (40%)

The comparison of absolute emissions is less informative than emission intensities, which would take into account changes in production levels. Unfortunately production amounts are only publically available for two narrow sectors in this study: pulp and paper mills and oil refineries. These cases are explored next to help identify

whether the quality of corporate climate change policy has any observable impact on emission intensity rates over time.

6.1.1. Case Study One: Pulp and Paper Mills

To look closer at the link between corporate climate change policies and performance, Table 18 compares the rank of pulp and paper companies according to the assessment of corporate responses to climate change alongside emission intensity rates for 2007 and 2010. Similar to the previous cross-tabulations, there seems to be a relationship between the quality of corporate climate change policy and emission intensity in 2007. Again, the relationship is not as evident in 2010, when intensities have begun to converge at the lower end of the spectrum.

Table 18. BC pulp and paper climate policy ranking and emission intensities

Company	**Assessment ranking**	**Intensity** (t CO_2e/t of pulp & paper)		**Intensity change (%)** 2007 to 2010
		2007	**2010**	
Catalyst	1st	0.21	0.24	11.1%
Canfor	2nd	0.29	0.27	-5.1%
West Fraser	3rd	0.32	0.24	-25.2%

Catalyst, the company that has ranks highest for its corporate climate change policy response, achieved the lowest intensity rate in 2007. Due to financial trouble, Catalyst has cut production considerably across its operations, including its most emission-intensive mill (the one captured in this study) which dropped production by 20% from 2007 to 2010. There is the potential that this significant fall in production has some impact on the rise in emission intensity for 2010, on the premise that a mill cannot run as efficiently (in terms of energy usage and other emission impacts) when production has dropped to 75% of total capacity.

Canfor ranks second in the climate policy assessment, and correspondingly had the second lowest intensity rate in 2007. West Fraser had the highest intensity rate in 2007, but has seen the greatest reduction in emission intensity from 2007 to 2010. This suggests that West Fraser has achieved reductions by finally catching up to the climate change performance of its peers in recent years. Domtar cannot be included in the rankings as production values are not provided.

6.1.2. Case Study Two: Oil Refineries

In general, members of the oil and gas sector are behind on climate change initiatives relative to other companies in the study. Of the two companies operating oil refineries, Chevron comes out ahead of Husky in the corporate climate change assessment (largely because Chevron has set GHG targets). CDP supports the assessment results as Chevron scored 86 in their rankings and was included in the Carbon Disclosure Leadership Index, while Husky scored only 41 (CDP, 2011a, 2011c).

Both Chevron and Husky actually saw an increase in their emission intensity rates from 2007 to 2010. While both companies indicate that they have recently started to make improvements in energy efficiency as well as flaring and venting mitigation across their operations, other market and operational forces may have impacted their recent emission intensities (Chevron, 2011d; Husky, 2011).

Table 19. BC oil refineries climate policy ranking and emission intensities

Company	Assessment ranking	**Intensity** (t CO_2e/thousand barrels)		**Intensity change(%)** 2007 to 2010
		2007	**2010**	
Chevron	1st	26.6	28.0	5.1%
Husky	2nd	31.3	35.1	12.1%

Once again, Table 19 shows there is an alignment in the assessment of the corporate response to climate change and emission intensity performance. Chevron has the lower of the two emission intensity rates in both 2007 and 2010. Unfortunately, there has been an intensity rate increase over this period, from 26.6 to 28.0 tonnes of CO_2e per thousand barrels of oil. A review of Chevron's production and emission rates from Table 5 shows that both have dropped from 2007 to 2010, by 18.4% and 14.2% respectively. In 2010, Chevron's refinery operated as 72% of capacity.

Husky's intensity rate has also climbed over this period, from 31.3 to 35.1 tonnes of CO_2e/thousand barrels. Again, Table 5 identifies that Husky reduced production from 2007 to 2010, though it was a less drastic drop (only 4.8%) compared to Chevron. And as for absolute emission performance, Husky's emissions grew by 6.7% over this period. This increase in emissions actually shows represents some progress compared to the previous period (2004 to 2007), where Husky saw an 18.9% increase in emission. It is

not too surprising given Husky's low climate change policy rating that its convergence towards emission reductions is slow.

6.1.3. Link between Climate Change Policies and Performance

The two case studies provide some partial evidence that companies that make a stronger effort to mitigate their GHG emissions achieve lower emission intensity level. Corporate climate change assessment rankings and 2007 emission intensity rates correspond in all cases. This outcome seems to corroborate tentative findings in the cross-tabulations regarding the relationship between the quality of corporate climate policy and absolute emission change from 2004 to 2007.

Findings based on the most recent data (2010) do not follow the pattern of strong corporate responses corresponding with emission reductions and weak responses with increases in GHG output. Instead it appears that, for the most part, all companies have shifted towards reductions in emission performance since 2007, regardless of the quality of their corporate climate change policies. There are even signs that companies with high quality policies have seen a slow-down in their emission reductions, while those with medium or low quality policies are have made significant improvements in the most recent period. This is noticeable in the pulp and paper intensity case, and observable for 60% of the population (nine companies) when comparing absolute emission change for 2004-2007 to 2007-2010 (Appendix D).

There are a few considerations that might explain this potential result (and much more research needs to be conduct to confirm this trend). One impact could be the efficiency and technology plateau that several companies have alluded to in their reports, where all emission reductions projects that have an economic benefit or a low overall cost have already been put into practice by the more progressive companies. Without a significant incentive to invest in more expensive upgrades or research and development, some of these firms might not be encouraged to realize greater emission reductions. At the same time, there is also the potential that government action – whether the carbon tax or other signals (legislated emission targets, required reporting, plans for cap and trade or performance standards) – has triggered those companies not formerly motivated to reduce emissions to take action. These firms have now started to

make the economically viable investments for GHG mitigation and are therefore seeing substantial decreases in the most recent time period examined. These two considerations will be discussed further in the following sections.

6.2. Conflict between Environmental & Financial Goals?

The research literature on corporate environmentalism (Section 2.1.4) indicates that it is likely most corporations are willing to undertake environmental action only when it is to their financial advantage. One finding of concern that surfaced in the corporate policy assessment is that few companies are found to have internalized the costs and implications of climate change. Only three companies surveyed address actual climate change impacts in their business risk assessments (separate from the risk of climate change regulation, which most companies do highlight – to be discussed in the next section). Inadequate response to the risks that climate change poses to future operations and profit from most companies in the study suggests that short-term financial goals trump environmental goals and long-term sustainability.

Statements from companies as to how they reconcile financial and environmental objectives vary widely. Some companies align their economic success with the sustainability of the natural resources that they depend on, and indicate that environmental pursuits are mutually beneficial. Several firms reference the need to act responsibly towards the environment in order to maintain to their social license to operate. A few companies indicate that they undertake environmental actions to the extent that shareholder concerns are met, with allusions to the primacy of financial interest. While statements found in corporate sustainability reports (and even some annual reports) tend to emphasize that environmental action has long-term economic benefits for business, this does not seem to lead companies to voluntarily make huge investments for the sole purpose of improved environmental performance.

A common performance trend is that companies realize major GHG emission reductions when they first start investing in mitigation practices, as they undertake energy efficiency and upgrade projects that are most cost-effective, or ‘low-hanging fruit’. Once these types of projects are complete, greater investment is required to realize

further emission reductions. The cost effectiveness of emission reductions is dependent on the economic and regulatory environment that companies operate in. As energy (or other input) costs increase or regulations on outputs (such as GHG emissions) are introduced, projects for efficiency improvements that previously seemed too expensive can become economically viable. This may explain recent emission reductions (2007 to 2010) realized by companies with weak corporate climate policy that were not previously motivated to improve performance (Table 16). This shift is supported by the findings from the pulp and paper case study where emission intensities for all companies have started to converge towards the lowest rates (Table 18).

This shift has been further highlighted in Table 20 (below), which shows that six of the eight companies with low to medium quality climate policies have picked up the pace on emission reductions in recent years. A change in the external policy environment – with the introduction of a carbon tax, a lofty provincial GHG target and potential industrial regulations – may have improved the cost effectiveness of emission reduction projects for those companies who had not otherwise been compelled to make such investments.

Table 20. Company emission change and quality of climate change approach

Company	2004	2007	2010	Emission Change 2004-07	Emission Change 2007-10	Quality of Climate Change Approach	Supports Plateau/ Catch-Up Hypothesis[a]
BC Hydro (2)	400	232	202	-42.1%	-12.8%	High	Yes
Rio Tinto (1)	1,472	1,137	924	-22.7%	-18.8%	High	Yes
Canfor Pulp (2)	168	249	233	-12.7%	-6.1%	High	Yes
West Fraser (1)	120	104	81	-13.6%	-22.0%	Medium	Yes
Chevron (1)	456	476	408	4.3%	-14.2%	Medium	Yes
Heidelberg (1)	1,034	1,047	727	1.2%	-30.5%	Medium	Yes
Graymont (1)	139	196	122	40.5%	-37.9%	Low	Yes
TransCanada (1)	254	312	246	22.7%	-21.1%	Low	Yes
Husky Energy (1)	101	120	128	18.9%	6.7%	Low	Yes
Lafarge (2)	*1,033*	*1,156*	*640*	*11.9%*	*-44.7%*	*High*	*No*
Teck (5)	*1,580*	*1,682*	*1,288*	*6.5%*	*-23.5%*	*High*	*No*
Catalyst (1)	*155*	*149*	*132*	*-3.8%*	*-11.4%*	*High*	*No*
Domtar (1)	*103*	*112*	*204*	*8.1%*	*82.6%*	*High*	*No*
Penn West (1)	*240*	*142*	*99*	*-40.8%*	*-30.8%*	*Low*	*No*
Spectra Energy (5)	*4,534*	*3,133*	*3,473*	*-30.9%*	*10.9%*	*Low*	*No*

[a] Where companies with high quality policies have seen slower improvements in more recent period, while companies with medium or low quality policies have seen improvements/reductions.

Companies that had not previously made voluntarily improvements in emission reductions are now catching up to those companies that took early action, as progressive companies seem to be reaching a performance plateau. Several of the companies with strong corporate climate policy that saw considerable emission reduction rates from 2004 to 2007 have slowed on reductions in the more recent period. As Table 20 indicates, three of the seven companies with high quality climate change policies have seen emission reduction rates decline from 2007 to 2010. These results are tenuous as they are based on a small population and do not take into account a number of other factors such as production and outside economic effects. However, it is worth noting that even two companies whose BC facilities do not show this plateau – Lafarge and Teck – have brought up the effect in their own reports. Lafarge has stated

that “moving forward it will become increasingly difficult to reduce at the same pace as we start to reach technical limits. We will need to rely more on innovation to drive further reductions” (2011b, p. 26). Teck similarly identifies that “...mining is likely to become more energy intensive. This will make it challenging to reduce our energy intensity and the associated GHG emissions” (2011a, p. 52). This phenomenon could also explain stagnation in emission intensity rates in the pulp and paper case study (Table 18).

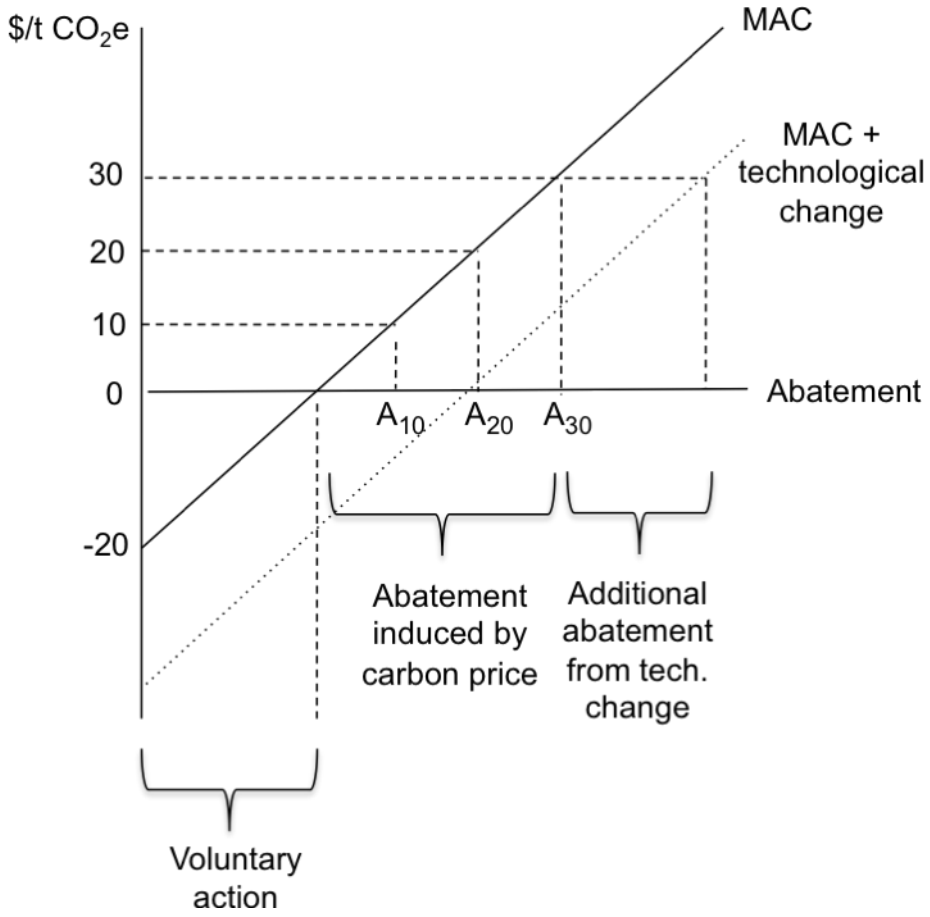

Figure 3. Marginal abatement cost curve

The plateau effect and influence of technological change can be demonstrated by the marginal abatement cost (MAC) curve in Figure 3 above. Voluntary action occurs where the cost of abatement is less than zero. As the price per unit of emissions increases, companies move along the MAC curve and greater GHG abatement is achieved. Once the marginal cost of abatement is higher than the cost per unit of emission, companies are not compelled to make further efforts and emission reduction

performance plateaus. Technological change, however, can shift the curve down and result in greater abatement as identified in Figure 3.

One sector that seems to be less responsive on emission reductions is the oil and gas industry. For the most part, the climate policies of these companies receive low ratings. The minor case study on oil refineries shows that both facilities have seen emission intensities increase from 2007 to 2010 (Table 19). This may be an indication that this particular sector has not been as motivated by external factors such as carbon pricing to improve emission reduction efforts. The rise in the world price of oil likely makes the carbon tax of little consequence to this sector. One company in the group (Penn West) specifically stated in their report to shareholders “the amount of carbon tax paid…was not material to us” (2011a, p. 14).

6.3. Corporate Anticipation of Government Policy

Uncertainty surrounding further government policy to deal with climate change is a concern that surfaced in many of the reviewed corporate publications. Within their business risk assessments, most companies noted the uncertain economic impacts of government legislation and policy measures, such as the BC carbon tax, potential carbon trading agreements and possible regulation. More than half of the companies provide recommendations and opinions on current and anticipated government policy for climate change, largely focused on carbon pricing.

Most companies in the study identify that imminent government climate policy is one motivation for their emission reduction effort, however few provided specific detail on how they incorporate future climate policy into their business planning. One company, Teck, explicitly stated that it incorporates a carbon price in capital investment and risk decision processes and estimates the absolute cost of annual carbon exposure to 2020 (2011a). It is assumed that calculations are based on the BC carbon tax rate schedule. Teck has also developed an Emissions Trading Compliance Strategy to prepare for a prospective cap and trade system in BC. While other companies have not been so forthright to detail their preparations for new or intensified climate change legislation, it is assumed that some might be taking similar action. Due to the range of corporate

requirements and impacts that are dependent on the design of specific climate policy, it is suggested that there a number of companies might instead be adopting a 'wait and see' approach due to the uncertain climate policy future (Sullivan, 2010).

Recommendations and critiques on government climate policy instruments are offered by companies from all sectors in the study to register their preference in an uncertain policy environment. Almost all of the commentary refers to the design and implementation of carbon pricing policy. Spectra Energy is one company that directly states a preference for a (revenue-neutral) carbon tax approach, with the addition that a cap and trade could also prove workable (n.d.). There are several companies that highlight the importance of equitable treatment across sector or a level playing field (*Chevron, Heidelberg, Spectra).* Companies from most sectors call for a federal policy program harmonized with the United States, though the oil and gas sector is particularly insistent on this point (*Chevron, Husky, Spectra, TransCanada).* The pulp and paper industry asserts a need for recognition of early action in any government climate policy approach (*Catalyst, Domtar)*.

6.4. Can Emission Reduction Targets be Met?

While the overall trend of GHG reductions at emission-intensive facilities in BC is promising, the analysis of voluntary action and corporate climate policy points to some concern for further gains. There are at least three concerns that may thwart further industrial emission reductions and result in a failure to reach BC's 2020 GHG target. First, when and if sectors hit by the recession recover, production levels will rise and if there has not been enough investment in processes, fuels or technology to reduce GHG emissions per unit output, these emissions could rise again. The second concern is the performance plateau effect evident in the recent decline in the rate of emission reductions for some companies with the most progressive corporate climate change policies. Third, there are companies in some sectors in particular that appear unaffected by climate policy intentions.

GDP for all of the sectors with emission-intensive facilities has dropped almost 12% from 2007 to 2010. Using sector-wide GDP as a proxy for production, the ratio per

kt of emissions to $ million GDP is nearly one-to-one. For every $1 million increase in GDP for emission-intensive sectors in BC, emission output is expected increase by 1.01 kt CO_2e. (See Appendix E for emission intensities by GDP from 2004 to 2010.)

Table 21. BC emission intensities by GDP, 2010

Sector	**Facility Emissions** (kt CO_2e)	**GDP** ($ million)	**Intensity** (kt CO_2e/$ million GDP)
Pulp and Paper	650	1300	0.50
Oil and Gas	4354	2976	1.46
Minerals (Cement)	1489	397	3.75
Metals and Mining	2211	1854	1.19
Utilities	202	2300	0.09
Total	8906	8827	1.01

Table 21 identifies several sectors are particularly emission-intensive, where a rise in economic output could result in significant emission increases. Facilities that produce minerals necessary for cement have a substantial rate of emissions per unit GDP, where an increase of $1 million in output will result in an increase of 3.75 kt of GHG emissions. The oil and gas sector does not have quite as high an intensity rate, at 1.46 kt CO_2e/$ million GDP, with metals and mining ranking third with a rate of 1.19. Economic growth in these three industries could be detrimental to BC's industrial GHG emission output unless emission intensities are improved alongside economic recovery.

To take the impact of the most emission-intensive sectors one step further, estimations of future economic improvement in oil and gas, minerals (cement) and metals and mining are explored. Current commodity prices and a 12% gain in construction in 2010 suggest that all of these sectors will see continued economic improvement over the next few years (BC Stats, 2011d). Table 22 below presents a scenario whereby 2010 growth rates are applied to next three years, and provides estimates of facility emissions for 2011 to 2013 based on intensity ratios from Table 21.

Table 22. Projections of specific emission-intensive sectors, 2010 to 2013

Sector	2010 GDP growth rate	Facility GHG/ $ million (2010)	Facility emissions (kt of CO_2e)				Emissions change 2010-2013
			2010 (actual)	2011 (projected)	2012 (projected)	2013 (projected)	
Oil and gas	2.9%	1.46	4,354	4,480	4,610	4,743	8.9%
Minerals (cement)	-6.5%[a]	3.75	1,489	1,518	1,577	1,638	10.1%
Metals and mining	6.3%	1.19	2,211	2,351	2,499	2,657	20.2%

[a] While growth specific to minerals (cement) was -6.5%, the rate applied for future projections was 1.95% - half the overall manufacturing growth rate for 2010 (3.9%). Growth in construction (12.3% in 2010) is expected to have a positive impact on mineral (cement) manufacturing, and the rate of decline is slowing compared to 2008 and 2009 (-17% and -38% respectively); therefore a slow recovery rate based on manufacturing growth rate was deemed appropriate.

Based on the results from Table 22, BC could see an increase of 1000 kt of CO_2e from these three industries by 2013. These projections are based on very rough estimations, but they may in fact represent a conservative estimate of economic recovery. The increases that they show are worrying; this estimated increase would suggest that industrial emissions could rise by 11% or more by 2013. Facility emissions from the two other sectors combined (pulp and paper and utilities) were only 852 kt in 2010, so even if they became GHG neutral these sectors would be unable to make up for emission increases from the more intensive sectors. As mentioned elsewhere in this study, the rationale for considering such an imprecise scenario is the need for swift action to mitigate serious climate change impacts with the added concern that we are already falling further behind rather than making the necessary emission reductions. The two-to-three year time lag on GHG emission and economic data prevents the precise and prompt analysis that would be preferable for climate policy decisions.

The performance plateau is another factor that may stall future reductions in emissions without further policy stimulus, Companies who were early actors in emission reductions may see no gain in trying to reduce their emissions further, while the latecomers may also stall in their emission reduction if further policy is not introduced. At a certain level, the marginal cost of abatement becomes quite steep, where additional reduction efforts are not perceived as economically viable. Finally, there are sectors that

still seem unmotivated to reduce emissions due to their market conditions, lack of pressure from their shareholders the public, or buyers of their products. Without further regulatory pressure, it is hard to see what else would motivate them.

There is the potential that some of the movement on emission reductions from 2007 to 2010 is attributable to the change in the policy environment. The introduction of the BC carbon tax, and perhaps signals from both the provincial and federal government that industry-specific emission policy is underway, could explain some of findings (though much more robust research is necessary as the parameters of this study are extremely limited). The important consideration for future climate policy will be how to push companies past the emission performance plateau and encourage more significant investment in reduction projects. In order to meet provincial and national emission targets, it seems likely that reduction efforts will need to either be made more cost effective through carbon pricing, or compelled by regulation, or both.

7. Policy Directions

Three main policy approaches have been considered to encourage emission reductions in BC. The first, voluntary action, has been implicit in the emission reporting frameworks applied in BC by both the federal and provincial government. The other two policy mechanisms are carbon pricing and command-and-control regulation. The status quo for BC includes carbon pricing, but at a level that may not be sufficient for significant reductions. Consequently this policy analysis will include four policy directions: voluntary action alone (based on the status quo without the carbon tax), status quo with the current carbon tax, increased carbon pricing, and command-and-control regulation. These approaches are briefly reviewed and compared to determine if further policy intervention might enhance industrial GHG emission reductions in BC.

7.1. Voluntary Action

An evaluation of voluntary action alone requires an inquiry as to how companies might have performed without the carbon tax. Prior to the introduction of the carbon tax, there were emission-intensive companies in BC already taking action to reduce emissions of their own volition. In an attempt to speculate on the GHG emission performance of surveyed BC facilities if a carbon tax had not been introduced, a potential scenario is presented in Table 23 below.

Table 23. Potential 2010 scenario without carbon tax

Company	**2007 Actual**	**2010 Actual**	**2010 Projected** (no carbon tax)
BC Hydro	232	202	202
Rio Tinto	1,137	924	924
Canfor Pulp	249	233	233
West Fraser	104	81	**90**
Chevron	476	408	**496**
Heidelberg	1,047	727	**1060**
Graymont	196	122	**275**
TransCanada	312	246	**382**
Husky Energy	120	128	**143**
Lafarge	1,156	640	640
Teck	1,682	1,288	1288
Catalyst	149	132	132
Domtar	112	204	**121**
Penn West	142	99	99
Spectra Energy	3,133	3,473	3473
Total	10,247	8,907	9,559
Emissions Change (%) 2007-10		-13.08%	-6.72%

Only seven companies in Table 23 have new 2010 figures generated to predict emission performance that may have resulted without carbon tax, denoted in bold. The first six companies are those with medium to poor environmental policy ratings, who have realized significant emission improvements since the implementation of the carbon tax. (Appendix F provides an expanded version of the table with emission change and climate policy quality data.) The assumption made is that without the carbon tax, these companies would not have been motivated to reduce their emissions so substantially. Based on this assumption, their previous emission change rate (2004 to 2007) was applied for the 2007 to 2010 period. Those companies with high quality climate change policies are expected to have proceeded similarly if the carbon tax had not been implemented, with some companies reaching a reduction plateau and others (Lafarge, Teck, Catalyst) finally realizing emission reductions due to their voluntary practices. As

mentioned earlier, 2010 GHG data for Domtar are extremely inconsistent, and therefore the previous emission increase rate (2004 to 2007) was applied in this case as well. Finally, it is assumed that Penn West and Spectra have not altered their emission performance on account of the carbon tax, and therefore would have similar GHG outcomes whether or not it had been implemented.

Based on the above assumptions, it appears that voluntary actions alone might potentially have resulted in an overall emission reduction in the order of 6 to 7% for BC's high emitters had the carbon tax not been implemented. This result represents a rough counter-factual estimation based on historical emission change rates and does not take into account economic impacts or other external factors. However, it shows some sign that the carbon tax may have encouraged some companies that were not as likely to have reduced GHG outputs on their own, based on the assessment of their corporate climate policies. These results could support the hypothesis that relying on companies to take voluntary action will not yield significant emission reductions. Based on this cursory projection, BC's highest emitters would have only seen half the reductions that were realized in actuality without the carbon tax (in the range of -6 to -7% rather than -13%).

7.2. Status Quo

BC's carbon tax is set at $25 per tonne of CO_2e (as of July 1, 2011), and increases to $30 per tonne on July 1, 2012 with no further increase scheduled (BC Ministry of Finance, n.d.). As discussed in Section 2.2.2, the tax is not presumed to be high enough to make a substantial difference in corporate behaviour. While the emission-intensive facilities in the study have to pay a carbon tax on fossil fuel used in stationary combustion for their operations, industrial processes that emit GHG emissions are not covered. Both the provincial and federal government have imposed reporting regulations that currently apply to facilities with more than 10 kt or 50 kt of annual emission respectively. No other legislation is currently implemented to curb industrial emissions, though further federal and provincial regulations are reportedly under development. There are also voluntary initiatives that encourage companies to disclose GHG emission and reduction efforts, as well as some public pressure for companies to report on environmental performance to maintain a social license to operate.

7.3. Increased Carbon Price

An increase in the carbon price can be implemented through raising the current carbon tax rate or the implementation of a cap and trade program. To review, carbon pricing internalizes the externality of GHG emissions by creating a cost to companies for industrial emissions. (See Section 2.2.2 for further detail).

While a cap and trade system does offer several advantages over a carbon tax, there is too much variation in impacts depending on the design of such a system to assess this approach in general within the scope of this policy analysis. Cap and trade has advantages over a carbon tax in terms of setting a specific limit to GHG emissions, as well as an ability to capture emissions from industrial processes that are currently not captured by BC's carbon tax. However, the level of administrative complexity is much higher than a carbon tax. For example, a cap and trade system requires program infrastructure to distribute permits and allow for banking and borrowing (offsets), and also regulators to monitor performance and apply penalties where necessary. (Avi-Yohan and Uhlmann, 2009; Sterner, 2012).

Unlike a carbon tax, a cap and trade system does not intrinsically raise revenue unless the permits are auctioned, which adds another administrative aspect. (Note that revenues generated by BC's carbon tax are cycled back to British Columbians through tax reductions so as to be revenue neutral, an aspect that will be reviewed in a subsequent section.) There is some consensus that both types of instruments are effective in terms of environmental performance and outcomes (Press, 2007). Therefore, due to the complexity inherent to designing a cap and trade system, I will only consider the use of a carbon tax as a policy tool to increase the price of carbon.

An increase in the carbon tax would send a signal to industry and add certainty to the current climate policy environment. Carbon tax increases could be scheduled to approach the recommended threshold of $100 per tonne by 2020 to achieve significant reductions (NRTEE, 2009; Pembina 2009).[7] While this amount is potentially an underestimate of the level of carbon tax needed to reach BC's GHG target, it provides a starting point until an assessment specific to this province is conducted. A continuation of annual $5 increases in BC's carbon tax would result in a carbon price of $70 per tonne by 2020. Alternatively, a shift to an increase of $10 annually would result in a carbon tax rate of $110 per tonne by 2020.

7.4. Command-and-Control Regulation

The federal government has signalled its intentions to regulate industrial emission. The design and implementation of such regulations have not been confirmed. The federal program may involve intensity-based performance regulations if policy reflects the plan outlined in the 2008 government report, *Turning the Corner*. Therefore the following policy analysis will assume a regulatory approach based on emission intensity performance. In essence, the government will set a standard for emission performance by requiring specific reductions in emission intensity. (Refer back to Section 2.2.3 for further detail).

[7] The modelling results are several years old. One report recommended a carbon price of $40 per tonne for 2011 (Pembina), and the other prescribed upward of $50 per tonne by 2015 (NRTEE). These proposals were based on the national context, which differs from BC in terms of overall industrial composition and also a much less ambitious GHG target. The 2020 rate of $100 per tonne may therefore be an underestimate of a carbon price necessary to meet BC's targets. And yet current BC carbon tax rates do not align with the recommended increases, suggesting higher increases may be necessary to make up for lost time.

8. Assessment of Policy Directions

My research suggests that the current climate policy landscape puts too much emphasis on voluntary measures by corporations and too low a price on carbon for significant GHG emission reductions to be realized. While there has been some progress in corporate climate action from 2007 to 2010, the impact of economic recovery and an emission performance plateau effect may at a minimum stall further emission reductions and could lead to a reversal in the downward trend. If the BC government wishes to increase the likelihood that it achieves its GHG targets, increases in the stringency of government policy are necessary to encourage greater corporate investment in emission reductions. Each policy approach is rated on pertinent criteria, based on findings from the assessment of BC's top emitters and relevant research literature. Measurement allows us to determine the approach with the greatest potential to enhance GHG reduction efforts in BC's emission-intensive industrial facilities.

8.1. Criteria and Measures

Evaluation of the identified policy approaches will consider the following criteria:

Table 24. Criteria and measures

Criteria	Definition	Measure	Source
Effectiveness	Likelihood of policy to reduce industrial emissions	High, medium, low	Literature review
		Emission reductions (absolute and %)	Facility emission data and scenario with/ without carbon tax
Acceptability	Support from firms, political parties, public	High, medium, low	Company reports; media reports; public polls
Administrative Feasibility/Cost	Ease of implementing, operating, financing policy	High, medium, low	Literature review
Equity	Fairness across/between sectors and companies	High, medium, low	Company and industry reports; literature review

Effectiveness is one of the most important criteria, evaluated in terms of how successful a policy approach is expected to be in the reduction of industrial GHG emissions. Acceptability measures the potential receptiveness of companies, political stakeholders and the wider public to each policy approach. The complexity of policy infrastructure that government will need to implement is measured in administrative feasibility, and cost considers the financial resources government would need for each policy approach. An important dimension that cannot be commented on is competitiveness, which could vary significantly for each option depending on the specifics of a proposed carbon pricing or regulatory policy.

8.1.1. Effectiveness

The effectiveness of voluntary action, based on the projections in Section 7.1, is rated as low. The counter-factual scenario generate to estimate resultant emission reductions if the BC carbon tax had not been implemented indicates that voluntary actions alone may have only resulted in reductions of GHG emissions in the order of 6 to 7% from the high-emitting facilities included in this study.

Actual emission performance results indicate that the effectiveness of the status quo is also low. The examined facilities achieved a 13% reduction in GHG emissions from 2007 to 2010. Anecdotal evidence indicates that this outcome is mostly linked to reduced production over this period; however production amounts are not available for a full assessment. One proximate measure (presented in Section 6.4) is the application of an intensity rate based on facility emissions by sector-wide GDP for the most emission-intensive sectors included in this study. A tentative prediction of economic recovery for oil and gas, minerals (cement), and metals and mining suggests that annual facility emissions could rise by 1000 kt of CO_2e in 2013, a 10% increase from total BC facility emissions in 2010. Overall, this research indicates the status quo has not proved effective in terms of significant reductions in industrial emissions.

An increase in the carbon tax is expected to be much more effective than the status quo. Setting a higher cost for GHG emissions from stationary combustion is expected to encourage most sectors to take more aggressive action to reduce emissions. As discussed, carbon pricing is highly promoted for its flexibility and

efficiency. A schedule of carbon tax increases signals to industry the future costs of their emissions, and they can choose what actions to take to avoid increasing costs. In the tentative assessment of the affect BC's carbon tax may have had on industry in the past several years, there is some possibility that it has already had some impact (Table 16). A proper assessment is need to properly assess the level of tax needed to achieve BC's GHG goals, but in the meantime a schedule that get BC's carbon tax to at least $100 per tonne by 2020 is suggested. (Refer back to Section 7.3 for discussion.) . In terms of pushing companies beyond the performance plateau after initial energy efficiencies are met, the International Energy Agency (IEA) asserts that "clear, stable, long-term policies that support carbon pricing will be needed to stimulate the technology transition in industry (IEA, 2010, p.12).

In terms of effectiveness, the regulatory standard approach rates as medium. The proposed regulatory framework from the federal government utilizes emission intensity performance standards which, as my calculations show, will not limit absolute GHG emissions in BC as production rates increase unless emission intensities decline. For example, if emission intensities in the sectors examined fell to the level of the utility sector, emissions would drop significantly. But it is unreasonable to expect an intensity target to be set at that level for the emissions intensive sectors. The key point is that unless absolute levels of emissions are targeted, emissions intensity may not lead to significant reductions in GHGs. The plan also allows for unlimited offsets and credit for contribution to a technology fund that reduce the impetus to meet the intensity standard (Rivers & Jaccard, 2010).

Complexity is intrinsic to emission intensity targets. National emission intensities generally decline over time without policy intervention, so intensity targets need to be evaluated with regard to historic GHG trends and projections to determine effectiveness. This contributes to the difficulty of determining whether emission intensity standards are stringent enough. A similar GHG intensity initiative implemented in the US called for an 18% reduction between 2002 and 2012. Based on projections from historical data, it is likely this reduction could have been achieved without any policy intervention (Herzog, Baumert, & Pershing, 2006). Intensity standards can contribute to emission reductions, but ensuring effectiveness proves to be difficult.

8.1.2. Acceptability

The success of a policy approach will be impacted by how corporations, political stakeholder, and the general public perceive the government intervention. Acceptability affects company responsiveness as well as political and public buy-in. A policy that is strongly resisted may take more time and effort for government to implement and the outcomes may be less productive than a policy that is more palatable to all stakeholders. Most companies would likely prefer no interference, but this is not an option with climate policy already in place and if governments are committed to reaching their GHG targets. Political stakeholders have used climate policy as a divisive issue, especially in the BC context. Public opinion plays an important role in signalling societal expectations regarding climate policy to corporations and governments. I examine the level of acceptability for each of the policy options in the paragraphs below.

Voluntary actions appear highly acceptable to most companies, expressed in the fact that all companies comply with government GHG reporting requirements, almost all companies have generated sustainability reports, and many participate in GHG disclosure programs. The proliferation of reports and programs that highlight corporate climate action also suggests there is an appetite from the public and political stakeholders for this approach. It is not necessarily the case that voluntary action alone ranks high with these groups, but could be that such efforts are appreciated alongside other policy approaches to help monitor corporate environmental performance.

The status quo receives a medium rating from companies. Most companies reference the risk of uncertainty on the future of climate policy in BC in their annual reports. However, acceptability does not rate high for corporation as it is recognized that the current business environment might be preferable to a future with alternate or intensified climate policy. Political responses to the status quo are mixed. The current BC Liberal government indicated that it is not entirely satisfied with the current policy environment when it announced a review of the carbon tax (Bailey, 2012). The provincial NDP party is now in favour of the carbon tax, but are not content with the status quo (they would apply revenues from the tax toward carbon reduction initiatives), while the BC Conservative party is against the carbon tax (Barrett, 2011). Public support for the carbon tax was registered at 57% in a poll conducted in November 2011 – with 41%

opposed – which is interpreted as a medium ranking in terms of acceptability (Environics Research Group, 2011). All stakeholder interests considered, the status quo receives a medium acceptability rating.

From the survey of company responses in Section 6.3, it is anticipated that companies would not vehemently oppose an increases in the carbon price (though it is expected that there will always be resistance to any policy that increases operational costs for corporations). Some companies in the sample have indicated a preference for carbon pricing as a policy mechanism. As well, the regulatory risk statements from many companies indicate that they anticipate a higher carbon cost, and scheduled increases will provide some certainty for the future. Based on these indicators, an increase in the carbon price is ranked at as medium level of acceptance for corporations. Politically, none of the provincial parties have advocated for an increase in the carbon tax. As noted, the BC Conservatives are the only party that is against the carbon tax in principle; it is assumed that an increase might be considered by the other two parties. This warrants a medium rank in acceptability from political actors. And based on the public polling data referenced above, it is further anticipated that most of those in support of the carbon tax would be willing to see it rise. Overall, there seems to be a medium level of acceptability for an increase in the carbon tax.

None of the companies in the sample provided any support for regulations and since regulations are viewed as more compulsory than market-based policy instruments, it is anticipated that their acceptability to business ranks low. The delay in the implementation or elaboration on the federal regulatory plan may indeed demonstrate its low political acceptability. Public opinion polls have registered a high level of support for regulating limits on carbon emissions (74%), but this indicator refers to ”setting limits on carbon dioxide emissions and making companies pay for emissions”, which is not specific to the regulatory standards under review. As well, intensity performance standards are criticized for a lack of transparency and difficulty in communicating progress to the public (Rivers & Jaccard, 2010; Herzog et al., 2006). It is therefore anticipated that performance regulations average a low acceptability ranking from stakeholders.

8.1.3. Equity

Equity needs to be measured for several dimensions. Horizontal equity identifies whether each company will be treated similarly. Vertical equity looks at how different sectors and companies within them may be affected differently by each policy approach. Transitional equity recognizes specific companies or sectors that benefit from policy in ways that other do not, which can create winners and/or losers.

The voluntary action approach does not present major equity issues. All companies are required to report annual emissions over 100 kt of CO_2e, which treats all the companies considered in this study the same (as this parameter was used to select companies in the first place). Though voluntary measures are encouraged through emission disclosure, the non-compulsory nature of this approach allows all companies to choose for themselves whether to participate, which is fair in terms of horizontal equity. The divergence in emission output based on specific industrial processes presents some vertical inequity as facilities in specific sectors, such as cement plants and metal smelters, are likely to always register higher emissions than other industries. Transitional equity rates medium as emissions reporting does reward those companies who are already making concerted efforts to reduce emission.

The status quo is horizontally equitable in that all companies pay the same costs in the purchase of fossil fuels inclusive of the carbon tax. Vertical equity may not rate as high since industrial sector have different levels of reliance on fossil fuels and processes that produce GHG emission. There is also vertical inequity based on the size of companies; while companies with smaller operations and earnings identified the carbon tax as a significant cost to their operations (e.g. Catalyst), more prosperous companies might not find the current carbon cost consequential. For example, Penn West statement that “in 2010, the amount of carbon tax paid by us pursuant to [BC Carbon Tax] legislation with respect to our operated and non-operated properties in British Columbia was not material to us” (2011a, p. 14).

An increase in the carbon tax is horizontally equitable as the price is universal, and it is up to the company to determine how to adjust their performance based on that cost. Similar to the status quo, vertical equity can be difficult as sector have different levels of reliance on fossil fuels and processes that produce GHG emission. Transitional

equity In general, carbon pricing rates medium in terms of equity as there are ways to improve the equity in design, but there will be trade-offs in implementation that will create winners and losers.

The emission-intensity regulatory program set out by the federal government appears to be horizontally equitable, in that it all regulated facilities are required to improve intensity rates by a certain number of percentage points, treating all within the same industry identically. Vertical equity is more problematic in that some sectors with fewer technological developments or innovations available to improve emission intensity will have a harder time achieving improvements, and may need to purchase emission credits to make up for noncompliance with the intensity standard. But the exact impact depends on the specific way the regulations are introduced. If the government takes into account the differences across industry, inequity can be reduced. The plan also provides credit for early actors, which helps to address transitional equity.

8.1.4. Administrative Feasibility and Cost

The administrative feasibility of each policy approach takes into account the amount of work required in terms of the creation and implementation of new programs or markets (for trading, monitoring, and certification) and other government infrastructure. This criterion also takes into account the public resources that would be necessary for each option; in other words, cost.

Voluntary action does not require any additional government administration or financial resources, so it receives a high rating. The administrative feasibility of the status quo is also high, as it is already in place and does not require any additional administrative capacity or investments.

To increase carbon pricing through the raising the carbon tax rate, the level of administrative feasibility would be high. A new schedule of carbon tax increases would require a new carbon tax plan as directed under the Carbon Tax Act. Otherwise, all necessary administrative support is already in place for the implemented carbon tax. The financial imposition of a carbon tax increase on public funds would be positive. The government would collect more revenue. Currently more than 100% of carbon tax is returned to BC in the form of tax cuts and credits to households and sectors who have

been most impacted by the carbon tax, which goes beyond revenue neutrality to become a revenue drain. The increased amounts collected with an increase in the carbon tax could be similarly reinvested in hard-hit sectors or used for other provincial climate action endeavours to reduce overall GHG emissions.

For a regulatory framework, the administrative feasibility is rated as medium. There is already some level of government infrastructure in place with the reporting regulations to monitor emissions. The administration of credits and offsets would involve additional capacity but is not expected to add significant complexity. The fact that there is a government document that lays out the plan indicates that administrative considerations have already been deemed affordable. The cost for implementation of the proposed federal performance standard regulation is rated as medium. Implementation would require some resources to put a management and monitoring system in place. The fact that such a system has already been proposed suggests that cost are not viewed as prohibitive, if the lack of implementation is assumed to have more to do with political will than cost barriers.

8.2. Results of Criteria Analysis

The criteria matrix (Table 25) summarizes the results of the criteria analysis. Equity receives the same medium rank across all options, and therefore is not included as it does not provide differentiation.

Table 25. Criteria matrix

Criteria	Voluntary action	Status quo	Increased carbon price	Performance regulation
Effectiveness	Low	Low	High	Medium
Acceptability	High	Medium	Medium	Low
Administrative feasibility	High	High	High	Medium

The criterion that has the most significance for emission reductions is effectiveness. In this regard, the analysis indicates that an increased carbon price is the best option. It is the only policy option that ranks as highly effective. Increasing the carbon tax also rates high in administrative feasibility, with a medium rating in

acceptability. With a priority on effectiveness, performance regulation is determined to be the second-best option, though its low acceptability would prove problematic. The voluntary action approach and the status quo are the least favoured options for further reductions of industrial GHG emissions due to low effectiveness ratings. While voluntary action has positive results for the other criteria, these results do not compensate for its low effectiveness score as a stand-alone policy.

9. Policy Strategy

9.1. Policy Recommendation

In order to reduce the risk of industrial emissions increasing in BC and achieve substantial reductions in industrial GHG emission in the near future, the price of carbon must increase. While action to create a higher cost for GHG emissions by any policy means would be an improvement, the advantage of an increased carbon tax in BC is that it could be implemented swiftly and easily, and is expected to be highly effective. A significant carbon price is likely to spur companies that have hit an emission reduction plateau back to action. Those with quality climate change policies may already have GHG mitigation projects under consideration that have not yet been implemented only because the marginal abatement cost for further emission reductions is too high in the current climate policy environment. An increased carbon price encourages those companies who have only recently started making significant reductions to continue such pursuits, and those with minimal concern for climate action might be incentivized to start investing in GHG emission abatement.

It would be possible to ramp up other climate policy effort to compliment an increase in the carbon tax and enhance impacts. Further reporting requirements would help identify climate leaders, improve performance oversight, enable investors to better identify progressive and effective companies, and help sectors move towards the ‘best practice frontier’. Emission intensity regulations could play an important role alongside an increased carbon tax by reigning in GHG emissions not currently captured by the carbon tax, such as those from industrial processes and fugitive sources. However, the first-best policy option is a new schedule of increases in the BC carbon tax to reach levels near $100 per tonne by 2020. Other policy options cannot compare in stand-alone effectiveness.

9.2. Considerations from Corporate Assessment

The relationship between corporate climate change policy and performance can help enhance the effectiveness of policy to reduce industrial emissions. Those companies with high quality climate policies are likely to be lead the way in innovations when the cost of emissions becomes substantial enough, as they did for the 'low hanging fruit' of energy efficiencies. Press (2007) asserts that through identifying best-performing firms, policy makers can push for all sector members to approach the 'best practice frontier'. While emission reporting provides some opportunity for the public, researcher, government and corporations themselves to gauge performance, requiring emission-intensity rates as well would be revealing and relevant. The current performance plateau is likely to vanish when economic incentives make further investments in emission reductions viable.

9.3. Considerations from Sector Analysis

The assessment of corporate climate change policies also identifies sectors in BC that deserve particular attention to ensure industrial emission reductions are achieved. The oil and gas sector has not been as motivated to engage in voluntary action or impacted by the current carbon tax in relation to other sectors. Focussed efforts might be necessary to encourage climate action from oil and gas companies. Further rationale for singling out oil and gas sector is their high estimated emission intensity in terms of GDP (Table 21). Increased economic activity in this sector is estimated to result in greater emission outputs than most other sectors. The mineral (cement) industry also warrants special attention for its estimated emission intensity rate, which is much higher than all other sectors. Additional policy that might encourage technology innovation and other emission reductions strategies in these identified sectors could help keep industrial GHG emissions on a downward trajectory.

9.4. Considerations for BC's Carbon Tax Review

In light of the impending review of BC's carbon tax, several issues identified in this research should be considered. First, industrial GHG emissions will almost certainly increase if the carbon tax is removed, and it is most likely that they will increase even if the carbon tax remains at its current rate. Second, most companies operating emission-intensive facilities in BC highlight the uncertainty of climate policy as a business risk in their corporate reporting. Third, several of these companies have expressed a preference for carbon pricing in their public corporate documents.

A retraction of the carbon tax would disadvantage companies that have already invested in emission reduction technologies based on their marginal abatement cost at the current carbon tax rate. As indicated, most companies have acknowledged that climate change policy will be part of the future business environment, whether BC remains on its climate action path or not. The tax review presents an opportunity for BC to conduct research for the next round of rate increases. With the statistical information available to the government, a more in-depth assessment of how different companies and sectors have reacted to increased carbon tax rates could enable the modelling of marginal abatement curves. Such analysis would provide some precision to determine the level of carbon tax necessary to affect emission-intensive sectors.

10. Conclusions

10.1. What Was Found

Without stronger government policy, industrial emissions have the potential to rise with economic recovery in BC. GHG emissions from industry contribute over one-third of BC's annual emission, and they have not seen substantial decreases in the last few years. For BC to meet its 2020 target of GHG output below its 2007 level, industry in one of the sectors with an important role to play. Companies have taken some voluntary action to bring down emissions, but there will not be further gains on this front as it appears that all of the 'low-hanging fruit' of energy efficiencies have been realized.

The limited data available for BC industrial emitters suggests that the BC carbon tax and other government signalling might have encouraged emission reductions from companies that had not shown previous improvements. By putting a price on carbon, some companies seem to have been compelled to invest in GHG mitigation measures. Production decreases due to the recession also played a significant role in reductions. In both cases, reductions will not continue if the price of carbon does not increase. For long-term reductions, all firms need to be pushed beyond the performance plateau with a carbon price high enough to encourage greater investments in technological change, particularly as production levels increase.

The carbon tax presents the most efficient and effective method to affect industrial emissions performance in the short term, and companies already anticipate higher carbon prices. The certainty that a schedule of future carbon tax rates would bring could help companies plan and put BC on track to meet its 2020 GHG target.

10.2. What Was Missing

Limitations in data availability, time and expertise had an impact on the scope of this study. The population of emission-intensive facilities was constrained by the historical data for BC facilities from the GHGRP. More precise methodology could have been utilized if the population of facilities that emit more than 100 kt of CO_2e annually was larger. In more recent years the threshold for reporting requirements has dropped, which means more companies are now included, but not enough time has elapsed for proper evaluation.

A nation-wide comparison of industrial emitters would provide a clearer picture of the effect that the carbon tax has had in BC, but such an undertaking was too complex to consider in terms of jurisdictional differences and time constraints. Alternatively, a comparison to other provinces could also help determine the impact of the BC carbon tax, particularly through selecting specific sectors for comparison. Sectors with comparable production levels and divergent policy environments provide optimal conditions for determining corporate emission performance with and without a carbon tax.

The ability to obtain production data would allow for further analysis of sectors beyond pulp and paper mills or oil refineries. Production data could also allow for an assessment of GHG intensity per unit that might be compared within a sector and across jurisdictions to determine how efficiently BC facilities are operating compared with similar facilities in other provinces or countries. Such as study might have been best conducted with a sector-specific approach, and could have allowed for more careful examination of the impacts of the recession and other economic considerations. A closer examination of individual sectors could also allow for an assessment of technical change possibilities that would cause the marginal cost of abatement curve to shift downward.

Another further area of research is specific carbon tax modelling to determine the rates necessary for BC's economy and GHG targets. The national estimate of $100 per tonne of carbon by 2020 has been used in the meantime, but it would be preferable to have modelling conducted for BC alone. (As mentioned, it would be ideal if the provincial review of the carbon tax might take this into consideration.) The impact and make-up of

industrial facilities in BC differs from the national inventory, and other sectors such as transportation make a much larger contribution provincially than nationally. It has also been identified that different sectors have varying emission intensities, though these cannot be properly calculated with current public data. Research into proportionate target reductions for industry (and even particular industries) relative to other sources of emissions (such as transportation) could help craft more effective climate policy for BC.

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Appendices

Appendix A. Company Listing

Table 26. Companies with highest GHG emission facilities in BC[a]

Company	# of facilities	Sector	2010 Earnings (millions)	Headquarters
Canfor Pulp Products Inc.	2	Pulp and Paper	$230	Canada
Catalyst Paper Corporation	1	Pulp and Paper	($397)[b]	Canada
Domtar Pulp and Paper	1	Pulp and Paper	$605	Canada
West Fraser Timber	1	Pulp and Paper	$438	Canada
Chevron Corporation	1	Oil and Gas	$119,641	Canada
Husky Oil Operations Ltd.	1	Oil and Gas	$1,173	Canada
Penn West Exploration	1	Oil and Gas	$3,034	Canada
Spectra Energy	5	Oil and Gas	$2,101	US
TransCanada	1	Oil and Gas	$3,900	Canada
Graymont Western Canada Inc.	1	Minerals (Cement)	n.d.a.[c]	Canada & US
Heidelberg Cement	1	Minerals (Cement)	$1,782	Germany
Lafarge Group	2	Minerals (Cement)	$21,601	France
Rio Tinto	1	Metal Manufacturing	$26,000	UK
Teck Resources Limited	5	Metal Manufacturing Mining	$4,297	Canada
BC Hydro	2	Utilities	n.d.a.[d]	Canada

[a] With five years or more of data reported to GHGRP

[b] Catalyst Paper had a loss of $397 million in 2010.

[c] Graymont Western Canada is a private company and does not share its earnings.

[d] BC Hydro is a crown corporation owned by the Province of British Columbia.

Appendix B. Company Scorecard

Table 27. Assessment results *(see next page for legend)*

	Canfor	Catalyst	Domtar	West Fraser	Chevron	Husky	Penn West	Spectra	Trans Can	Gray-mont	Heidel-berg	Lafarge	Rio Tinto	Teck	BC Hydro
POLICY															
Policy & approaches	High	High	High	High	Medium	Medium	Low	Low	Low	Low	Medium	High	High	High	High
Key bus. concern	Yes	Yes	Yes	Partial	No	No	No	No	No	Partial	Partial	Yes	Yes	Partial	Yes
Reduction commit.	Yes	Yes	Partial	Partial	Partial	No	No	No	No	Partial	Partial	Yes	Yes	Partial	Yes
GOVERNANCE															
Executive*	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes
Board committee*	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes
RISK ASSESSMENT															
Risk identified	No	No	No	No	No	No	No	No	Partial	No	No	Yes	Yes	No	Yes
INVENTORY															
GHG data history	Long	Long	Medium	Medium	Medium	Short	Long	Short	Medium	Medium	Medium	Medium	Long	Long	Long
TARGETS															
Recent GHG target	In process	Yes	In process	No	Yes	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
Absolute/ relative	Relative	Absolute	n.d.a	n/a	Absolute	n/a	n/a	n/a	n/a	n/a	Relative	Relative	Relative	Absolute	Absolute
IMPLEMENTATION															
Reduction plan	Partial	Yes	Partial	Partial	Partial	Partial	Partial	No	Partial	Partial	Yes	Yes	Yes	Partial	Yes
LEADERSHIP															
Initiatives	Medium	High	Medium	Medium	Medium	Low	Low	Medium	Medium	Low	Medium	High	High	High	Medium
TOTAL SCORE (/20)	**13**	**18**	**12**	**8**	**11**	**4**	**4**	**2**	**5**	**6**	**11**	**18**	**18**	**15**	**19**
OVERALL RATING	High	High	High	Medium	Medium	Low	Low	Low	Low	Low	Medium	High	High	High	High

Scoring: High/Yes/Long/Absolute/Both = 2; Medium/Partial/In process/Relative = 1; Low/No/Short/(n/a) = 0
*Except for Executive and Board Committee (Governance): Yes = 1; No = 0

Overall Rating: High = 12 to 20 (60% and above); Medium = 7 to 11 (<60% and >30%); Low = 0 to 6 (30% and below)

Table 28. Legend for assessment results

Performance Area	Description/Criteria	Measure
POLICY		
Policy statement & strategies on climate change/environment	Includes: 1) intent to reduce impacts (specifically emissions); 2) references targets/goals and continuous improvement; 3) mentions transparency/audits and monitoring; and 4) accompanied by aligned approaches	High: 3-4 criteria Medium: 2 criteria Low: 0-1 criterion
Key business concern	Climate issues mentioned in context of business plan; i.e., aligned with business strategy	Yes: strongly aligned Partial: mentioned No no mention
Reduction commitment	Company makes specific commitment to reduce GHG emissions (or at least acknowledge an effort to reduce: "strives for", "aims to" reduce emissions)	Yes: commitment Partial: reduction effort No: no mention
GOVERNANCE		
Executive officer	Executive assigned to environment	Yes/No
Board committee	Board committee for environment	Yes/No
RISK ASSESSMENT		
Risk identified	Identification of climate hazards and references to adaptation in corporate risk assessment	Yes: hazard & adaptation Partial: hazards only No: neither identified
INVENTORY		
Historical GHG data	Company reports historical GHG data	High: before 2000 Medium: 2000 - 2005 Low: 2005 or later
TARGETS		
Recent GHG target	GHG target in place (or under development)	Yes: target in place In process: medium score No: no target found
Absolute/relative	Absolute or relative (intensity-based) GHG target	Absolute: high score Relative: medium score N/a: not applicable (low) N.d.a: no data available

IMPLEMENTATION		
Reduction plan	Company reports on comprehensive plan/approach to reduce GHG emissions	Yes: comprehensive plan Partial: limited approach No: no plan identified
LEADERSHIP		
Certifications/ initiatives (refer to Appendix C for description of certification/initiative)	Level of participation in major climate initiatives and certifications (CDP, GRI) and other climate-related initiatives (ISO, WBCSD, UNGC, DJSI, CK Best 50, plus several sector-specific) **Points: Major initatives** (worth 1 point each) CDP: Yes = 1 (score above 50); Partial = 0.5 (answered questionnaire, not included, orscore below 50); No = 0 (no reference) GRI: Yes = 1 (checked by GRI); Partial = (self-assessed); No = 0 (no reference) **Points: Other initiatives** (worth 0.5 point each) ISO: Yes = 0.5 (referenced); No = 0 (no reference) WBCSD: Yes = 0.5 (member); No = 0 (not member) UNGC: Yes = 0.5 (signatory); No = 0 (not signatory) DJSI: Yes = 0.5 (listed); No = 0 (Not listed) CK Best 50: Yes = 0.5 (listed); No = 0 (not listed) WWF Climate Savers: Yes = 0.5 (participant); No = 0 (not participant) Sector-specific: High = 1 (more than one sector-specific climate initiative); Medium = 0.5 (one sector-specific climate initiative); None = 0	High: more than 4 points Medium: 2 to 4 points Low: less than 2 points

Appendix C. Company Certifications

Table 29. Participant companies in climate change initiatives and certifications

Name	Description	Companies	Website
Carbon Disclosure Project	Non-profit organization with world's largest database of primary corporate climate change information	Catalyst, Chevron, Domtar, Husky, Lafarge, Heidelberg, Penn West, Rio Tinto, Spectra, Teck	www.cdproject.net
Global Reporting Initiative	Non-profit organization that provides sustainability reporting framework	BC Hydro, Catalyst, Chevron, Domtar, Lafarge, Heidelberg, Rio Tinto, Spectra, Teck	www.globalreporting.org
International Organization for Standardization	14001: Internatiional standard for environmental management	Canfor, Catalyst, Domtar, West Fraser, Chevron, Spectra, TransCanada, Heidelberg, Lafarge, Rio Tinto, Teck, BC Hydro	www.iso.org
Dow Jones Sustainability Indexes	Track the financial performance of world's leading sustainability-driven companies	Lafarge, Rio Tinto, Spectra, Teck, TransCanada	www.sustainability-indexes.com
United Nations Global Compact	Policy initative for businesses commited to human rights, labour, environment and anti-corruption principles	Catalyst, Lafarge, Rio Tinto, Teck	www.unglobalcompact.org
World Business Council for Sustainable Development	Global business organization to create a sustainable future for business, society and the environment	Chevron, Lafarge, Heidelberg, Rio Tinto	www.wbcsd.org
World Wildlife Fund Climate Savers	Partnerships with leading companies to deliver real, measurable and additional reductions in CO_2 emissions	Catalyst, Lafarge	www.wwf.panda.org
Corporate Knights Best 50 Corporate Citizens 2011	Corporate ranking for environmental and social citizenship	BC Hydro (5th), Catalyst (13th), Domtar (3rd), Teck (28th), TransCanda (44th)	www.corporateknights.ca

Appendix D. Company GHG Emissions

Table 30. GHG emissions and change by company for BC facilities, 2004 to 2010

Company	2004	2005	2006	2007	2008	2009	2010	Emission Change 2004-2010	Emission Change 2007-2010
Canfor Pulp (2)	285[a]	261	244	249	243	256	233	-18.0%	-6.1%
Catalyst (1)	155	127	128	149	162	112	132	-14.8%	-11.4%
Domtar (1)	103	172	127	112	108	110	204[b]	97.3%	82.6%
West Fraser (1)	120	116	104	104	103	90	81	-32.6%	-22.0%
Chevron (1)	456	429	466	476	341	466	408	-10.5%	-14.2%
Husky Energy (1)	101	107	n.d.a.	120	128	133	128	26.9%	6.7%
Penn West (1)	240	211	190	142	151	118	99	-59.0%	-30.8%
Spectra Energy (5)	4,534	4,452	3,679	3,133	3,729	3,457	3,473	-23.4%	10.9%
TransCanada (1)	254	194	241	312	224	231	246	-3.2%	-21.1%
Graymont (1)	139	128	139	196	117	124	122	-12.8%	-37.9%
Heidelberg (1)	1,034	1,013	1,028	1,047	963	591	727	-29.7%	-30.5%
Lafarge (2)	1,033	1,048	1,081	1,156	1,052	594	640	-38.1%	-44.7%
Rio Tinto (1)	1,472	1,182	1,052	1,137	1,205	1,196	924	-37.3%	-18.8%
Teck (5)	1,580	1,540	1,516	1,682	1,647	1,493	1,288	-18.5%	-23.5%
BC Hydro (2)	400	235	517	232	335	299	202	-49.5%	-12.8%

[a] GHG data missing for one facility in 2004; used 2005 amount in its place.

[b] GHG data for 2010 not consistent with previous years; N_2O increased 375% compared to 2009 amount. (Inquiry sent to BC Climate Secretariat – currently checking to see if N_2O and CH_4 amounts for Domtar's Kamloops mill are correct. Not yet determined at time of writing.)

Appendix E. Company Intensities

Table 31. BC facility emission intensities by GDP[a], 2004 to 2010

	2004	2005	2006	2007	2008	2009	2010
Oil and gas[a]							
Facility Emissions (kt CO_2e)	5,585	5,393	4,676	4,183	4,574	4,406	4,354
GDP ($ million)	2,816	3,010	3,152	3,077	2,966	2,890	2,976
Intensity (kt CO_2e/$ million)	1.98	1.79	1.48	1.36	1.54	1.52	1.46
Electric power							
Facility Emissions (kt CO_2e)	400	235	517	232	335	299	202
GDP ($ million)	2,119	2,588	2,310	2,651	2,469	2,392	2,300
Intensity (kt CO_2e/$ million)	0.19	0.09	0.22	0.09	0.14	0.12	0.09
Paper							
Facility Emissions (kt CO_2e)	663	676	604	613	616	568	650
GDP ($ million)	1,549	1,669	1,615	1,698	1,476	1,286	1,300
Intensity (kt CO_2e/$ million)	0.43	0.40	0.37	0.36	0.42	0.44	0.50
Minerals (cement)							
Facility Emissions (kt CO_2e)	2,207	2,189	2,249	2,399	2,132	1,310	1,489
GDP ($ million)	512	513	561	681	582	423	397
Intensity (kt CO_2e/$ million)	4.31	4.27	4.01	3.52	3.66	3.10	3.75
Mining and Metals							
Facility Emissions (kt CO_2e)	3,052	2,722	2,568	2,820	2,853	2,689	2,211
GDP ($ million)	2,162	2,114	1,936	1,921	1,897	1,737	1,854
Intensity (kt CO_2e/$ million)	1.41	1.29	1.33	1.47	1.50	1.55	1.19
Total							
Facility Emissions (kt CO_2e)	11,908	11,214	10,614	10,246	10,509	9,271	8,906
GDP ($ million)	9,158	9,894	9,574	10,028	9,390	8,728	8,827
Intensity (kt CO_2e/$ million)	1.30	1.13	1.11	1.02	1.12	1.06	1.01

[a] GDP is proved in chained 2002 dollars.

[b] GDP amounts for petroleum manufacturing are not available.

[c] Utilities includes only electric power.

Appendix F. Voluntary Action Scenario

Table 32. Expanded version of potential 2010 scenario without BC carbon tax

Company	**2004** Actual	**2007** Actual	**2010** Actual	**Emission Change** 2004-07	**Emission Change** 2007-10	**2010** without carbon tax	2010 scenario amount	Quality of climate change approach
BC Hydro	400	232	202	-42.10%	**-12.80%**	202	Same	High
Rio Tinto	1,472	1,137	924	-22.70%	**-18.80%**	924	Same	High
Canfor	168	249	233	-12.70%	**-6.10%**	233	Same	High
West Fraser	120	104	81	**-13.60%**	-22.00%	90	New	Medium
Chevron	456	476	408	**4.30%**	-14.20%	496	New	Medium
Heidelberg	1,034	1,047	727	**1.20%**	-30.50%	1060	New	Medium
Graymont	139	196	122	**40.50%**	-37.90%	275	New	Low
TransCan	254	312	246	**22.70%**	-21.10%	383	New	Low
Husky	101	120	128	**18.90%**	6.70%	143	New	Low
Lafarge	1,033	1,156	640	11.90%	**-44.70%**	640	Same	High
Teck	1,580	1,682	1,288	6.50%	**-23.50%**	1,288	Same	High
Catalyst	155	149	132	-3.80%	**-11.40%**	132	Same	High
Domtar[a]	103	112	204	**8.10%**	82.60%	121	New	High
Penn West[b]	240	142	99	-40.80%	**-30.80%**	99	Same	Low
Spectra[b]	4,534	3,133	3,473	-30.90%	**10.90%**	3,473	Same	Low

[a] For Domtar, expectation is that 2010 amount is a mistake or takes into account new measurements that cannot be compared; therefore default to 2004-07 amount.

[b] For Penn West and Spectra, assume that they are acting with little regard for emission performance in either period; therefore would have same result without carbon tax.

Appendix G. Company Assessments

Table 33. Company assessment: Canfor Pulp

CANFOR	Ranking	Score	Details
Policy			
Policy statement & approaches	High	2	All four aspects covered: reduction, objectives, auditing, other approaches (Sustainable Enterprise Program)
Key business concern	Yes	2	"regards sustainability as inseparable from business strategy"
Reduction commitment	Yes	2	"invested heavily"
Governance			
Executive officer*	Yes	1	
Board committee*	No	0	
Risk Assessment			
Risk Identified	No	0	
Inventory			
Historical GHG data	Long	2	Starting in 1998
Targets			
Recent GHG target	In process	1	To be set in 2011
Relative/absolute	Relative	1	Intensity measure
Implementation			
Reduction Plan	Partial	1	References several projects to reduce emissions under specific programs: Green Transformation and Pacific Carbon Trust
Leadership			
Certifications/initiatives	Medium	1	CDP (partial), ISO, 4 of 8 sector-specific
OVERALL RATING	**High**	**13**	

Scoring: High/Yes/Long/Absolute/Both = 2; Medium/Partial/In process/Relative = 1;
Low/No/Short/(n/a) = 0
*Except for Executive and Board Committee (Governance): Yes = 1; No = 0

Overall Rating: High = 12 to 20 (60% and above); Medium = 7 to 11 (<60% and >30%);
Low = 0 to 6 (30% and below)

Table 34. Company assessment: Catalyst

CATALYST	Ranking	Score	Details
Policy			
Policy statement & approaches	High	2	All four aspects covered: reduce, objectives/targets, transparent, other approaches (Carbon Reduction Strategy, WWF Climate Savers commitment, etc.)
Key business concern	Yes	2	Based on extent of climate change approaches and reduction plans
Reduction commitment	Yes	2	Carbon Reduction Strategy
Governance			
Executive officer*	Yes	1	
Board committee*	Yes	1	
Risk Assessment			
Risk Identified	No	0	
Inventory			
Historical GHG data	Long	2	Starting in 1993
Targets			
Recent GHG target	Yes	2	2020: 169 kT (33% below 2007)
Relative/absolute	Absolute	2	
Implementation			
Reduction Plan	Yes	2	
Leadership			
Certifications/initiatives	High	2	CDP: leader; GRI: C level (self-assessed), ISO, UNGC, WWF Climate Savers, Best 50 CK (13th), 6 of 8 sector-specific (forestry)
OVERALL RATING	**High**	**18**	

Scoring: High/Yes/Long/Absolute/Both = 2; Medium/Partial/In process/Relative = 1;
Low/No/Short/(n/a) = 0
*Except for Executive and Board Committee (Governance): Yes = 1; No = 0

Overall Rating: High = 12 to 20 (60% and above); Medium = 7 to 11 (<60% and >30%);
Low = 0 to 6 (30% and below)

Table 35. Company assessment: Domtar

DOMTAR	Ranking	Score	Details
Policy			
Policy statement & approaches	High	2	All four aspects covered: reduce, set/review/update goals, 3rd party verify, other approaches (Sustainable Growth)
Key business concern	Yes	2	"Sustainability will reamin priority… will play a key role in our growth over time"
Reduction commitment	Partial	1	"strive to continually reduce the environmental footprint of our operations by emitting less"
Governance			
Executive officer*	Yes	1	
Board committee*	Yes	1	
Risk Assessment			
Risk Identified	No	0	
Inventory			
Historical GHG data	Medium	1	Starting in 2002
Targets			
Recent GHG target	In process	1	2010: In development
Relative/absolute	n.d.a.	1	
Implementation			
Reduction Plan	Partial	1	Not specific: "projects that increase energy efficency and minimize reliance on fossil fuel"
Leadership			
Certifications/initiatives	Medium	1	CDP: 66, GRI: C+, GRI-checked, ISO, CK Best 50 (3rd), 4 of 8 sector-specific
OVERALL RATING	**High**	**12**	

Scoring: High/Yes/Long/Absolute/Both = 2; Medium/Partial/In process/Relative = 1;
Low/No/Short/(n/a) = 0
*Except for Executive and Board Committee (Governance): Yes = 1; No = 0

Overall Rating: High = 12 to 20 (60% and above); Medium = 7 to 11 (<60% and >30%);
Low = 0 to 6 (30% and below)

Table 36. Company assessment: West Fraser

WEST FRASER	Ranking	Score	Details
Policy			
Policy statement & approaches	High	2	Three of four aspects covered: minimize/ eliminate impacts; set/review objectives; other approaches: Sustainability Commitment; (missing: transparency/monitor)
Key business concern	Partial	1	"We work… to ensure environmental, social and economic values are balanced appropriately"
Reduction commitment	Partial	1	"take meaningful and ongoing steps..[to] reduc[e] greenhouse gas emissions"
Governance			
Executive officer*	No	0	
Board committee*	Yes	1	
Risk Assessment			
Risk Identified	No	0	
Inventory			
Historical GHG data	Medium	1	Starting in 2000
Targets			
Recent GHG target	No	0	
Relative/absolute	n/a	0	
Implementation			
Reduction Plan	Partial	1	Not specific: energy efficency/biomass projects
Leadership			
Certifications/initiatives	Medium	1	CDP: partal, ISO, 5 of 8 sector-specific
OVERALL RATING	**Medium**	**8**	

Scoring: High/Yes/Long/Absolute/Both = 2; Medium/Partial/In process/Relative = 1;
Low/No/Short/(n/a) = 0
*Except for Executive and Board Committee (Governance): Yes = 1; No = 0

Overall Rating: High = 12 to 20 (60% and above); Medium = 7 to 11 (<60% and >30%);
Low = 0 to 6 (30% and below)

Table 37. Company assessment: Chevron

CHEVRON	Ranking	Score	Details
Policy			
Policy statement & approaches	Medium	1	Two of four aspects covered: reduce emissions; transparency; (missing: objectives/goals; other approaches)
Key business concern	No	0	
Reduction commitment	Partial	1	"working to reduce"
Governance			
Executive officer*	Yes	1	
Board committee*	Yes	1	
Risk Assessment			
Risk Identified	No	0	
Inventory			
Historical GHG data	Medium	1	Starting in 2002
Targets			
Recent GHG target	Yes	2	2011: 60 Mt
Relative/absolute	Absolute	2	
Implementation			
Reduction Plan	Partial	1	Not specific: "The plan calls for reducing emissions and increasing energy efficiency"
Leadership			
Certifications/initiatives	Medium	1	CDP: leader, GRI: no grade, ISO, WBCSD, 1 sector-specific initiative
OVERALL RATING	**Medium**	**11**	

Scoring: High/Yes/Long/Absolute/Both = 2; Medium/Partial/In process/Relative = 1;
Low/No/Short/(n/a) = 0
*Except for Executive and Board Committee (Governance): Yes = 1; No = 0

Overall Rating: High = 12 to 20 (60% and above); Medium = 7 to 11 (<60% and >30%);
Low = 0 to 6 (30% and below)

Table 38. Company assessment: Husky

HUSKY	Ranking	Score	Details
Policy			
Policy statement & approaches	Medium	1	Two of four aspects covered: audit (monitoring); other approaches: GHG Management Strategy, (missing: objectives/goals; emission reduction statement)
Key business concern	No	0	
Reduction commitment	No	0	
Governance			
Executive officer*	Yes	1	
Board committee*	Yes	1	
Risk Assessment			
Risk Identified	No	0	
Inventory			
Historical GHG data	Short	0	Starting in 2006
Targets			
Recent GHG target	No	0	
Relative/absolute	n/a	0	
Implementation			
Reduction Plan	Partial	1	Not specific: "The plan calls for reducing emissions and increasing energy efficiency"
Leadership			
Certifications/initiatives	Low	0	CDP: 41 (partial), 1 sector-specific initiative
OVERALL RATING	**Low**	**4**	

Scoring: High/Yes/Long/Absolute/Both = 2; Medium/Partial/In process/Relative = 1;
Low/No/Short/(n/a) = 0
*Except for Executive and Board Committee (Governance): Yes = 1; No = 0

Overall Rating: High = 12 to 20 (60% and above); Medium = 7 to 11 (<60% and >30%);
Low = 0 to 6 (30% and below)

Table 39. Company assessment: Penn West

PENN WEST	Ranking	Score	Details
Policy			
Policy statement & approaches	Low	0	None of four aspects covered: "The Company's continuing policy is to meet or exceed all provincial and federal laws, regulations and standards pertaining to the environment."
Key business concern	No	0	
Reduction commitment	No	0	
Governance			
Executive officer*	No	0	
Board committee*	Yes	1	
Risk Assessment			
Risk Identified	No	0	
Inventory			
Historical GHG data	Long	2	Starting in 1996 (This information was collected in November 2011. As of April 2012, Penn West has removed historical GHG data from website.)
Targets			
Recent GHG target	No	0	
Relative/absolute	n/a	0	
Implementation			
Reduction Plan	Partial	1	Focus on CO_2 enhanced oil recovery and offsets
Leadership			
Certifications/initiatives	Low	0	CDP: 66
OVERALL RATING	**Low**	**4**	

Scoring: High/Yes/Long/Absolute/Both = 2; Medium/Partial/In process/Relative = 1;
Low/No/Short/(n/a) = 0
*Except for Executive and Board Committee (Governance): Yes = 1; No = 0

Overall Rating: High = 12 to 20 (60% and above); Medium = 7 to 11 (<60% and >30%);
Low = 0 to 6 (30% and below)

Table 40. Company assessment: Spectra

SPECTRA	Ranking	Score	Details
Policy			
Policy statement & approaches	Low	0	One of four aspects covered: setting goals (Missing: emission reduction statement; auditing/monitoring; other approaches)
Key business concern	No	0	
Reduction commitment	No	0	
Governance			
Executive officer*	Yes	1	
Board committee*	No	0	
Risk Assessment			
Risk Identified	No	0	
Inventory			
Historical GHG data	Short	0	Starting in 2007
Targets			
Recent GHG target	No	0	Identified that "a Spectra Energy-wide quantitative goal was not practical in driving further reductions at the business unit level"
Relative/absolute	n/a	0	
Implementation			
Reduction Plan	No	0	
Leadership			
Certifications/initiatives	Medium	1	CDP: leader, GRI: B (self-assessed), ISO, DJSI
OVERALL RATING	**Low**	**2**	

Scoring: High/Yes/Long/Absolute/Both = 2; Medium/Partial/In process/Relative = 1;
Low/No/Short/(n/a) = 0
*Except for Executive and Board Committee (Governance): Yes = 1; No = 0

Overall Rating: High = 12 to 20 (60% and above); Medium = 7 to 11 (<60% and >30%);
Low = 0 to 6 (30% and below)

Table 41. Company assessment: TransCanada

TRANSCANADA	Ranking	Score	Details
Policy			
Policy statement & approaches	Low	0	One of four aspects covered: continuous improvement (objectives/goals) Missing: emission reduction statement; auditing/monitoring; other approaches
Key business concern	No	0	
Reduction commitment	No	0	
Governance			
Executive officer*	No	0	
Board committee*	Yes	1	
Risk Assessment			
Risk Identified	Partial	1	
Inventory			
Historical GHG data	Medium	1	Starting in 2004
Targets			
Recent GHG target	No	0	
Relative/absolute	n/a	0	
Implementation			
Reduction Plan	Partial	1	General strategy: "conserving energy", "conducting research"
Leadership			
Certifications/initiatives	Medium	1	CDP: partial, ISO, DJSI, CK Best 50 (44th)
OVERALL RATING	**Low**	**5**	

Scoring: High/Yes/Long/Absolute/Both = 2; Medium/Partial/In process/Relative = 1;
Low/No/Short/(n/a) = 0
*Except for Executive and Board Committee (Governance): Yes = 1; No = 0

Overall Rating: High = 12 to 20 (60% and above); Medium = 7 to 11 (<60% and >30%);
Low = 0 to 6 (30% and below)

Table 42. Company assessment: Graymont

GRAYMONT	Ranking	Score	Details
Policy			
Policy statement & approaches	Low	0	None of four aspects covered: "Graymont is committed to responsibly meeting society's needs for quality lime and stone products through high levels of social, economic and environmental performance."
Key business concern	Partial	1	"Graymont is committed to protection of the environment… by controlling the impact of our operations on the environment."
Reduction commitment	Partial	1	"dedicated to producing lime with the lowest carbon dioxide emissions in the lime industry"
Governance			
Executive officer*	Yes	1	
Board committee*	Yes	1	
Risk Assessment			
Risk Identified	No	0	
Inventory			
Historical GHG data	Medium	1	Starting in 2004
Targets			
Recent GHG target	No	0	
Relative/absolute	n/a	0	
Implementation			
Reduction Plan	Partial	1	General plan: biomass fuel, energy efficiency
Leadership			
Certifications/initiatives	Low	0	None (private company)
OVERALL RATING	**Low**	**6**	

Scoring: High/Yes/Long/Absolute/Both = 2; Medium/Partial/In process/Relative = 1;
Low/No/Short/(n/a) = 0
*Except for Executive and Board Committee (Governance): Yes = 1; No = 0

Overall Rating: High = 12 to 20 (60% and above); Medium = 7 to 11 (<60% and >30%);
Low = 0 to 6 (30% and below)

Table 43. Company assessment: Heidelberg

HEIDELBERG	Ranking	Score	Details
Policy			
Policy statement & approaches	Medium	1	Two of four aspects covered: reduce emissions, goals (missing: auditing/monitoring; other approaches)
Key business concern	Partial	1	*Sustainability* is a key pillar of corporate strategy
Reduction commitment	Partial	1	"work continuously" to reduce CO_2 emissions
Governance			
Executive officer*	Yes	1	
Board committee*	No	0	
Risk Assessment			
Risk Identified	No	0	
Inventory			
Historical GHG data	Medium	1	Starting in 2002
Targets			
Recent GHG target	Yes	2	23% reduction compared to 1990 level by 2015
Relative/absolute	Relative	1	CO_2 per tonne of cement
Implementation			
Reduction Plan	Yes	2	Specific measures: use of composite cement (76% less clinker content); biomass fuel (20.5% of energy total in 2010)
Leadership			
Certifications/initiatives	Medium	1	CDP: partial, GRI: A (self-assessed), WBCSD, 1 sector-specific initiative
OVERALL RATING	**Medium**	**11**	

Scoring: High/Yes/Long/Absolute/Both = 2; Medium/Partial/In process/Relative = 1;
Low/No/Short/(n/a) = 0
*Except for Executive and Board Committee (Governance): Yes = 1; No = 0

Overall Rating: High = 12 to 20 (60% and above); Medium = 7 to 11 (<60% and >30%);
Low = 0 to 6 (30% and below)

Table 44. Company assessment: Lafarge

LAFARGE	Ranking	Score	Details
Policy			
Policy statement & approaches	High	2	All four aspects covered: reduce emissions, objectives, audits, other approaches
Key business concern	Yes	2	One of four business priorities (reducing environmental footprint)
Reduction commitment	Yes	2	Substantial emission targets ("2nd Generation commitments"), set up with WWF
Governance			
Executive officer*	Yes	1	
Board committee*	Yes	1	
Risk Assessment			
Risk Identified	Yes	2	Identifies "climate hazards"
Inventory			
Historical GHG data	Medium	1	Starting in 2000
Targets			
Recent GHG target	Yes	2	Reducing CO_2 emissions per ton of cement produced by 33% between 1990 and 2020
Relative/absolute	Relative	1	Per ton of cement
Implementation			
Reduction Plan	Yes	2	Specific measures: modernizing plants, improving industrial processes, alternative fuels
Leadership			
Certifications/initiatives	High	2	CDP: leader, GRI: A+ (GRI checked), OSI, WBCSD, UNGC, DJSI, WWF Climate Savers, 1 sector-specific initiative
OVERALL RATING	**High**	**18**	

Scoring: High/Yes/Long/Absolute/Both = 2; Medium/Partial/In process/Relative = 1; Low/No/Short/(n/a) = 0
*Except for Executive and Board Committee (Governance): Yes = 1; No = 0

Overall Rating: High = 12 to 20 (60% and above); Medium = 7 to 11 (<60% and >30%); Low = 0 to 6 (30% and below)

Table 45. Company assessment: Rio Tinto

RIO TINTO	Ranking	Score	Details
Policy			
Policy statement & approaches	High	2	All four aspects covered: reduce emissions, objectives, evaluate/monitor, other approaches
Key business concern	Yes	2	"Our focus on sustainable development [inc. "reduce environmental impacts"] provides the framework in which our business operates"
Reduction commitment	Yes	2	"We have targets to improve the energy and GHG intensities of all our operations."
Governance			
Executive officer*	No	0	
Board committee*	Yes	1	
Risk Assessment			
Risk Identified	Yes	2	Identifies "operations are vulnerable to the possible effects of climate change"
Inventory			
Historical GHG data	Long	2	Starting in 1996
Targets			
Recent GHG target	Yes	2	6% reduction between 2008 and 2013
Relative/absolute	Relative	1	
Implementation			
Reduction Plan	Yes	2	Program to reduce emissions in operations, understand/develop low emission product paths
Leadership			
Certifications/initiatives	High	2	CDP: 86, GRI: A+ (GRI checked), OSI, WBCSD, UNGC, DJSI, CR Index (UK)
OVERALL RATING	**High**	**18**	

Scoring: High/Yes/Long/Absolute/Both = 2; Medium/Partial/In process/Relative = 1; Low/No/Short/(n/a) = 0
*Except for Executive and Board Committee (Governance): Yes = 1; No = 0

Overall Rating: High = 12 to 20 (60% and above); Medium = 7 to 11 (<60% and >30%); Low = 0 to 6 (30% and below)

Table 46. Company assessment: Teck

TECK	Ranking	Score	Details
Policy			
Policy statement & approaches	High	2	All four aspects covered: reduce emissions, objectives, auditing, other approaches
Key business concern	Partial	1	*Sustainablity* refered to as a core value
Reduction commitment	Partial	1	"Goal" to reduce greenhouse gas emissions
Governance			
Executive officer*	Yes	1	
Board committee*	Yes	1	
Risk Assessment			
Risk Identified	No	0	
Inventory			
Historical GHG data	Long	2	Starting in 1990
Targets			
Recent GHG target	Yes	2	Implement 75 kt of CO_2e GHG reductions at existing operations (2015)
Relative/absolute	Absolute	2	
Implementation			
Reduction Plan	Partial	1	General: energy conservation and energy-efficiency projects
Leadership			
Certifications/initiatives	High	2	CDP: 68, GRI: A+ (GRI checked), OSI, UNGC, DJSI, CK Best 50 (28th), 2 sector-specific initiatives
OVERALL RATING	**High**	**15**	

Scoring: High/Yes/Long/Absolute/Both = 2; Medium/Partial/In process/Relative = 1;
Low/No/Short/(n/a) = 0
*Except for Executive and Board Committee (Governance): Yes = 1; No = 0

Overall Rating: High = 12 to 20 (60% and above); Medium = 7 to 11 (<60% and >30%);
Low = 0 to 6 (30% and below)

Table 47. Company assessment: BC Hydro

BC HYDRO	Ranking	Score	Details
Policy			
Policy statement & approaches	High	2	All four aspects covered: reduce emissions, targets, verification, other approaches
Key business concern	Yes	2	"Embedding environmental impacts into our decision-making"
Reduction commitment	Yes	2	"…including GHG emissions performance in our annual service plan targets."
Governance			
Executive officer*	Yes	1	
Board committee*	Yes	1	
Risk Assessment			
Risk Identified	Yes	2	"assess options to adapt our operations and activities to the potential physical impacts of climate change"
Inventory			
Historical GHG data	Long	2	Starting in 1995
Targets			
Recent GHG target	Yes	2	2012-13: 30 Kt, 2014: 29 Kt
Relative/absolute	Absolute	2	
Implementation			
Reduction Plan	Yes	2	Specific carbon neutral plan: fleet greening, electricity savings, server virtualization, etc.
Leadership			
Certifications/initiatives	Medium	1	CDP: NI, GRI: no grade, OSI, CK Best 50 (5th)
OVERALL RATING	**High**	**19**	

Scoring: High/Yes/Long/Absolute/Both = 2; Medium/Partial/In process/Relative = 1;
Low/No/Short/(n/a) = 0
*Except for Executive and Board Committee (Governance): Yes = 1; No = 0

Overall Rating: High = 12 to 20 (60% and above); Medium = 7 to 11 (<60% and >30%);
Low = 0 to 6 (30% and below)