BRITISH COLUMBIA’S ‘CARBON NEUTRAL GOVERNMENT’ MANDATE
– INFLUENCE ON INFRASTRUCTURE DECISIONS

by

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Abstract

The ‘carbon neutral government’ mandate in British Columbia offers an excellent opportunity to study whether requiring public sector organizations to be ‘carbon neutral’ is an effective policy within an overall strategy to drastically reduce greenhouse gas emissions. While many have criticized the use of offsets to achieve ‘carbon neutrality’ and channeling of public funds to the private sector, others have pointed out that the mandate has forced public sector organizations to measure and manage their greenhouse gas emissions, and incentivized them to proceed with infrastructure projects that significantly reduced these emissions. Using a mixed methods case study approach, four post-secondary educational institutions in the Greater Vancouver region were selected, to investigate whether the ‘carbon neutral government’ mandate has influenced their decisions on infrastructure investments that would significantly reduce these organizations’ emissions. Through analyzing data on greenhouse gas emissions, energy consumption and expert interviews, this study provides a better understanding of the factors that motivate public sector organizations to take action to drastically reduce their greenhouse gas emissions, including the need to provide adequate resources and support mechanisms that will enable them to act so as to achieve the best possible policy outcome.
Preface

This research was completed by Kim Yang Lau in part to fulfill the requirements of the Master of Arts degree at the Institute for Resources, Environment and Sustainability. The document analysis, expert interviews, transcription, analysis, and writing were all completed by Kim Yang Lau. The scope and methodology for this research were developed under the guidance of the Supervisory Committee. Some sections of Chapters 2 and 6 are based on research completed earlier by the author for the Pacific Institute for Climate Solutions and published as a White Paper and two Briefing Notes. This research project was approved by the University of British Columbia Behavioural Research Ethics Board, certificate number H10-02519.
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<tbody>
<tr>
<td>AASHE</td>
<td>American Association for Sustainability in Higher Education</td>
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<td>BC</td>
<td>British Columbia</td>
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<tr>
<td>BCIT</td>
<td>British Columbia Institute of Technology</td>
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<tr>
<td>BRDF</td>
<td>Bioenergy Research and Demonstration Facility</td>
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<td>CAC</td>
<td>Command and Control</td>
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<td>CAP</td>
<td>Climate Action Plan</td>
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<td>CARIP</td>
<td>Climate Action Revenue Incentive Programme</td>
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<td>CAS</td>
<td>Climate Action Secretariat</td>
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<td>CEEI</td>
<td>Community Energy and Emissions Inventory</td>
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<tr>
<td>CFL</td>
<td>Compact Fluorescent Lamp</td>
</tr>
<tr>
<td>CIRS</td>
<td>Centre for Interactive Research on Sustainability</td>
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<td>CNAR</td>
<td>Carbon Neutral Action Report</td>
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<td>CNCP</td>
<td>Carbon Neutral Capital Programme</td>
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<td>CNG</td>
<td>Carbon Neutral Government</td>
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<tr>
<td>CNGR</td>
<td>Carbon Neutral Government Regulation</td>
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<tr>
<td>CO₂e</td>
<td>Carbon Dioxide equivalent</td>
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<tr>
<td>COP</td>
<td>Continuous Optimization Programme</td>
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<tr>
<td>DDC</td>
<td>Direct Digital Control</td>
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<tr>
<td>DO</td>
<td>Douglas College</td>
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<tr>
<td>EIS</td>
<td>Environmental Impact Statement</td>
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<tr>
<td>ESCO</td>
<td>Energy Service Company</td>
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<tr>
<td>FTE</td>
<td>Full-Time Equivalent</td>
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<td>GGRTA</td>
<td>Greenhouse Gas Reduction Targets Act</td>
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<td>GHG</td>
<td>Greenhouse Gas</td>
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<td>GJ</td>
<td>Gigajoules</td>
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<tr>
<td>GWh</td>
<td>Gigawatt-hour</td>
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<tr>
<td>HVAC</td>
<td>Heating, Ventilation, and Air Conditioning</td>
</tr>
<tr>
<td>KIP</td>
<td>Knowledge Infrastructure Programme</td>
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<tr>
<td>kWh</td>
<td>Kilowatt-hour</td>
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<tr>
<td>LED</td>
<td>Light Emitting Diode</td>
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<tr>
<td>LEED</td>
<td>Leadership in Energy and Environmental Design</td>
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<tr>
<td>MNECB</td>
<td>Model National Energy Code for Buildings</td>
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<tr>
<td>NEPA</td>
<td>National Environmental Policy Act</td>
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<tr>
<td>NRCan</td>
<td>Natural Resources Canada</td>
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<tr>
<td>PCT</td>
<td>Pacific Carbon Trust</td>
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<tr>
<td>PICS</td>
<td>Pacific Institute for Climate Solutions</td>
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<td>PSECA</td>
<td>Public Sector Energy Conservation Agreement</td>
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<td>PSO</td>
<td>Public Sector Organization</td>
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<td>PVP</td>
<td>Public Voluntary Programme</td>
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<td>REAP</td>
<td>Residential Environmental Assessment Programme</td>
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<tr>
<td>SFU</td>
<td>Simon Fraser University</td>
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<tr>
<td>UBC</td>
<td>University of British Columbia</td>
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<tr>
<td>UBC-V</td>
<td>University of British Columbia Vancouver Campus</td>
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<tr>
<td>UNBC</td>
<td>University of Northern British Columbia</td>
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<tr>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>USI</td>
<td>UBC Sustainability Initiative</td>
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<tr>
<td>U.S.</td>
<td>United States</td>
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<tr>
<td>VCC</td>
<td>Vancouver Community College</td>
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1. Introduction

1.1 British Columbia’s Experiment

The government of British Columbia (BC) launched an ambitious climate action plan in 2007. Among the most challenging goals in this plan (Ministry of Environment, B.C. 2008) are legislated targets to reduce provincial greenhouse gas (GHG) emissions by 33% by 2020 and 80% by 2050, from a baseline in 2007 (British Columbia Government 2007). One of the tools in this plan is a revenue-neutral carbon tax, which started from $10 per tonne of carbon dioxide equivalent (CO₂e) in 2008 and increased by $5 a year to reach $30 per tonne CO₂e in July 2012. A second provision is a cap-and-trade system that was to be launched as part of the Western Climate Initiative, but further development and implementation of this tool in BC have been stalled for some time, despite California’s decision to proceed in 2012.

Another signature policy of BC’s climate action plan, which has not received as much international attention as the carbon tax, is a commitment that provincial government operations would be ‘carbon neutral’ by 2010. The government defines carbon neutrality as measuring its operational GHG emissions, reducing these where possible, offsetting the remainder to ensure net emissions are zero and demonstrating leadership through public reporting (Ministry of Environment, B.C. 2009). This ‘carbon neutral government’ (CNG) mandate is one of the most aggressive climate action targets, set so far, by a major jurisdiction in North America, and certainly among the earliest where substantial impacts, if any, can be observed. Its scale of involvement is large, covering more than 150 core government and public sector organizations (PSOs) with more than 7,000 public buildings, including all post-secondary educational institutions, health authorities, school districts and crown corporations. Moreover, the rapid passage of legislation and short timeframe given to PSOs to respond to this mandate suggest that prior to its
launch, policy analysis on the mandate may not have been sufficiently rigorous, considering its potential impact on both the public and private sectors.

This programme has also been extended to local governments in BC. While not mandatory, 180 out of 188 local governments have so far signed the Climate Action Charter (Ministry of Environment, B.C. 2013a). By committing to be ‘carbon neutral’ by 2012, these local governments would receive a grant equal to 100% of the carbon tax costs they have paid for their operations in the previous year, through the Climate Action Revenue Incentive Programme or CARIP (Ministry of Community, Sport & Cultural Development, B.C. 2013a). This commitment was subsequently relaxed, so that local governments can still receive the grant without being ‘carbon neutral’ from 2012, as long as they commit to take actions towards ‘carbon neutrality’ and “report publicly on their plan and progress toward meeting their climate action goals, including progress toward carbon neutrality” (Ministry of Community, Sport & Cultural Development, B.C. 2013b).

At the time of its launch in 2007, BC’s climate action plan placed the province among a small group of leading jurisdictions that have committed to take action to address climate change, despite the absence of an international agreement on emissions reduction. Some 4 years after, there are encouraging signs that the carbon tax has had some effect. Petroleum fuel consumption per capita in BC has dropped about 15%, while for Canada as a whole, there was a 1% increase (Elgie 2012). Meanwhile, there appears to have been little negative effect on BC’s economy over the period, with BC growing slightly more than Canada as a whole in per capita terms (Elgie 2012; Ministry of Environment, B.C. 2012c). Another study attributes the decline in motor gasoline demand largely to the carbon tax (Rivers and Schaufele 2013). While some point to these as evidence that the carbon tax is working and is positive for BC, others are more cautious, pointing out that the study period is too short and more data is required to establish this as a trend. In particular, these studies may not have
dealt adequately with an alternative explanation for the decline in fuel sales in BC, which is that higher prices due to the carbon tax may have encouraged more drivers to fill their tanks in neighbouring jurisdictions Washington and Alberta.

In light of the above finding for the carbon tax, a natural question to ask is whether the CNG mandate has similarly influenced fossil fuel consumption or energy use by PSOs, since PSOs have to pay the carbon tax from July 2008 and, on top of that, buy offsets for their carbon emissions from 2010 onwards. Given the above backdrop, BC’s experiment in climate change action offers an excellent opportunity to study whether requiring PSOs to be ‘carbon neutral’ is an effective policy to bring about lower emissions from organizations, within an overall strategy to drastically reduce GHG emissions from the province.

1.2 Carbon Neutral Government

In the run-up to the CNG implementation deadline of 2010, a report entitled “Taking Action: British Columbia’s Universities and Colleges Respond to the Greenhouse Gas Reduction Targets Act” was written on behalf of the BC Working Group and Network for Educational Sustainability. The authors interviewed staff at 3 government bodies and 9 post-secondary institutions in various regions of BC, in an attempt to assess the progress of the organizations towards meeting the government’s climate action plan targets. The report concluded that while some progress has been made, post-secondary institutions continue to face substantial barriers to achieving sustainability including bureaucratic inertia, a lack of money and lack of awareness and communication. The institutions interviewed said financing was the greatest challenge they face in implementing the Act and there was concern that without additional funding some institutions may be forced to make cuts in areas that could affect core programming (Webster and Moore 2009). Since then, there has been no systematic independent assessment of impacts arising from the CNG mandate, at the
organizational level.

The government's declaration of carbon neutrality in 2010 was met with skepticism from several quarters. A report pointed out that a very large proportion of PSO’s total GHG emissions is not covered under the CNG mandate (Lau and Dowlatabadi 2011a). Moreover, despite the attempts by many PSOs to reduce their energy use and emissions since the CNG mandate was first announced in late 2007, carbon neutrality was only achieved in 2010 through 2012 primarily through the purchase of offsets from emission-reduction projects within BC. A common criticism of this approach is that it allows organizations (or countries) to avoid making real changes to their own operations by off-loading services or by buying offsets. “In short, while some types of offsets can act as an effective means to address greenhouse gas emissions, they should not be seen as a license to pollute or as a means to continue unsustainable practices. Too often, offsets are used by governments and businesses as smokescreens to distract people from the need to cut emissions. By diverting people’s funds and attention to projects that are unlikely to reduce emissions significantly, some offset schemes could ultimately do more harm than good.” (Downie 2007)

Not surprisingly, some critics have questioned whether offsets represent real and ‘additional’ emission reductions, with one report even calling for BC to abandon its goal of a carbon neutral public sector (Jaccard and Griffin 2011). It should be noted here that with regard to the controversy over the benefits of carbon offsets, there are already many studies that focus on the challenges of determining additionality, verification and permanence of GHG reductions, among others (Mason and Plantinga 2013; Murray, Sohngen, and Ross 2007; Van Kooten, Bogle, and de Vries 2012).
Other critics have argued that the purchase of offsets siphons funds away from cash-strapped public agencies in BC to the private sector (Simpson 2011), even to the extent of reducing the ability of PSOs to invest in emission reduction projects or at the expense of service provision. Many critics have called for the scheme to be adjusted, for example, to allow funds to flow back to public bodies “to create a base of low-carbon public buildings” (Lee 2011). These calls are being repeated every so often, as PSOs continue to face budgetary shortfalls and other cost pressures, despite the fact that the offset purchases account for less than 0.05% of the BC public sector annual budget.

On the other hand, there is feedback from some PSOs that they are able to proceed with more GHG emission reduction projects because carbon pricing in the form of both the carbon tax and offset purchases has tilted the balance in business case evaluations (Barrett 2011) and “the high carbon price has led to real projects that are reducing emissions” (Lee 2011). New government funding from the Public Sector Energy Conservation Agreement (PSECA), amounting to $75 million over 3 years, has also helped to kick-start some major projects in the public sector. Moreover, many PSOs are measuring their GHG emissions for the first time using the government-developed software programme called SMARTTool, and are incentivized to manage these emissions (Barrett 2011).

It can be expected that while the direct footprint of the public sector is small, the mandate through both positive and negative spillover effects may generate more widespread consequences. Anecdotally, the mandate has spurred some consulting activities, increased demand for services in measurement and reduction of GHG, as well as created a market for offsets for close to 1 million tonnes of CO$_2$e per year through the Pacific Carbon Trust (PCT). By being an early mover, there could also be a potential positive spillover that the government will create a learning environment, increasing know-how for GHG measurement, audit and mitigation in
the province and reducing the cost of mitigation for other actors in the province. However, it is not clear how much this has translated into growth and jobs for BC’s ‘green’ economy, although some reports have painted relatively rosy pictures (Globe Foundation 2010; KPMG LLP Canada 2012).

1.3 Differential Performance of Public Sector Organizations

During the first three years of declared ‘carbon neutrality’, the quantity of emissions from the BC public sector that is covered by the CNG mandate showed a small increase overall. There were relatively large year-to-year fluctuations, probably due to variations in the weather over this period. There were also sectoral differences, for example between core government ministries and agencies and post-secondary institutions, which are examined in greater detail in Chapter 4.

Among the group of post-secondary institutions, emissions performance between 2010 and 2012 is varied. While some recorded increases of close to 20%, a few had only single-digit increases and others even a decrease of 10 to 20% in their emissions. There could be a number of explanations for the differences in emissions of these institutions, ranging from variability of weather conditions in different regions of BC during this short period of time, expanding enrolments and more facilities being brought on-stream, and past efforts of pursuing energy efficiency retrofits or new infrastructure projects that had already lowered GHG emissions. By examining closely the emissions performance of a selected number of PSOs, and gaining a deeper understanding of why they differed, it is possible to draw some lessons that could help other organizations to more effectively reduce their emissions.
1.4 Objectives of Study

For the large majority of environmental and climate policies, the bulk of policy analysis takes place before decisions are made, but relatively little analysis takes place after decisions have been made and implemented. However, retrospective evaluation of the performance of a policy or mandate can identify whether it is serving its purpose and ascertain what outcomes have actually been achieved, which is useful to inform policy deliberations and help move decision-making closer to an evidence-based practice (Bennear and Coglianese 2005). It can also consider whether there are other effects, particularly those that are unintended or undesirable. With information from retrospective evaluations of policies, policymakers will be better able to determine what policies to adopt and how to design them better in the future. It becomes a vital part of an adaptive management approach to environmental or climate policy (Holling 1978).

It is therefore an objective of this study to evaluate the impacts of the CNG mandate on PSOs since its announcement in 2007. Besides the impact on actual GHG emissions, the CNG mandate could also have had an influence on major decisions for infrastructure projects that would significantly reduce the GHG emissions of PSOs in future years, or motivate other initiatives and behavioural changes that contribute to reducing the demand for energy and hence resulting in lower emissions.

This study would also seek to find out whether the CNG mandate has mitigated any of the major constraints identified in previous studies, especially the study of BC institutions (Webster and Moore 2009), and whether support mechanisms provided by the provincial government or other government agencies have helped PSOs to overcome some of the constraints hindering emissions reduction projects and programmes. For the purpose of this study, the effectiveness of the CNG mandate is
indicated by a positive influence on decision-making for emission reduction infrastructure projects, as well as a sustained reduction in PSO's GHG emissions.

By bringing theories of decision-making and management science to bear on real issues faced by different PSOs, and drawing common lessons from these different decision contexts, the study will help to improve our understanding of the decision processes and trade-offs faced by these PSOs. In particular, by focusing attention on whether this mandate has influenced decisions on infrastructure investments that will significantly reduce the organizations’ emissions, this study aims to better understand the factors that motivate PSOs to reduce their GHG emissions, including the need to provide adequate resources and support mechanisms that will enable these organizations to act.

Moreover, by pointing out difficulties encountered during the first few years of implementation, this study can recommend improvements to be made to the mandate to enhance its effectiveness in mitigating climate change, strengthen support mechanisms and learning networks, including educational and capacity-building strategies. These recommendations can help to ensure that PSOs are provided with the assistance and tools they need to overcome barriers and adopt innovative solutions that will enable them to achieve the desired outcomes of the mandate. The lessons learnt from these could be helpful not only to the case study PSOs, but also to other PSOs and local governments in BC. In addition, the insights will be very useful, if and when a similar mandate is extended to or adopted by other organizations, sectors or jurisdictions.

### 1.5 Structure of Thesis

This thesis is divided into 7 chapters. Chapter 1 introduces the policy context in BC that offers an excellent opportunity to study whether requiring PSOs to be ‘carbon
neutral’ is an effective policy to drastically reduce GHG emissions from these organizations. Chapter 2 summarizes the insights from a review of the existing literature relevant to the topics under study. Chapter 3 describes the methodology selected for this study. Chapter 4 presents the findings from the document analysis and quantitative analysis of GHG emissions and energy consumption data, while Chapter 5 summarizes the findings from the expert interviews. Chapter 6 discusses the findings in relation to the propositions and research questions posed in this study and Chapter 7 concludes with the implications of the research findings, some policy recommendations and possible directions for future research.
2. Literature Review

2.1 Introduction

This chapter summarizes the insights from a review of the existing literature relevant to the topics for this study. These insights form the theoretical foundations and context for framing or scoping the study, identifying the research questions and formulating the methodology. They also help to select the key areas and questions that should be asked during the expert interviews, in order to ensure that information needed to understand the important categories or types of climate change actions undertaken by organizations, and critical factors that motivate organizations to take such action is collected. In addition, they provide the theoretical basis for analyzing quantitative data and qualitative information obtained from documents and expert interviews.

Section 2.2 explains the importance of taking an organizational perspective of climate change action and the need for more research on the roles of decision-making processes and change management efforts within public sector organizations in making transformative changes to organizational GHG emissions. Section 2.3 follows with an examination of the impact and effectiveness of different approaches for intervention, including government mandates, in achieving environmental or climate goals. Section 2.4 highlights the influence that policy boundaries can have on the effectiveness of a climate policy.
2.2 An Organizational Perspective of Climate Change Action

2.2.1 Importance of Organizations

Organizations can play an important and essential role in achieving the deep reductions in global GHG emissions that are required, if we are to avoid the most devastating impacts of climate change. Organizations are a ubiquitous feature of the modern society (Simon 1991) and “corporations are the fundamental cells of modern economic life and their phenomenal success in transforming the earth’s resources into wealth has shaped the physical and social world in which we live.” (Dunphy 2007) The industrial and commercial sectors account for significantly more of global GHG emissions than the individual/household sector. Yet, research on modification of environmental behavior has mainly targeted individuals or small groups (Nilsson, von Borgstede, and Biel 2004). Companies develop new technologies and produce consumer goods for the market, while public organizations administer and enforce policy tools to influence the behavior of target groups. Hence, through their activities, companies and other organizations create both direct and indirect effects on the environment and so it is useful to understand how climate change policies affect them (Nilsson, von Borgstede, and Biel 2004). Moreover, organizations, individually or as a group, control large amounts of resources. These resources are often critical for bringing about the changes that are needed to drastically reduce GHG emissions.

The organizational perspective is also important because organizations, whether public or private, are major discretionary consumers of goods and services. Consumption directly and indirectly accounts for the bulk of GHG emissions (Bin and Dowlatabadi 2005). Efforts to ‘green’ the economy therefore require an understanding of organizations as consumers, besides an understanding of individual end-user consumers. Organizations are “a dominant but under-emphasized force in greening the economy”, and there may be currently many more
opportunities for intervention in the organizations’ supply chains and inter-organizational networks, through changing how and what organizations consume, than there are for greening end-user consumption (Green, Morton, and New 2000).

2.2.2 Public Sector Organizations

A survey of the literature clearly shows that most climate change policies focus on influencing the private sector, whereas the performance of government agencies themselves has not been adequately scrutinized. One main reason is that direct emissions from the public sector are generally small (typically about 1–2%, depending on the role of governments). However, indirect emissions arising from their activities, and goods and services consumed by PSOs, are much more significant. For example, government procurement makes up about 15% of European Union economic activity (Erdmenger 2003).

Another reason for studying public sector organizations is the increasing recognition in recent years that every level of government has a role to play in addressing climate change, although that role is still being intensely debated (Collier and Lofstedt 1997; Rabe 2008; Lutsey and Sperling 2008; Aall, Groven, and Lindseth 2011). One issue is the appropriate scale of intervention. Given the global nature of the problem, the question often asked is whether state- or local-level climate change actions matter, or are they instead counter-productive to national and international efforts (Keeler 2007). What is clear, however, is that the drastic reduction of GHG required to stabilize global climates cannot be achieved without the active participation of all levels of government. Moreover, “because no single approach guarantees a sure path to ultimate success, the best strategy to address this ultimate commons problem may be to pursue a variety of approaches simultaneously.” (Stavins 2011)
The need for involvement of multiple levels of government may already be unavoidable, given the experience thus far with unsuccessful attempts at forging an agreement at the international level. Several national and sub-national governments have unilaterally proceeded with their own experiments, such as setting carbon-neutrality targets for their public sector or selected municipalities, and grouping together with similar jurisdictions to form regional emission markets. Some of these efforts are without doubt undertaken 'to lead by example', based on the premise that public sector action would influence private sector action, or at least enhance the political acceptance of regulation in future (Northrop 2004; Ball et al. 2009).

Governments have carried out many ‘experiments’ in the past involving both mandatory and voluntary programs for environmental protection. These could hold useful lessons that inform policies and implementation for climate change mitigation. In particular, an interesting aspect that has been under-studied is how government agencies themselves have performed in the face of regulation or mandates. If such mandates are effective, they may be an alternative, complementary or interim way to proceed, as part of a portfolio of different approaches involving multiple actors (Kok et al. 2002), especially where it is politically difficult to initiate regulation of the private sector.

2.2.3 Transformative Changes Needed

Deep reductions in global GHG emissions may only be achieved and sustained with transformative changes in the way the world produces and uses energy. Some of the most significant transformative changes involve infrastructure and management systems, such as switching to a lower-carbon form of energy or a more efficient heating system. Moreover, it may be necessary to shift from discrete goals and initiatives to more integrative and systemic approaches in energy efficiency and conservation (Dusyk et al. 2009). Individual attitudinal and behavioural changes can
also play a part, often aided by informational campaigns and small financial incentives. But these may bring about “at best incremental change, which is unstable, fragmented and subject to reversal” (Webb 2012).

For service organizations, including most public sector organizations, the bulk of their GHG emissions arise from stationary sources such as heating and cooling systems, and mobile sources such as their fleet of vehicles. Such infrastructure typically have long lifespans, so once installed, their GHG emissions are locked in for a lengthy period and further investment is usually required to significantly reduce their GHG emissions. For instance, based on their reports from 2010 to 2012, 90% or more of carbon emissions of post-secondary institutions in BC were from stationary emission sources, primarily heating and cooling of buildings. Hence, transformative changes to GHG emissions of service organizations and public sector organizations would likely hinge on decisions regarding investment in new infrastructure for energy production and use, as well as retrofit of older infrastructure.

2.2.4 Organizational Efforts

Over the last decade or so, several large organizations (e.g. Walmart) have voluntarily embarked on high-profile efforts towards more ‘sustainable’ ways of doing business. Some studies have praised these efforts, while others have criticized these as mere ‘green-washing’. For example, whilst Walmart has been lauded for its efforts to ‘green’ its supply chain, it has been blamed for causing an increase in emissions arising from construction of its mega-stores and increased traffic of shoppers (Wal-mart Watch 2007). There are few, if any, rigorous independent studies of how successful these private sector voluntary efforts have been in reducing GHG emissions. Part of the reason could be that these organizations have been unwilling to share detailed information, for competitiveness reasons.
Studies have also found mixed results on the link between corporate social and financial performance (Margolis and Walsh 2003; Busch and Hoffmann 2011). Corporate response to climate change “is highly ambiguous, with energetic efforts yielding few meaningful results” (Jones and Levy 2007). Corporate responses also tend to be directed towards organizational changes rather than emission reduction per se (Jones and Levy 2007). Most companies that have carbon neutrality goals are still in business-as-usual mode and have not undergone major transformation of their operations, except perhaps in tiny parts of their businesses, and corporate efforts in carbon neutrality are mostly achieved by offsets rather than reduction of own emissions (Hewitt 2008).

Many prominent post-secondary institutions (also referred to as ‘universities and colleges’), too, have increased their emphasis towards ‘sustainability’, most notably by their efforts to ‘green’ their campuses. These were accompanied by much-publicized commitments, such as the American College and University Presidents’ Climate Commitment. Since most of these institutions are accountable to the public for their performance, one might expect that it would be possible to obtain more information on these potentially transformative efforts compared to private companies. However, while there are a few success stories (Mascarelli 2009; Worth 2005), there are few independent studies that have produced strong evidence that these efforts have resulted in universities and colleges becoming more ‘sustainable’ (whatever the definition is), nor have their absolute level of GHG emissions been shown to decrease significantly. Most of these studies documented the commitments and actions taken, but do not quantify the outcome of these actions. Another study also found that sustainability appears to be something of a luxury good in higher education, since larger and wealthier institutions are more likely to adopt sustainability than smaller, less well-endowed institutions (Stafford 2011).
2.2.5 Decision-Making

To better understand what motivates these organizations to go beyond compliance to government regulations to achieve ‘sustainability’, ‘climate neutrality’ or simply to reduce their GHG emissions, we can look at how decisions are made to undertake transformative changes to their infrastructure, such as implementing an energy efficiency project. Several organizational or institutional theories have been put forward to explain the decision-making process and factors that influence decisions in organizations (Goitein 1989). Besides purely economic factors, such as energy cost, other factors like payback period, availability of funds and expertise have been found to be important in such decisions (Sorrell et al. 2000; Abadie, Ortiz, and Galarraga 2012).

Prior research on organizations has identified both external and internal drivers of corporate environmental response, including legislation, stakeholder pressures, economic opportunities, and ethical motives. Governments, in setting targets and benchmarks, effectively focus firms’ planning, execution, and measurement. These policies create a favorable environment in which companies can allocate funds or secure financing to pay for measures that might otherwise be more difficult to justify (Northrop 2004). (Bansal and Roth 2000) highlighted the importance of organizational relationships at different levels, with individuals, other organizations and with nature, in shaping organizational responses.

(Florida, Atlas, and Cline 2001) focused attention on factors operating inside the ‘black box’ of the organization. The major findings of their research confirmed that organizational factors matter significantly in the process of adopting environmentally conscious manufacturing. They also found that organizational capabilities and resources play a considerable role, particularly specialized environmental resources that provide the embedded capacity that enables organizations to respond to external stimuli and implement environmental

Other research on the adoption of environmental initiatives has demonstrated the importance of matching the attributes of a proposed initiative, such as voluntary purchase of green electricity, with organizational values (Berkhout and Rowlands 2007). However, predicting how companies would respond to particular policy instruments remains an imprecise science because ‘rational’ behavior from an economic perspective is often overshadowed by non-economic factors, such as imperfect information, the ‘lumpiness’ of capital and technology, competing sectoral policies, and diverse national and corporate cultures. Hence, environmental policy implementation cannot be properly understood and improved without a thorough comprehension of the values, attitudes, pressures and motivations shaping actor behavior (Bailey and Rupp 2005).

Another important thread within this literature deals with the role of organizational structures and procedures. (Berkhout and Rowlands 2007) provides evidence to support the functional role that formal organizational structures play in establishing a favorable organizational context for issue selling, whereas (Delmas and Toffel 2008) argues that differences in organizations’ adoption of environmental management practices reflect not only different levels of institutional pressures, but also differences in the influence of functional departments through which market and nonmarket signals are transmitted through the organization.

Institutional structures and procedures also feature prominently when (Green, Morton, and New 2000) looked at the transmission of market signals within organizations carrying out ‘green’ procurement activities. They found that the places within many organizations and mechanisms for translating environmental concerns into procurement activity were rather ill defined. There was also a wide range of patterns of departmental and personal involvement and the widely varying
effects (real and perceived) of purchasing procedures. All these just goes to show how complicated adoption of green procurement (and other environmental practices) by organizations can be (Green, Morton, and New 2000).

There is a long history of studies on decision-making processes and driving forces in the public sector. In the book Administrative Behavior (Simon 1957), Simon theorized that organization behavior is (and should be understood as) a complex network of decisional processes. Metaphorically, the anatomy of the organization is to be found in the distribution and allocation of decision-making functions, while the physiology of the organization is to be found in the processes whereby the organization influences the decisions of each of its members. For Simon, the practical limits to human rationality point to the need for an administrative theory. These limits are not static, but depend upon the organizational environment in which the individual's decision takes place. The task of administration is thus to design this environment so that the individual will approach as close as practicable to rationality in his decisions, judged in terms of the organization's goals (Simon 1957).

Similarly, for Charles Lindblom, limits on human intellectual capacities and on available information set definite limits to man's capacity to be comprehensive in decision-making. As such, no one can practice the rational-comprehensive method of decision-making for really complex problems, and every administrator faced with a sufficiently complex problem must find ways to drastically simplify it. Decision-making is therefore a process of “muddling through” or successive approximation to some desired objectives, in which what is desired changes continuously (Lindblom 1959).

Another prominent framework that is often used to explain decision-making in organizations comes from the ‘garbage can’ models introduced by (Cohen, March,
and Olsen 1972). In their seminal article, they describe the decision-making process of ‘organized anarchies’ – organizations or decision-situations characterized by three general properties of problematic preferences, unclear technology, and fluid participation. To them, organized anarchy will describe a portion of almost any organization’s activities, although they are particularly conspicuous in public and educational organizations such as universities. In their garbage can model, a decision is an outcome or interaction of several relatively independent streams within an organization. Four such streams were highlighted – problems, solutions, participants and choice opportunities. Putting these together, one can view a choice opportunity as a garbage can into which various kinds of problems and solutions are dumped by participants as they are generated (Cohen, March, and Olsen 1972). The problems that are solved depend on the complicated intermeshing of elements, including the mix of choices available at any one time, the mix of problems that have access to the organization, and the outside demands on the decision makers. Although this process does not always resolve problems well, it enables choices to be made even when the organization is plagued with goal ambiguity and conflict (Cohen, March, and Olsen 1972).

In particular, post-secondary institutions are acknowledged to be among the most complex organizations in terms of decision-making (Cohen, March, and Olsen 1972). They have multiple goals, such as providing high quality education to students, promoting research in numerous disciplines, and enhancing the general welfare of their community (Stafford 2011). Some even operate like a small municipality, owning its own energy production facilities. Among their decisions are those critical ones on infrastructure within the campus and policies regarding energy use, which affect their GHG emissions over an extended period of time. Overall, they are likely to be less influenced by financial considerations than for-profit firms both because they may be able to take a longer-term view than for-profit firms and because they may have a mission that includes service to the community. Encouraging sustainability and leading by example may be one way in which an institution
achieves this mission. They may also be more likely to invest in sustainable practices that have a long-term impact than for-profit firms (Stafford 2011). An understanding of these institutions is therefore important not only because they are often publicly-funded, but also because these institutions “may be seen as “microcosms” of society, and therefore their experiences may inform efforts for change at the societal level” (Brinkhurst et al. 2011).

2.2.6 Change Management

The literature on change management offers another organizational perspective that focuses on factors that affect or facilitate change, in particular, large-scale planned, strategic, and administrative transformation towards a lower-carbon state. This literature is “immense but overwhelmingly focused on the private sector”, with the majority of articles reporting research and theory appearing more often in research journals on general management and organization theory, rather than public administration journals. Moreover, “this vast body of work abounds with complexities, including multiple and conflicting theories and research findings and a good bit of inconclusiveness.” (Fernandez and Rainey 2006)

One major theoretical conflict surrounds the causes of change in organizations, especially the capacity of managers to bring about change. Despite the differences in views among theorists, a significant body of research indicates that managers frequently do make change happen in their organizations (Fernandez and Rainey 2006).

(Benn, Dunphy, and Griffiths 2006) emphasized the importance of leadership and the roles and strategies that corporate change agents can employ to bring about both incremental and transformational change. They proposed an integrated phase model to better understand how organizations move from compliance modes to the
attainment of strategic sustainability and beyond to the 'ideal' or sustaining corporation. The range of potential change agents includes internal change agents such as board members, CEOs, managers and professionals in staff roles, while external change agents include politicians and bureaucrats, investors, consultants, suppliers and other key stakeholders such as community groups, regulators and consumers (Dunphy 2007). Significant shifts from one phase to another are often triggered by changes such as the appointment of new senior management, stakeholder pressure, new legislation and economic fluctuations, as well as influenced by the presence of a learning culture and internal or external networking capabilities and structures (Benn, Dunphy, and Griffiths 2006).

Public sector studies offer evidence of the critical role that public managers play in bringing about the kind of major organizational change required in climate mitigation (Fernandez and Rainey 2006). Fernandez and Rainey 2006 discerns from the existing body of research a consensus that change leaders and change participants should pay special attention to eight factors such as “ensure the need”, “provide a plan”, build both top management and external support, “provide resources”, “institutionalize change”. Researchers have also noted public sector leaders’ efforts to take advantage of mandates, political windows of opportunity, and external influences to verify and communicate the need for change.

As to how public organizations have responded to the challenges of climate change specifically, the public management literature is scant (Ball et al. 2009). One study (Nilsson, von Borgstede, and Biel 2004) examined how values, organizational goals and norms influence willingness to accept climate change policy measures within organizations. The results showed that for decision makers in the public sector, but not in the private sector, environmental values were important determinants of willingness to accept climate change policy measures.
2.3 Environmental Intervention Approaches

2.3.1 Introduction

This section looks at the main categories of environmental intervention approaches used by governments to spur climate change action on the part of organizations. As pointed out by Funtowicz and Ravetz, some of the most challenging environmental problems that the world is now confronting have common features that distinguish them from traditional scientific problems. Given the universal scale and long-term nature of their impact, these problems are characterized by uncertain facts, disputed values, high stakes and urgent need for decisions. For these problems, science usually cannot provide well-founded theories for explanation and prediction, so rational and correct policy decisions do not automatically follow from the facts discovered by science. As such, a ‘post-normal’ approach to science, built on recognition of the legitimacy of different perspectives and ways of knowing, is more appropriate to manage the uncertainties in knowledge and values in order to produce a sound basis for policy (Funtowicz and Ravetz 1993). The notion that a complex systems problem such as global climate change requires solutions gleaned from a plurality of perspectives (Gallopín et al. 2001) therefore underlies this examination of theories and empirical evidence.

The impact of government environmental intervention, including climate change policies, on private sector organizations has been keenly studied over the years. In contrast, “the public management literature is notable in that it contains virtually no academic analysis or debate regarding public sector carbon neutrality or climate change strategies” (Ball et al. 2009). Assuming that experience in private organizations may hold some useful lessons for public organizations, this literature review will examine studies of both private and public organizations. Intervention approaches can be broadly classified as mandatory, voluntary or a mix of both. For the public sector, we will pay special attention to the impact of mandates.
Environmental intervention by governments has taken many forms since the rise of the environmental movement in the 1960s. In more recent years, the academic literature has documented a general shift or at least an expressed preference by many governments to move away from a ‘command and control’ approach towards a plurality of alternative or ‘new’ approaches ranging from market-based to management-based interventions and voluntary efforts. According to some, this is reflective of a larger movement from policies based mainly on a positivist worldview that assumes “scientific premises are provable and that rigid technology-based instruments will be effective” (Funtowicz and Ravetz 1993; Fiorino 1999), towards a reflexive, post-modern or even post-normal approach that is more accommodating of multiple viewpoints (Funtowicz and Ravetz 1993; Gunningham and Sinclair 1999) and which adopts a complex-systemic approach that takes into account linkages, relationships and context (Gallopín et al. 2001).

2.3.2 *Command and Control Approach*

The command and control (CAC) approach to environmental regulation has been credited with much of the success in environmental protection in the 1960s and 1970s. This approach is an expression of bureaucratic rationality, which is based on the notion that the problems of modern society may be solved through the neutral application of technical expertise (Fiorino 2006). It has “the virtues of high dependability and predictability (if adequately enforced)” (Gunningham and Sinclair 1999). Under this approach, developed country governments created environmental ministries that set uniform regulatory requirements or standards that specified the method, and sometimes the actual equipment, for particular industries or firms. The resulting technology-based regulations secured significant reductions in environmental hazards in spite of population and consumption increases (Driesen 2010). In some cases, regulators set a uniform performance standard or target for firms, while allowing some latitude in how this target is met (Stavins 2003).
In the 1980s, governance philosophies began to shift around the world, especially in English speaking countries, with free markets and economic efficiency increasingly valued as major goals (Driesen 2010). Against this backdrop, critics see CAC regulation as having reached its limits in effectiveness, being rigid (Bardach and Kagan 1982) and unresponsive to the needs of the economy and industries (Fiorino 1996; Gunningham 2007). In particular, environmental regulations have been singled out as examples of excessive regulation, riddled with unreasonable requirements and heavy-handed enforcement (Bardach and Kagan 1982). CAC was also criticized for forcing firms to take on similar shares of the environmental burden, regardless of the cost of abatement. This is seen as not cost-effective, especially where there is significant heterogeneity of costs, which is a common feature of pollution abatement and of climate change mitigation (Stavins 2011).

Another complaint was that inaccurate ex-ante estimation of the costs of compliance might have affected the stringency of regulation, though (Harrington, Morgenstern, and Nelson 2000) found empirically that economic incentives or market-based regulations (Please see the next section) were just as susceptible to such inaccuracies as CAC; perhaps more so when unanticipated technological innovations were not factored in.

There was therefore much interest in moving toward a regulatory system that is more performance-based and tailors regulation to the particular characteristics of an industry sector or facility (Fiorino 1996), thus giving firms the flexibility to achieve those results in a cost-effective manner (Coglianese, Nash, and Olmstead 2003). However, whether performance-based regulation is the appropriate approach depends on the nature of the problem and certain conditions. Among the problems with performance-based regulations is vagueness of performance standards, lack of expertise on the part of enforcers and difficulties in observing or predicting results that make accountability for results a particularly thorny issue (May 2003). There are also very few empirical studies aimed at measuring the effectiveness of performance-based standards, especially in comparison with the
effectiveness of other regulatory instruments (Coglianese, Nash, and Olmstead 2003). An exception is (Harrington, Morgenstern, and Sterner 2004), which is elaborated in the next section.

2.3.3 Market-Based Approach

A popular alternative to CAC is the use of instruments that influence behavior through market signals rather than through explicit directives regarding pollution control levels or methods. Market-based interventions may be mandatory or voluntary. Mandatory interventions include imposition of pollution charges and tradeable permits, while some product labelling and reporting programs may be voluntary in nature.

In theory, if properly designed and implemented, market-based instruments provide powerful incentives for the greatest reduction in pollution by those firms that can achieve these reductions most cheaply. However, the performance of market-based instruments is “mixed”, and “they have not always performed as anticipated” (Stavins 2003). An empirical study (Harrington, Morgenstern, and Sterner 2004) was conducted where 6 pairs of CAC and market-based environmental instruments adopted in the United States and Europe were systematically compared in terms of their actual performance in addressing 6 environmental problems. Both approaches were found to work, in the sense of achieving their goals, and despite the perceived stringency of CAC, pollution abatement was just as high when market-based instruments were used. Generally market-based instruments were more efficient, in terms of achieving a given level of environmental protection at lower cost to the community as a whole, partly because they provide greater incentives for innovation over time. This study also found that almost all of the programmes studied contained a mix of market-based and CAC instruments, although there was wide variation in the relative emphasis.
In a study that compared the propensity of different U.S. states to employ economic incentives in the area of climate change, (Ciocirlan 2008) reveals that states’ adoption of climate policies may be related to a host of different reasons such as energy efficiency, interest group struggles, dependence on natural gas, availability of resources, public opinion or, simply, the policy activity of neighboring states. The effectiveness of market-based instruments also depend on the level set by government; for example, relatively few countries have implemented sufficiently high pollution taxes to motivate substantial emission reductions (Driesen 2010).

Another potentially important cause of the mixed performance of market-based approaches is that many firms are simply not well equipped internally to make the decisions necessary to fully utilize these instruments. Most firms continue to have structures and personnel that are experienced in minimizing the costs of complying with conventional regulation, but not in making the strategic decisions allowed by market-based instruments (Stavins 2003).

2.3.4 Management-Based Intervention

Coglianese and Lazer introduced the term ‘management-based’ intervention, which they distinguished from technology-based and performance-based regulation, in that the former does not specify the technologies to be used, nor does it require specific outputs in terms of social goals. Rather, a management-based approach requires firms to engage in their own planning and internal rulemaking efforts that aim toward the achievement of specific public goals (Coglianese and Lazer 2003).

Management-based approaches hold a number of potential advantages over traditional regulation. They place responsibility for decision-making with those who possess the most information about risks and potential control methods. They can achieve greater compliance than with government-imposed rules, help mitigate the
problems associated with limited governmental enforcement resources and enable firms to experiment and seek out better, more innovative and less costly solutions (Coglianese and Lazer 2003). Management-based interventions include both mandatory management-based regulation such as environmental management systems and risk management planning, and voluntary management-based incentives such as information disclosure.

Theoretical analysis suggests that management-based intervention is most appealing when the population of regulated entities is heterogeneous and the capacity of the regulator to assess output measures is limited (Coglianese and Lazer 2003). However, the question remains whether such intervention can ensure that firms adequately internalize social goals in their planning processes and then implement these plans. Management-based strategies encourage or require management practices, but not necessarily improvements in environmental outcomes. So it is possible that some firms will create plans, documents and procedures that look good on paper but do not reflect their day-to-day operations (Coglianese 2008).

The U.S. experience discussed in (Coglianese and Lazer 2003) indicates that in some cases, management-based policy strategies can lead to improvements in industry’s environmental performance, but not in others. Similarly, (Bennear 2007) suggests that management-based regulation for toxic chemical use and release has had a measurable positive effect on the environmental performance of manufacturing plants during the early 1990s. There is also evidence to suggest that mandates backed up by government or private sector sanctions, requiring firms to engage in specific management practices, appear to have much greater impact on firms’ performance than strategies that merely encourage firms to improve their environmental management (Coglianese and Nash 2006; Coglianese 2008). There remains a need for further empirical research on the impacts of management-based
strategies, especially to learn whether they can achieve meaningful benefits for society over the long term (Coglianese 2008).

2.3.5 Voluntary Approaches

In recent years, there has been a lot of interest in ‘corporate environmentalism’ – environmental initiatives undertaken by businesses, that have gone beyond what is required by law or regulation (Bansal and Roth 2000; Lyon and Maxwell 2004). There have also been a growing number of industry-led programs for self-regulation by firms and trade associations (Khanna 2001). At the same time, governments have increasingly turned to programs in the form of public voluntary programmes (PVPs), or negotiated agreements between regulator and firms. Environmental PVPs like Energy Star in the U.S. involve government offers of positive publicity and technical assistance to firms that reach certain environmental goals. Among the areas with the most PVP activity are pollution prevention and climate change (Lyon and Maxwell 2007). These efforts are partly a response to the escalating political and resource costs of creating and enforcing traditional command-and-control regulations (Lyon and Maxwell 2004) and partly to substitute a co-operative approach for the prevailing adversary relationship between industry and government (Khanna 2001).

The primary problem with self-regulation and meta-regulation (where regulators seek to induce targets to develop their own internal, self-regulatory responses to public problems) is that even though businesses have better information, they do not necessarily have better incentives to find solutions to public problems (Coglianese and Mendelson 2010). These voluntary initiatives also do not require or guarantee an improvement in environmental performance and lack any sanctions for non-improvement (Khanna 2001). Studies have shown that traditional regulation is more effective than the voluntary approach alone (May 2005).
Moreover, although studies on a diverse set of voluntary programs demonstrate that at least some firms are motivated to act voluntarily for various reasons, related research has demonstrated the limitations of these programs by showing that participation by firms is uneven, the environmental improvements are sometimes limited, and the programs are difficult to sustain and expand beyond a core group of committed entities. Taken together, these studies suggest that voluntary programs have promise, but they are not a panacea (Khanna 2001; May 2005).

Despite the fact that voluntary programs tend to be weak tools, some argue that they still have a role to play, for example, when political resistance makes strong action virtually impossible, or the costs or benefits of action are poorly understood, or emissions sources are so numerous that monitoring them is prohibitively costly (Lyon and Maxwell 2004). In such cases, voluntary programs may be used as a complement to existing or forthcoming regulations, or as an alternative when the traditional legislative and regulatory approaches are not feasible (Khanna 2001; Lyon and Maxwell 2007).

2.3.6 Regulation of Government

This section focuses on literature regarding government interventions imposed on the public sector itself. The rough public sector analogy to government’s regulation of private businesses has been termed arm’s-length ‘regulation of government’ (Hood, James, and Scott 2000). This regulation involves oversight of the government bureaucracy, as well as other publicly owned and/or funded bodies, by other public agencies operating away from the direct line of command, with the overseers being given some authority or official ‘mandate’ over their charges. It is a form of steering or control system that involves a combination of information gathering, standard setting and attempts at behavior modification (Hood, James, and Scott 2000).
There is a developing literature that suggests regulation of government is growing in significance (Hood et al. 1999). Hood, James, and Scott 2000 and James 2005 noted that against a backdrop of substantial downsizing in overall public sector staff numbers, regulation of the United Kingdom government grew substantially over the twenty years to the mid-1990s (during the ‘New Public Management’ era) and continued to increase, in terms of numbers of organizations, direct spending and staffing relative to other forms of control. This increasing interest in governments’ own performance arises partly from a desire to address ‘government failures’ (James 2005) and may perhaps be based on a belief that the government may have (or should have) better control over its own operations.

More than 3 decades ago, Wilson and Rachal argued that the fundamental problem of government regulating itself had to do with issues of ownership. “It is easier for a public agency to change the behavior of a private organization than of another public agency” because “the private sector cannot deny the authority of the state”, while a government agency can and does deny the authority of another agency (Wilson and Rachal 1977). (Lodge and Hood 2010) found that many of the obstacles to effective regulation of government that were noted in Wilson and Rachal’s theory are still readily observable today, although there is a greater understanding and analysis of some of the ways to reduce or get round these obstacles.

To get a sense of how effectively environmental mandates on the public sector have worked, the next two sections summarize the findings of selected studies on the impact of mandates for environmental protection.

2.3.7 National Environmental Policy Act (NEPA)

Enacted in 1969, NEPA was the first law in the U.S. to focus environmental concerns within a comprehensive national policy. A major goal of NEPA was to force agencies
that had formerly focused too heavily on their primary missions, to also consider the impacts of their actions on the environment. It has been hailed as one of the nation’s most important environmental laws and the U.S. was recognized as a leader in environmental management worldwide in large part because of NEPA (Council on Environmental Quality 1997).

A review done by the Council on Environmental Quality found that overall NEPA is a success. It has made agencies take a hard look at the potential environmental consequences of their actions, and it has brought the public into the decision-making process of federal agencies like no other statute (Council on Environmental Quality 1997). The NEPA process had become institutionalized in federal agencies’ standard operating procedures by the late 1970s and, unlike the situation before 1970, environmental impacts are now considered in making natural resources decisions (Culhane 1990). NEPA forced agencies to employ specialists who are responsible for preparing environmental impact statements (EISs) and acting generally as environmental advocates in internal agency decision processes. Public participation also provided a new opportunity for environmental groups, concerned citizens, and individual scientists to influence agency decisions (Culhane 1990).

Critics, on the other hand, lament the burdensome procedural formalities and cost of the NEPA process, while “accomplishing little or nothing of substance” (Karkkainen 2002). Although NEPA seems to have transformed the institutional landscape, bringing important and lasting changes to the way government operates, there is not much evidence that, in practice, the information revealed in EISs actually influences agency decision-making (Karkkainen 2002). Similarly, (Culhane 1990) noted that there is still debate on whether an EIS’s consideration of impacts is serious and acute, although its mere existence, even if it were just a procedural requirement, contrasts significantly with the pre-1970 situation.
Many studies have tried to evaluate whether NEPA has fundamentally changed the agency decision-making process and influenced how they operate (Biber 2009). In particular, principal-agent theories have been used to explain agencies’ motivations when responding to this environmental mandate. A principal (e.g. the U.S. Congress) is a party that delegates performance of a task to an agent (e.g. a federal government agency), usually because the principal is limited in its ability to perform the task directly by time, expertise, or other resources. The basic problems of any principal-agent system are those of differing incentives and inadequate information (Biber 2009). Biber established that these agencies often will not be able to overcome the challenges posed by conflicting multiple goals on their own, due to a range of constraints, including agency missions, historical inertia, the professional orientation of agency staff and other internal institutional incentives that are often crucial to the success of government agencies. The principals can employ different models to address this problem with their agents, e.g. ‘agency as lobbyist’ and ‘agency as regulator’ models. He concluded that the more stringent the inter-agency monitoring is, the more effective regulation might be at achieving minimum compliance with undervalued goals, but with the consequence of greatly increasing transaction costs such as litigation (Biber 2009).

(Wichelman 1976) points out that disagreement over NEPA’s actual and potential impact on agency decision-making tends to gloss over the many political and practical differences that characterize the vast array of federal agencies, which differ markedly in power, purpose, and clientele. He found that generally the greater the perceived conflict between NEPA implementation activities and an agency’s pre-NEPA mandate, the more likely the agency was to go slowly and cautiously in implementing the Act.

By examining the institutional changes made within agencies at each phase of implementing NEPA reforms, (Wichelman 1976) was able to highlight the critical
factors that influenced the pace and extent of reform adopted by different agencies, such as provision of supplemental funding to agencies and specialized personnel to police compliance. He also highlighted the importance of continuing external oversight, establishment of new agency routines and learning processes to effect changes to the standard operating procedures and organizational structures, and ensure a pervasive integration of environmental values into the agencies’ routine decision-making activities.

Another study that investigated federal agencies’ response describes NEPA as an ‘aspirational’ command. ‘Aspirational’ commands are those that require or compel targeted agencies to cooperate in good faith – to ‘aspire’ – in implementing federal policies “as best they can” (Henderson and Pearson 1978). NEPA directs federal agencies to interpret and administer “to the fullest possible extent” their policies and regulations in accordance with its policy statement, making environmental protection part of the mandate of each federal agency.

With respect to all four examples evaluated in their study, including NEPA, aspirational commands have limited effectiveness and failed to achieve the desired goals. Complex hierarchical organizations tend to respond to aspirational commands in ways which are more consistent with its standard operating procedures than with the values of either the commandeer or the individuals making up the organization. Further, in the light of their limited effectiveness, it would also seem misplaced to rely on aspirational commands to change attitudes toward environmental protection (Henderson and Pearson 1978).

Finally, with regard to organizational learning and institutionalization of environmental values through the interplay of internal and external factors, (Taylor 1984) pointed to NEPA’s influence resulting in a large increase in the number of experts or environmental analysts employed within federal agencies, resources
leveraged in environmental non-governmental organizations including lawyers and scientists, and institutionalization of a greater sensitivity to environmental risks in the federal bureaucracy. This may serve as a model for regulating government organizations when complex policy tradeoffs make simple rules technically infeasible, yet the involvement of many agencies makes hierarchical reorganization into one ‘superagency’ politically undesirable (Taylor 1984). Climate change would qualify as such a situation.

2.3.8 Unfunded Mandates

There has also been a lot of debate on the impact of other unfunded mandates in the U.S. These are situations where federal policymakers dictate to lower-level governments without compensating them adequately for the expense of complying with the dictates (Nivola and Shields 2001), such as those imposed by the U.S. federal government on state and local governments in the 1980s and early 1990s. Unfunded mandates have a major impact on local finances and tend to absorb resources that local governments would otherwise allocate among other services or critical areas (Nivola and Shields 2001; Weiland 1998). Prominently featured in the unfunded mandates debate were the nation’s environmental laws (Weiland 1998).

While the majority of studies on unfunded mandates focus on their high cost and other negative aspects, some studies have shown that these mandates have built up organizational capacity. For example, (Weiland 1998) found that environmental mandates imposed by the US federal government led to increased training of state and local government officials, and better communication among them. In 1970 most states were underequipped to deal effectively with the environmental problems they faced. Today, the environmental agencies of the fifty states together employ about 60,000 people, more than three times as many as the Environmental Protection Agency. The states also pay most of the expense of environmental
programs, and some of their initiatives have inspired national policies (Nivola and Shields 2001).

(May and Burby 1996) noted that often state and local governments complain that the actions they are mandated to undertake do not adequately reflect their own preferences. As a consequence, they are reluctant partners whose compliance is marked by half-hearted efforts. The empirical study compared state hazard-mitigation policy in Florida and New South Wales, Australia. The results showed that when local governments are not committed to state policy objectives, the coercive (mandatory) policy produced higher rates of procedural compliance and greater effort by local governments to achieve policy objectives compared to the cooperative (voluntary) policy. Moreover, the coercive policy appeared to be successful in increasing the capacity of local governments to work toward state policy aims, especially when coupled with ample resources and support. On the other hand, when local governments are more committed, the cooperative policy produces substantive results that are at least the equivalent to the coercive policy. Moreover, over the long run cooperative policies may have greater promise in sustaining local government commitment and facilitating learning (May and Burby 1996).

Given the concerns with unfunded environmental mandates, an important challenge is to identify more palatable ways of securing compliance with the higher-level policy objectives (May and Burby 1996). This challenge is in some ways a parallel to that of private sector regulation, for which regulatory theorists have made some progress in thinking about alternative approaches to enhancing private sector compliance and cooperation.
2.3.9 Reflection

Whilst there has been a lot of criticism of traditional command and control regulation, there appears to be no clear consensus yet on the effectiveness of the alternative or ‘new’ approaches (Gunningham 2007) and not many empirical studies undertaken to evaluate efficacies of these different approaches on organizations. Instead, some academics may have “exhibited a tendency to be too fascinated with the description of the latest initiatives and regulatory tools rather than an inclination to engage in critical analysis” (Baldwin, Cave, and Lodge 2010). Similarly, too much confidence has arguably been placed in so-called ‘alternative forms of regulation’, so that there has been an overplaying of the potential problem-solving capacities of self-regulatory or market-based systems. Therefore it is important to continue to investigate the capacities of these systems to develop standards, to enforce them, and to gather robust information (Baldwin, Cave, and Lodge 2010).

Similarly, (Gunningham and Sinclair 1999) argues that most traditional approaches to regulation are seriously suboptimal, in that they are not effective in achieving their purported policy goals, not efficient in doing so at least cost, nor do they perform well in terms of other criteria such as equity or political acceptability. On the other hand, market-based instruments tend to be efficient but, in most cases, not as dependable. Information-based strategies, voluntarism, and self-regulation have the virtues of being non-coercive and un-intrusive, but also have low reliability when used in isolation. Given these limitations, the capacity of these alternative approaches to deliver optimal environmental outcomes may be even more limited than that of command and control regulation (Gunningham and Sinclair 1999).

It is therefore suggested that, in the majority of circumstances, the use of multiple rather than single-policy instruments and a broader range of regulatory actors will produce better outcomes. The best means of overcoming the deficiencies of individual instruments or approaches, while taking advantage of their strengths, is
through the design of combinations of instruments or approaches (Gunningham and Sinclair 1999). Further, this will allow the implementation of complementary combinations of instruments and participants tailored to meet the unique needs and challenges of specific environmental issues. By implication, this means a far more imaginative, flexible, and pluralistic approach to environmental regulation than has so far been adopted in most jurisdictions (Gunningham and Sinclair 1999).

Turning now to the challenge of climate change, we note that thus far, most of the studies on regulation/intervention have been based on environmental protection or pollution control, although they may provide useful lessons for climate change policies. More academic studies dealing specifically with climate change have started to emerge in recognition of the importance and complexity of this global challenge. Going forward, we could do well to be open to a plurality of approaches and focus more on evaluation of impacts, somewhat along the lines of the comparison of environmental policies in (Harrington, Morgenstern, and Sterner 2004). As suggested by (Lyon and Maxwell 2004), global warming provides an excellent laboratory for the study of the optimal policy mix and different countries will experiment with different combinations of policies, creating a natural experiment highly worthy of detailed study.

Further, to apply the above description of intervention approaches to the context of this study, we can see that BC’s CNG mandate may be considered to contain elements of several intervention approaches imposed by the BC provincial government on PSOs, including:

(a) Outcome or performance-based intervention, where PSOs are required to be ‘carbon neutral’ from 2010 through a combination of emissions reduction and offset purchase;

(b) Market-based intervention, where PSOs have to pay $25/tonne CO$_2$e to offset their remaining emissions; and
(c) Management-based intervention, where PSOs are required to update their GHG inventories annually and report on actions taken and plans to reduce GHG.

Moreover, PSO operational budgets have not been augmented to help them implement emission reduction measures or purchase offsets, although they could apply for project grants from a $75 million fund set aside for 3 years under the PSECA. This situation can be compared to that of ‘unfunded mandates’ imposed by the U.S. federal government on state and local governments.

2.4 Boundaries

An important determinant of a policy’s effectiveness, when viewed in relation to organizational responses and impacts, is the drawing of the policy’s boundaries. In the case of carbon neutrality for the public sector, policy boundaries set the foundation and define the scope for the subsequent steps of measurement, emission reduction, offset and verification. They are critical both for enhancing the credibility of a policy mandate and maximizing its effectiveness within and beyond the public sector.

The term ‘carbon neutral’ was initially used by companies like the American electric power company AES Corp., which decided in 1989 to offset part of its carbon dioxide emissions by launching carbon sequestration projects in Guatemala. Such pronouncements received favorable media attention at that time. However, in most of these cases, the emissions calculation takes into account mainly the carbon dioxide and other GHG emissions linked to direct consumption of energy that arises from their own operations, but emissions from the rest of the supply chain – that exist because of these operations – are usually left out.
In recent years, with greater attention worldwide on climate change, the term ‘carbon neutral’ has been used increasingly by governments, organizations, communities and individuals. Both regulated and voluntary markets have also expanded to meet the growing demand for carbon offsets, necessary for most organizations to achieve carbon neutrality in the short to medium term. Yet the general lack of clarity about the term has led to confusion and even cynicism, which can be counter-productive to genuine efforts to reduce emissions. Despite efforts to clarify the meaning of carbon neutrality, many governments and organizations still choose to define the term in different ways to suit their own purposes. Generally speaking, without a clear definition of which emissions are being measured and reported, and which emissions are excluded, there is no firm foundation for reductions, so achieving ‘carbon neutrality’ would not be very meaningful.

The Greenhouse Gas Protocol, the most common and internationally accepted approach to categorize and manage emissions, recommends that an organization, at a minimum, should report scope 1 and scope 2 GHG emissions. However, where possible, inclusion of scope 3 emissions is recommended (WRI and WBCSD 2004). Scope 1 (Direct) GHG emissions are from sources owned or controlled by the organization, for example, emissions from owned or controlled boilers, furnaces and vehicles. Scope 2 (Electricity indirect) emissions are from the generation of purchased electricity consumed by the organization. Scope 3 (Other indirect) GHG emissions are those that are a consequence of the activities of the organization, but occur from sources not owned or controlled by it. Examples are business travel, waste disposal, and use of sold products or services (WRI and WBCSD 2004).

The setting of organizational and operational boundaries has significant implications for the extent of coverage and cost of mitigation. By definition, scope 3 emissions are not owned or controlled by the reporting company, but are the scope 1 and 2 emissions of other entities such as suppliers, customers, waste management
and shipping companies. Although it is optional, including relevant scope 3 emissions in a GHG inventory ensures that the GHG inventory is complete and may provide companies with innovative opportunities to reduce emissions. IKEA, for example, included scope 3 emissions from its customers’ trips to and from its stores because it perceived this activity as important to its business. Its GHG inventory confirmed that this activity accounted for 56% of its total emissions. Moreover, IKEA found that it could have significant influence over its scope 3 emissions when selecting sites for new stores, by making its stores accessible by public transit (WRI and WBCSD 2004).

In the *Corporate Value Chain (Scope 3) Accounting and Reporting Standard* (WRI and WBCSD 2011), it is pointed out that scope 3 emissions are actually a consequence of the activities of the reporting company, and companies often have the ability to influence GHG reductions upstream and downstream of their operations. Companies are therefore advised to account for and report the largest scope 3 sources that collectively account for at least 80% of total anticipated scope 3 emissions.

In *The GHG Protocol for the U.S. Public Sector* (WRI and LMI 2010), it is proposed that organizations should initially focus on accounting for and reporting activities that are relevant to their organizational mission and goals, and for which they have reliable information. In particular, organizations should consider reporting relevant scope 3 emissions that are large (or believed to be large) relative to its scope 1 and scope 2 emissions and where potential emissions reductions could be undertaken or influenced by the organization. Given the substantial impact public sector organizations can have on indirect GHG emissions through the use of contractors and procurement contracts, scope 3 emissions for the public sector may be quite significant.
The Carbon Neutral Government Regulation (CNGR) makes it clear that the CNG mandate focuses on GHG emissions from the use of energy in the operations of PSOs, but not embodied GHG emissions in existing or new buildings, equipment, material or services used by PSOs in the course of their operations. Thus emissions to be reported and offset under GGRTA are mainly scope 1 and scope 2 emissions. The only scope 3 emissions included are those from business travel (for core government only) and office paper usage. According to the Climate Action Secretariat (CAS) of the Ministry of Environment, this latter category is included because it is highly visible, and is something that public sector employees can easily relate to and act upon.

The current coverage of BC’s mandate is a positive first step. Scope 1 and 2 emissions are easier to measure and less controversial since they can be directly linked to energy consumption. However, although all non-energy services and materials used by the PSOs in their operations are potentially reportable under the scope 3 heading, only a small fraction of them are covered by the current mandate. Scope 3 emissions include everything from employees’ commuting to work, through to outsourced activities such as billing and insurance, to embodied energy/emissions in new buildings and appliances. These emissions exist because of government operations, but are not directly owned or controlled by the public sector; yet they make up a significant proportion of the total emissions of some PSOs. In such cases, the PSOs may be able to exert considerable influence over these emissions through their policies and decisions regarding transportation subsidies, parking provision, contracting and procurement, etc. At the same time, it may also be more cost-effective to reduce some of these scope 3 emissions, as compared to reducing PSOs’ scope 1 or scope 2 emissions or purchasing offsets through the PCT. For an illustration of this, please refer to the UBC case in Chapter 6.
2.5 Summary

This literature review has highlighted that there is some evidence that mandatory policies have been generally more effective in securing compliance of private firms to meet environmental goals, although in other instances, such policies have failed to work as anticipated. In addition, the empirical studies evaluating the outcome of different approaches draw our attention to the complexities of the real world and the importance of history and context in determining the outcomes. They emphasize that the details of policies and instruments used can make a big difference to their impact and effectiveness.

Several studies have also pointed out that policy design needs to take into account the characteristics of organizations, their values, structures and decision-making processes. There is no single approach that works effectively for all situations, so the key is to select the approaches and combination of instruments to best fit the situation and targets of intervention. Thus, we may see here an application of Simon’s administrative theory, where effective climate change action would consist of the government designing policies and instruments and creating conditions such that the target organizations will be motivated to approach as close as practicable to rational decisions in terms of climate action goals. However, given the global and fundamental nature of the climate change challenge, and with organizations being more interconnected than ever before, we need to pay particular attention to the boundaries of the target organizations that the policies are aimed at influencing, since the definition of the boundaries affects the effectiveness of the chosen policies and their spillover impacts. For example, an expanded coverage of BC’s ‘carbon neutral government’ mandate can open up more opportunities for reducing GHG emissions in BC at a lower cost.
In contrast to the many studies that have examined the impact of environmental interventions on private sector organizations, few have focused on the impact on government organizations and, more specifically, on environmental mandates imposed on government organizations. There are even fewer empirical studies or evaluations of government mandates, despite theoretical pieces that highlight the importance of organizational factors in influencing how government organizations respond to environmental interventions.

Since environmental mandates on government organizations is potentially an important and effective way to bring about drastic reduction of GHG emissions in the public sector, with the additional prospect of influencing the private sector through the mandate’s spillover effects, there should be more research to help us to better understand the factors that influence how government organizations respond to environmental mandates, including the provision of adequate resources and support mechanisms that will enable these organizations to act so as to achieve the best possible policy outcome. Specifically, by assessing the performance of climate policies in terms of their actual outcomes, retrospective programme evaluation can inform policy deliberations within an adaptive management approach and help move climate decision-making closer to an evidence-based practice (Bennear and Coglianese 2005).

2.6 Observations

The literature review in this chapter suggests a strong case for this study to focus on climate change action at the organizational level, in particular, the importance of looking at the perspective of public sector organizations taking action to mitigate climate change. This perspective can help to inform on the potential effectiveness of imposing a climate change mandate on public organizations in order to reduce their GHG emissions, as well as provide a better understanding of the factors that affect
the effectiveness of the mandate, including how the mandate facilitates and hinders decision-making by these organizations.

There are several important observations arising from the above literature review that are noteworthy for the purpose of framing or scoping this study, identifying the research questions and formulating the methodology:

(a) Decision-making is a highly complex process in most organizations, perhaps more so in public organizations, and in particular, post-secondary institutions. Decisions regarding environmental practices and allocation of funds for infrastructure projects are made based not only on rational and economic factors, but are also affected by organizational values, stakeholder pressures, personalities, past experiences, internal resources and institutional structures, among others.

(b) Studies have identified leadership and organizational structure as among the key factors that determine the extent to which organizations, including public sector organizations, can bring about transformational change in the pursuit of climate change action, or more generally, sustainability.

(c) There is some evidence that mandatory policies have been generally more effective in securing compliance of private firms to meet environmental goals.

(d) Although most studies on government mandates and unfunded mandates focused on the high costs of such mandates, a few studies have found that they have led to an increase in emphasis on previously neglected areas such as environmental impact, greater environmental expertise overall and enhanced training and capacity of local governments.

(e) Previous studies of public sector organizations, including post-secondary institutions, have focused mainly on actions taken by these organizations to become more ‘sustainable’, of which reducing GHG emissions are but one aspect. Few independent studies have evaluated the outcome of these actions in terms of actual performance against their targets, such as GHG targets.
(f) As far as we know, there is no independent evaluation of the impacts and effectiveness of the CNG mandate in BC.

(g) Previous studies, such as (Webster and Moore 2009), have highlighted that the major constraints hindering post-secondary institutions from doing more to reduce GHG emissions include: bureaucratic inertia, lack of funding and lack of awareness and communication. Financing was the greatest challenge they face in implementing the GGRTA and there was concern that without additional funding some institutions may be forced to make cuts in areas that could affect core programming.

(h) The drawing of policy boundaries can affect the way organizations respond to a policy and may shift priorities within organizations, which in turn affect the effectiveness of the policy. Boundaries may even result in incentives and outcomes that are contrary to the original intent of the policy. This could happen if an organization outsources its emission-producing activities to avoid having to pay tax or buy offsets for these emissions, but the outsourced activities lead to an increase in emissions outside the policy boundaries.
3. Methodology

3.1 Introduction

As mentioned in Section 1.4, the objectives of this study are to evaluate the impacts of the CNG mandate on PSOs since its announcement in 2007, including the impact on actual GHG emissions and influence on decisions regarding infrastructure projects that would significantly reduce the GHG emissions of PSOs. This study also seeks to find out whether the CNG mandate has mitigated any of the major constraints, and whether support mechanisms provided by the provincial government or other government agencies have helped PSOs to overcome some of the constraints hindering emissions reduction infrastructure projects.

3.2 Overall Approach

This study uses a sequential explanatory design mixed methods approach (Tashakkori and Teddlie 2003; Creswell et al. 2003). This consists of two phases, beginning with the collection and analysis of quantitative data, followed by the collection and analysis of qualitative data that aims to explain, interpret or enhance the quantitative results. During the second, follow-up phase of this explanatory design, the researcher may identify specific quantitative findings from the first phase, such as unexpected results, outliers or differences between groups that need further exploration using qualitative methodology (Tashakkori and Teddlie 2003).

This pragmatic mixed methods approach recognizes the usefulness of both quantitative and qualitative paradigms and identifies how these paradigms can be used together in a single study to maximize the strengths and minimize the weaknesses of each other, thus allowing the researcher to design a study that will offer the best chance of answering the specific research questions (Creswell et al. 2003).
2003; Johnson and Onwuegbuzie 2004). Moreover, this allows for greater validity in the study by seeking convergence or corroboration between quantitative and qualitative data, and using a combination of research approaches to provide a more complete and comprehensive picture of the phenomenon being studied (Greene, Caracelli, and Graham 1989).

Within the mixed methods approach, the case study form is used, recognizing that decisions on infrastructure investments are likely to be influenced by many different personal and organizational factors. The case study form is particularly appropriate when researchers want to cover contextual conditions that might be highly pertinent to the phenomenon being studied (Yin 2009) and need to rely on multiple sources of evidence (Yin 2003). Explanatory case studies are also the preferred strategy when ‘how’ or ‘why’ questions are being posed, when the researcher has little control over events, and when the focus is on contemporary phenomenon within some real-life context (Yin 2009), as in this study. In addition, one of the primary virtues of the case study method is the depth of analysis that it offers, in terms of the detail, richness, completeness, or degree of variance that is accounted for by an explanation (Gerring 2004).

Specifically, to gain a deeper understanding of the driving forces behind the changes to organizational decision-making during the period under study, a comparative or multiple case study design (Stake 2005) is employed with a few selected PSOs being studied in-depth. They can be selected based on analysis of quantitative data during the first phase of the study, using criteria such as size of organization (e.g. annual budget), nature of operations, and percentage reduction of GHG emissions during the study period. Another important criteria for the selection of case study organization can be based on the potential for maximum learning, where pairs of organizations are chosen for their similar or contrasting situations, rather than their representativeness of the general population of organizations (Stake 2005).
The mixed methods case study approach employed by this study involves a quantitative analysis of GHG emissions inventories from 2010 to 2012 and a qualitative analysis of documents of the case study PSOs, as well as expert interviews of key stakeholders. As the available quantitative data is from a limited implementation period, the qualitative analyses will help to expand on facts or observations found during the quantitative analysis, as well as corroborate or help interpret the quantitative results.

3.3 Research Questions

According to theories of rational choice or bounded rationality, a PSO acting as a rational decision-making body is expected to undertake actions to reduce GHG emissions up to the point where the total cost of doing so, including allowances for the risks involved, is no higher than the price of these emissions. In the case of a PSO in BC, the latter would be the combination of carbon tax and cost of purchasing offsets, which varied between $40 to $55 per tonne CO$_{2}$e during 2008 to 2012. However, in practice, there are many other considerations that a PSO has to take into account, such as organizational goals and priorities, its financial situation, know-how, institutional procedures, contractual obligations, legal constraints (Cohen, March, and Olsen 1972), past experiences (March and Olsen 1975) and “rules or logic of appropriateness” (March 1991). PSOs faced with sizeable budget shortfalls will have to weigh various options that may involve trade-offs between short-term cost (e.g. offset purchases) and long-term global benefit (i.e. climate stabilization), or investing in higher capital cost energy efficiency against continued provision of core services. In addition, while a PSO can reduce its individual GHG emission by fuel switching (e.g. from gas to electricity) the long-run social and environmental impacts of such a choice needs to be clearly signaled in terms of the need to invest in new generation capacity and much higher electricity prices.
Therefore, this study aims to add to the current knowledge on policies, factors or conditions that can help post-secondary institutions to undertake transformative changes that significantly reduce their GHG emissions. In particular, it will examine whether and how mandating carbon neutrality can contribute towards facilitating investment in infrastructure projects that reduce GHG emissions. The study also aims to inform on the support mechanisms that can help public organizations to reduce their emissions. These mechanisms may include additional funding and expertise, as well as learning networks. Hence, one line of inquiry focuses on the roles of internal and external expertise and support networks in influencing the organizations’ responses and their organizational learning processes (Crossan, Lane, and White 1999).

Given the context of BC’s natural experiment on climate action as outlined in Chapter 1 and the research needs as identified by the literature review in Chapter 2, the main research questions for this study are formulated as follows:

**RQ1:** Has the carbon neutral government (CNG) mandate changed decision-making processes and outcomes for new or retrofit infrastructure projects that significantly reduce GHG emissions? How and why?

**RQ2:** What support mechanisms helped or would help decision-making in favour of infrastructure projects that substantially reduce GHG emissions?

In order to answer the above main research questions, the propositions that are tested by the study are:

**P1:** BC’s CNG mandate, together with the carbon tax, have made it significantly easier for post-secondary institutions to justify and decide to implement infrastructure projects that substantially reduce GHG emissions.
P2: Shortage of funding remains as the major constraint holding back infrastructure projects that substantially reduce GHG emissions in these institutions.

P3: Support mechanisms of the CNG mandate have helped to address the major constraints hindering emission reduction infrastructure projects.

3.4 Selection of Case Study Organizations

3.4.1 Selection Criteria

The selection of case study PSOs follows a replication rather than sampling logic, where cases are expected to have contrasting results from one another based on a theoretical framework, but in predictable ways (Yin 2009). All of the case study organizations operate within the same framework of the BC public sector. However, although PSOs within some sectors such as health or post-secondary education have a similar primary mission, individual PSOs vary greatly in size, location and focus, and they have different available resources and operational characteristics.

As noted from the literature review in Chapter 2, one group of public organizations that has relatively better documentation and been subjected to previous research is post-secondary institutions. This study will therefore focus on post-secondary institutions in BC. There are 26 post-secondary institutions listed by the Climate Action Secretariat (CAS), Ministry of Environment, in their annual summaries of the CNG programme (Note: UBC-V and UBC-Okanagan were counted as 2 institutions and submitted separate CNARs previously, but for the 2012 report they were combined into one report). These 26 institutions are spread over a very large geographical area across all the major regions of BC. These regions have vastly different climatic characteristics and there may be large variations in weather from year to year in some regions. These may significantly affect PSOs’ heating and
cooling requirements, which in turn impact on their energy consumption and GHG emissions. The institutions also vary in size and programmatic focus, with some of them designated as comprehensive research universities while others are smaller colleges with a local or regional student recruitment focus or specialized academic programmes.

To control for the effects of large climate variability from year to year across the vast areas and regions of BC, the case study organizations for this study are selected from among those located in the Lower Mainland of British Columbia, otherwise known as the Greater Vancouver region. There are 10 such institutions located in the Lower Mainland. Among these, institutions of different sizes are also chosen so that the research can explore the influence of size and resources, factors identified by (Stafford 2011) as likely to affect adoption of ‘sustainable’ practices. Institutions at different stages of pursuing ‘sustainability' will hopefully provide a perspective of the impact of values and past experiences on current efforts and decisions.

Based on a preliminary screening process, the following two groups of post-secondary institutions at different stages and sophistication of climate change action have been identified:

(a) Institutions that have undertaken climate change action (or more generally ‘sustainability’) for many years prior to the CNG mandate, and have clear institutional processes in place for managing energy consumption and climate action; and

(b) Institutions that have only recently started paying serious attention to climate change action, or where climate mitigation became a priority when CNG was mandated.
3.4.2 Profile of Case Study Organizations

For the case study, two institutions are chosen from each of the two groups mentioned in the previous section. A brief profile of the 4 selected case study organizations located in the Lower Mainland is provided in Table 3.1. The University of British Columbia (UBC) is the largest post-secondary institution in BC and among the largest in Canada. Simon Fraser University (SFU) is considered a medium-sized comprehensive research university among Canadian universities and colleges. Douglas College (DO) and Vancouver Community College (VCC) represent medium-sized colleges within the BC post-secondary system, but they are small relative to the research universities.

All 4 institutions experienced growth in enrolment, given increasing population in the province and healthy growth in the international student population during recent years. However, during the period from 2010 to 2012, the growth rate varied from 1.2% for VCC to 4.6% for UBC and 10.2% for DO.
Table 3.1: Brief Profile of Case Study Organizations

<table>
<thead>
<tr>
<th></th>
<th>UBC</th>
<th>SFU</th>
<th>DO</th>
<th>VCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012/13 Budget Total Operating Revenue ($ mil)</td>
<td>921.45</td>
<td>448.27</td>
<td>105.15</td>
<td>106.27</td>
</tr>
<tr>
<td>Number of Students (2010/11 FTE)</td>
<td>40,961</td>
<td>25,278</td>
<td>9,046</td>
<td>7,918</td>
</tr>
<tr>
<td>Number of Students (2012/13 FTE)</td>
<td>42,848</td>
<td>26,521</td>
<td>9,973</td>
<td>8010</td>
</tr>
<tr>
<td>Emissions offset in 2010 (tonnes CO$_2$e)</td>
<td>61,649</td>
<td>17,695</td>
<td>1,960</td>
<td>2,993</td>
</tr>
<tr>
<td>Offsets purchased for 2010 ($ mil)</td>
<td>1.541</td>
<td>0.442</td>
<td>0.049</td>
<td>0.075</td>
</tr>
<tr>
<td>Emissions offset in 2012 (tonnes CO$_2$e)</td>
<td>64,799</td>
<td>17,818</td>
<td>2,039</td>
<td>3,000</td>
</tr>
<tr>
<td>Offsets purchased for 2012 ($ mil)</td>
<td>1.620</td>
<td>0.445</td>
<td>0.051</td>
<td>0.075</td>
</tr>
<tr>
<td>2012 Emissions per student (tonnes CO$_2$e/student)</td>
<td>1.51</td>
<td>0.67</td>
<td>0.20</td>
<td>0.37</td>
</tr>
</tbody>
</table>

Main sources of GHG (2012)

<table>
<thead>
<tr>
<th></th>
<th>UBC</th>
<th>SFU</th>
<th>DO</th>
<th>VCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Buildings</td>
<td>97.1%</td>
<td>97.1%</td>
<td>88.8%</td>
<td>95.8%</td>
</tr>
<tr>
<td>- Fleet</td>
<td>2.0%</td>
<td>1.4%</td>
<td>0.1%</td>
<td>0%</td>
</tr>
<tr>
<td>- Paper</td>
<td>0.9%</td>
<td>1.5%</td>
<td>11.1%</td>
<td>4.2%</td>
</tr>
</tbody>
</table>

Sources: (University of British Columbia 2012a), UBC Planning & Institutional Research (http://www.pair.ubc.ca/statistics/students/students.htm), (Simon Fraser University 2012a), SFU Institutional Research and Planning website (www.sfu.ca/irp), Douglas College Finance Department website (http://www.douglas.bc.ca/employees/finance-department.html), Vancouver Community College website (http://www.vcc.ca/about/college-information/reports-and-publications/), (Ministry of Environment, B.C. 2011), (Ministry of Environment, B.C. 2013), 2010 and 2012 Carbon Neutral Action Reports of UBC, SFU, DO and VCC.
3.4.3 Physical Infrastructure

In terms of physical infrastructure, UBC has two major campuses, located in Vancouver, and Kelowna in the Okanagan Valley of the southern BC Interior. This study will focus on the Vancouver Campus, which comprises the main Point Grey Campus, the Downtown Vancouver site, the Great Northern Way Campus (shared with SFU, British Columbia Institute of Technology and Emily Carr University) and several other off-campus locations including the Malcolm Knapp Research Forest in Maple Ridge, BC and the Dairy Education and Research Centre at Agassiz, BC. The Point Grey Campus, at more than 400 hectares in area, includes about 200 core academic buildings, university-owned housing for more than 9,000 faculty, staff and students, a residential community where 18,000 people live and various ancillary buildings, conference and sports facilities and the UBC Farm. The planning, development and operation of all these facilities are led by Campus and Community Planning, Infrastructure Development, Building Operations, and UBC Properties Trust. Private developers are also involved in the case of the residential community. In June 2010, responsibility for local land use planning at the UBC Point Grey Campus was transferred to the Province and UBC was given the ability to manage amendments to their Land Use Plan, subject to Ministerial approval. In this respect, UBC operates somewhat like a municipality.

SFU has three major campuses in the Lower Mainland, on Burnaby Mountain, in Downtown Vancouver and in Surrey Central. These facilities are spread over an area of 157 hectares and more than 430,000 square metres of floor space. The largest campus is situated on Burnaby Mountain and includes more than 3-dozen academic buildings, student residences and UniverCity, a residential community managed by SFU Community Trust with shops, services and amenities. Campus planning, real estate and property management, development of new buildings, maintenance, operation and renovation of buildings, grounds and utility systems across the three campuses are the responsibility of the Facilities Services Department.
Founded in 1970, DO has two major campuses, the New Westminster Campus in Downtown New Westminster, BC and the David Lam Campus in Coquitlam, BC. The David Lam Campus has recently completed a major $39 million expansion, adding a large Health Sciences Centre which opened in January 2008 (British Columbia Government 2008a). The concourse in the New Westminster Campus was renovated in summer 2011 (Wikipedia 2013a). The Facilities Services Department is responsible for planning and developing College facilities, operating related services and for the ongoing maintenance of the buildings and grounds at both campuses.

Founded in 1965, VCC has two major campuses, one in Downtown Vancouver and the other on Broadway in East Vancouver. In 1983, the main campus was moved from the previous King Edward Centre location to its current location at 1155 Broadway, now known as the Broadway Campus. In January 2009, VCC’s $55 million Broadway Campus expansion project was completed and opened (Wikipedia 2013b). The Facilities Management Department is responsible for the ongoing maintenance of the campuses. Long-range facilities planning, including capital plans and oversight of land and facilities development, is overseen by the Facilities Development Committee of the Board of Governors.

### 3.5 Document Analysis

As outlined in Section 3.2, the first phase of the study involves a preliminary quantitative analysis, which helps in the selection of case study organizations described in Section 3.4. Given that the mandate under study has only been implemented over a short period of time, the data available is not likely to be sufficient to provide conclusive evidence of trends or causation. Nonetheless, during the study period, some interesting facts may be observed in individual PSOs or groups of PSOs.
The quantitative analysis for this study uses GHG inventory data primarily from 2010 to 2012, which contains the complete set of official emissions data for all PSOs under the CNG mandate. This set is compiled using the government software for GHG emissions calculation, SMARTTool, which is based on guidelines and emission factors issued by the CAS. Some PSOs, like UBC and SFU, have their own GHG emissions data prior to 2010, which use different assumptions or bases for calculation, making comparisons difficult. Since 2010, all PSOs are required to enter their data using SMARTTool, from which offset requirements are then determined. In 2012, an independent audit of 9 PSOs was conducted by Deloitte and Touche LLP to verify the accuracy of their 2011 consumption data entered into SMARTTool.

Where available, additional data or details are obtained for some case study organizations over and above the official set of emissions data. For example, energy consumption data is used as a supplement to the preliminary quantitative analysis to investigate whether there are any trends over a longer period of time.

Information for analyzing the responses of PSOs and impacts of the CNG mandate on PSOs are also obtained from public documents, including annual reports of the CAS and PCT, CNAR and annual sustainability reports of individual PSOs, and other progress reports on projects, emissions and offsets. The following are some of the main public documents that are available on the various topics covered by the study:

(a) Definitions of carbon-neutrality and GHG emissions – Greenhouse Gas Reduction Targets Act (GGRTA) and Regulations, public policy documents and guidelines issued by CAS, World Resources Institute GHG Protocol;

(b) Actions taken to reduce GHG emissions – annual progress reports by CAS, CNAR (from all PSOs), PSO annual reports, accountability documents and special reports on sustainability or climate change action;
(c) Sources of GHG emissions and offsets purchased – CAS and PCT reports, CNAR, BC GHG inventory reports; and

(d) Support mechanisms – PSECA announcements and reports, PSO budgets and accountability documents.

The findings from the document analysis and quantitative analysis are detailed in Chapter 4.

3.6 Expert Interviews

3.6.1 Selection of Interviewees

Structured and semi-structured expert interviews of major stakeholders of the case study organizations are conducted to provide deeper insights into organizational conditions and to better understand the underlying rationale or nuances for actions or decisions. These stakeholders include senior administrators, planning or development managers, facilities managers and sustainability managers. They are selected such that the interviews can build up a qualitative picture of how decisions involving infrastructure project planning, development and implementation are made, and what factors or mechanisms help or hinder these decisions.

A purposive sample of interviewees was identified based on their appointments in the case study organizations, whereby they are likely to have knowledge or expertise in the relevant issues. This sampling technique ensures that a diverse but representative set of informants from each organization will have the opportunity to provide comparative inputs that will facilitate an in-depth examination of the issues being studied (Teddlie and Yu 2007). This technique is chosen to yield a greater depth of information and insight about the impacts of the mandate, including high quality narrative data from these carefully selected sources (Teddlie and Yu 2007).
A snowball sampling method was also used to complement the purposive sample. When certain names repeatedly come up in the course of the interviews, these people were also approached to be interviewed. The original plan was to approach between 15 to 20 expert interviewees from the relevant functional areas in the 4 organizations. The preliminary list of appointment holders identified for the expert interview is given in Table 3.2.

**Table 3.2: Preliminary List of Interviewees**

<table>
<thead>
<tr>
<th>Functional Area</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UBC</td>
</tr>
<tr>
<td>Finance</td>
<td>VP Finance, Resources &amp; Operations</td>
</tr>
<tr>
<td>Campus Planning</td>
<td>AVP Campus &amp; Community Planning</td>
</tr>
<tr>
<td>Infrastructure Development</td>
<td>Managing Director, Infrastructure Development</td>
</tr>
<tr>
<td>Facilities Management</td>
<td>Managing Director, Building Operations</td>
</tr>
<tr>
<td>Sustainability</td>
<td>Associate Provost, Sustainability; Director, Operational Sustainability</td>
</tr>
</tbody>
</table>
3.6.2 Interview Protocol

The structured/semi-structured style of interview adopted provides the interviewer and interviewees the flexibility to make the best use of the allotted time for the interview to focus on aspects or issues that were particularly relevant and interesting, depending on the roles of the interviewees within their organization.

A common set of interview questions was used for the interviews (Please see Appendix G). The interview questions seek to improve our understanding of the following key areas related to infrastructure development in these institutions, which are identified in the literature review in Chapter 2:

(a) The historical and institutional context for the development of sustainability efforts or climate actions in these institutions;
(b) How climate actions have changed, if any, since CNG was mandated;
(c) How decisions on infrastructure projects are made;
(d) What factors facilitate or constrain such decisions; and
(e) What support mechanisms can help move these institutions towards greater investment in infrastructure projects that reduce GHG emissions.

Further, the interview questions also seek to understand whether and how learning has occurred among PSOs, and what other forums or channels can be used to increase such learning and sharing of innovative solutions.

The findings of the expert interviews are detailed in Chapter 5.
4. **Document Analysis**

4.1 **Introduction**

The document analysis carried out for this study relies heavily on reports and documents in the public domain, obtained via the public websites of the BC Government, ministries, agencies and PSOs, and through internet searches. Additional information, especially quantitative data, is obtained from the participating case study PSOs.

The main reports and documents used for analyzing the responses of PSOs and impacts of the CNG mandate on PSOs include annual reports of the CAS and PCT, CNARs and annual reports of the case study PSOs, and other reports and web pages on infrastructure projects, emissions and offsets.

The list of documents reviewed and analyzed is given in Appendix A which include, among others, the relevant BC legislation (GGRTA and Carbon Neutral Government Regulation (CNGR)), annual progress reports by CAS, CNARs, PSO annual reports, budget and accountability documents, and special reports on sustainability or climate change action.

Sections 4.2 and 4.3 highlight some notable efforts taken by the public sector as a whole and the 4 selected case study PSOs, both prior to the CNG mandate and since then, based on the review of documents. Section 4.4 presents the analysis of GHG emissions data, while Section 4.5 provides the analysis of energy consumption data of UBC and SFU. Energy consumption data for DO and VCC is not available.
4.2 Actions Taken

4.2.1 The Public Sector

BC’s GGRTA (British Columbia Government 2007) and CNGR (British Columbia Government 2008b) require all PSOs to measure, reduce and offset GHG emissions from their buildings, vehicle fleets and paper use from the calendar year 2010 onwards. The GGRTA also requires PSOs to make, beginning with the calendar year 2008, annual public reports (i.e. the CNAR) that include a description of the actions taken by the provincial government and PSOs in the relevant calendar year to minimize their GHG emissions and their plans to continue minimizing those emissions (British Columbia Government 2007).

The CAS coordinates climate action activities across the BC Government. When first established in 2008, CAS reported directly to the Premier’s Office, but it is now a unit reporting to the Minister of Environment. CAS works with other ministries, government agencies and Crown Corporations to develop policies to support CNG. It issues guidelines on the format and reporting requirements for CNAR and produces an annual summary of public sector efforts towards CNG. The first report was published for calendar year 2008 (Ministry of Environment, B.C. 2009).

The main source of information on actions taken by the BC public sector and PSOs therefore include the annual summary reports for the public sector by CAS and CNAR of individual PSOs. These are all available at the Ministry of Environment website (URL: [http://www.env.gov.bc.ca/cas/mitigation/cnar.html](http://www.env.gov.bc.ca/cas/mitigation/cnar.html)).

The BC government, led by Shared Services BC, developed its own web-based applications to assist with GHG measurement and reporting. ‘SMARTTool’ calculates and reports the emissions from PSO buildings, supplies (paper) and fleet vehicles
and equipment. ‘SMARTTEC’, the SMART Travel Emissions Calculator, computes the GHGs from government business travel and reports the emissions through SMARTTool. The emission factors and methodologies used by both applications to estimate GHG emissions are documented in the ‘2012 B.C. Best Practices Methodology For Quantifying Greenhouse Gas Emissions’ (Ministry of Environment, B.C. 2012g) and earlier versions of the document. Initially, the administration cost of SMARTTool was shared by all PSOs that are required to use the software, which imposed an additional financial burden on PSOs. However, responding to complaints from PSOs (Ministry of Environment, B.C. 2012a), the Government decided that from Fiscal Year 2012/13, this cost (approximately $850,000) would be absorbed by the PCT (Ministry of Environment, B.C. 2012b).

The public sector declared itself to be ‘carbon neutral’ since 2010, according to the definition of carbon neutrality in the GGRTA (British Columbia Government 2007). In order to be ‘carbon neutral’, the public sector spent $18.8 million to purchase 752,298 tonnes of offsets for 2012 emissions. Although PSOs are required under GGRTA to report and offset their emissions only from 2010, most PSOs started planning or taking action soon after the announcement of CNG in 2007.

All PSOs have, at the minimum, completed their organizational GHG inventories for 2010 up to 2012 using SMARTTool for ‘in-scope’ GHG emissions and reported annually on actions taken and planned since 2008. For some PSOs, this is the first time that they have an inventory of their main energy sources and the associated GHG emissions. These inventories can enable PSOs to benchmark performance and identify more opportunities for reducing their emissions.

Beyond measuring, however, different PSOs have demonstrated varying degrees of action on climate change. It appears that most PSOs have taken some actions, such as lighting or energy efficiency retrofits. Many of the PSOs have taken the
opportunity, within renovation projects or new building developments, to increase their energy efficiency or reduce energy consumption. Whether these are small or large scale projects, they should reduce energy consumption or GHG emissions, if not absolutely, at least compared to a 'business-as-usual' scenario. In 2007, BC has also committed that all new public sector buildings or major renovations must target Leadership in Energy and Environmental Design (LEED) Gold certification. By 2010, BC PSOs had approximately 105 LEED Gold projects completed or underway, with some choosing to go even further by pursuing the highest LEED certification level of Platinum (Ministry of Environment, B.C. 2011).

However, such infrastructure projects usually cost much more than a straightforward replacement. They also entail large upfront capital investments that produce a stream of savings over the life of the projects. Examples of transformative projects that significantly reduced GHG emissions include UNBC’s $16 million biomass gasification system project¹ that reduces GHG by 3,500 tonnes per year and creates annual savings of $500,000, and UBC’s $88 million steam to hot water conversion project that is expected to reduce 11,000 tonnes of GHG per year and $4 million annually in energy savings when fully completed.

4.2.2 New Capital Funding

As part of the CNG initiative to kick-start capital efforts by PSOs, the BC Government launched a public sector energy conservation capital fund in 2008. The original Public Sector Energy Conservation Agreement (PSECA) was created as a partnership between BC Hydro and the Government of BC. A sum of $75 million over three years was committed during Budget 2008 to help PSOs reduce GHG emissions, energy consumption and operating costs, to support the government in achieving its goal of

¹ An interviewee from SFU estimated that a conventional natural gas boiler with an equivalent capacity could be purchased for about $1.5 million.
carbon neutrality. In June 2010, Terasen Gas, now FortisBC, became a PSECA partner. The new agreement leveraged FortisBC's incentives to help build energy efficiency capacity across the public sector. SolarBC is also working with the Government of BC to promote solar hot water and air heating systems and leverage federal funding through Natural Resources Canada (NRCan) (Ministry of Environment, B.C. 2011; Ministry of Environment, B.C. 2013b).

Through 3 rounds of competitive applications, PSECA has approved funding for 247 energy projects in schools, hospitals, colleges, universities and other government buildings across the province. When completed, those projects are expected to reduce carbon output by 36,500 tonnes and save organizations about $12.6 million in annual energy costs (Ministry of Environment, B.C. 2013b).

Capital funding was not provided for the PSECA programme in Fiscal Year 2011/12. However, in response to pressure from PSOs and the public, the provincial government announced a new $5-million capital programme in 2012 that is available to school districts for energy-efficiency projects that will lower their carbon emissions. Starting in Fiscal Year 2012/13, the new K-12 energy-efficiency capital programme or Carbon Neutral Capital Programme (CNCP) was made available to boards of education through the Ministry of Education. The amount of available funding was set to be equal to or greater than the total paid by school boards each year for purchases of carbon offsets from the PCT (Ministry of Environment, B.C. 2012f).

Another programme, which is unrelated to the CNG mandate, but which BC’s post-secondary institutions have taken advantage of, is the Knowledge Infrastructure Programme (KIP). The KIP is a federal programme, introduced as part of Canada’s Economic Action Plan. It was a two-year, $2-billion economic stimulus plan to revitalize facilities at universities and colleges across Canada. The programme
invested in over 500 projects at post-secondary institutions. New buildings were constructed and existing facilities received needed upgrades that improved energy efficiency of these post-secondary institutions and addressed urgent deferred maintenance projects. In BC, 42 projects received KIP funding totaling $237 million. Thirty three of these projects involved energy efficiency improvements, including renewal of the Shrum Science Centre at SFU, installation of a ‘green’ roof at DO and upgrade/renewal of building envelope and boilers at VCC (Industry Canada 2013).

4.2.3 Learning

The CAS holds an annual event (Carbon Neutral Symposium) to celebrate the achievements of the CNG mandate, which is an opportunity for PSOs to share success stories and experiences in implementing the mandate. CAS also conducts several workshops, seminars and training sessions both online and in various locations across BC, aimed at providing information to those involved in the mandate on CNAR reporting requirements, updates to SMARTTool software, as well as topics like climate change, energy saving and energy-related tools. Some of these events are run jointly with partners like BC Hydro, FortisBC and NRCan.

CAS provides support to the LiveSmart BC Climate Leaders Community (http://www.livesmartbccommunity.ca), a social media site built and administered by the CAS to support the province’s climate action goals by providing tools and resources to individuals and organizations to help them reduce their GHG emissions. This is a collaborative space for individuals and organizations to share their ideas and successes, ask questions of their climate action colleagues, and build upon the collective knowledge and experience of others who are working on Climate Action, conservation, and sustainability in BC. This community complements the regularly occurring regional climate action mobilization events happening throughout BC.
Results from those events are posted at the site for further dialogue and conversation (Climate Action Secretariat, Ministry of Environment BC 2013).

4.2.4 The University of British Columbia (UBC)

Among BC’s post-secondary institutions, UBC Vancouver Campus has been a leader in campus sustainability and climate change action. Beginning with the 1990 signing of the Talloires Declaration, a ten-point action plan for incorporating sustainability and environmental literacy in teaching, research, operations and outreach at colleges and universities, and followed by establishment of the Campus Sustainability Office in 1998, UBC continued to set aggressive targets in 2010 to reduce GHG emissions 33% by 2015, 67% by 2020, and 100% by 2050, compared to 2007 levels (University of British Columbia 2010).

One of UBC’s major energy efficiency projects, Electrek, retrofitted lighting in the 30 largest core academic buildings at UBC and was completed in 2002. From 2001 to 2008, UBC undertook the EcoTrek project, the largest energy and water retrofit at a Canadian campus at the time, which retrofitted 288 buildings on campus, resulting in annual reduction of 8,000 tonnes of GHG emissions and savings of $4.2 million per year in energy and water consumption (UBC Campus Sustainability Office 2009). UBC reached its Kyoto Protocol target in 2007, reducing GHG emissions from academic buildings to 6% below 1990 levels.

The EcoTrek project employed an Energy Service Company (ESCO) model, where UBC entered into an energy performance contract with MCW Custom Energy Solutions Ltd. Under the contract, the ESCO undertook energy audits of campus buildings and implemented energy efficiency and conservation measures. The ESCO guaranteed a minimum level of savings, and this guarantee helped to reduce the performance risk to UBC, which facilitated financing and approval of this large
project. The capital cost of the project was about $39 million and was provided through a loan from the University, and incentives totaling nearly $4 million from BC Hydro, contingent on realizing the projected electricity savings during the first year after completion of the infrastructure retrofit.

UBC established a Technical Advisory Committee of academic, operations, staff and student members in 2007 to measure its GHG emissions. The initial inventory used the World Resources Institute Greenhouse Gas Protocol to quantify 2006 emissions, which included direct and indirect emissions (Scope 1 and Scope 2), as well as optional emissions (Scope 3).

Coinciding with the BC Government’s mandating of carbon neutrality, UBC President Stephen Toope and five other BC university and college presidents reaffirmed their commitment by being the first to sign the ‘University and College Presidents’ Climate Change Statement of Action for Canada’ in 2008.

In 2011, UBC opened the Centre for Interactive Research on Sustainability (CIRS) and proceeded with the Bioenergy Research and Demonstration Facility (BRDF) and the steam to hot water conversion project. The $34-million BRDF project, a partnership with Vancouver-based Nexterra and General Electric, is expected to eliminate 9% of campus GHG emissions per year by reducing natural gas consumption used for generating steam. The $88-million steam to hot water conversion project, when completed, will replace 14 kilometres of aging steam system pipeline infrastructure, reducing emissions by 22% and saving up to $4 million a year in energy and operational costs. From 2008 to 2012, UBC also undertook several lighting and energy retrofit projects, including the Continuous Optimization Programme (COP) with BC Hydro, and replacement of older vehicles with hybrid and electric vehicles.
New energy performance requirements for new construction and major renovations, including student residences, offices, classrooms and laboratory spaces, were written into the Sustainability section of the Technical Guidelines. UBC now sets an Energy Density Target for each new building project, which the design team must meet or exceed.

4.2.5 Simon Fraser University (SFU)

SFU also has a long history of energy conservation and energy efficiency efforts. It is one of the early signatories of the Talloires Declaration in 1990. SFU Burnaby campus’ $3-million lighting retrofit programme was carried out between 2003 and 2005, saving 6 gigawatt-hours (GWh) of energy per year. Every year, energy retrofit projects that have passed business case analysis are implemented by Facilities Operations. SFU claims that in the past two decades, its energy conservation strategies and PowerSmart initiatives have cumulatively resulted in more than $25 million in cost avoidance (Simon Fraser University 2009).

SFU renewed its commitment to taking action on the environment by signing the ‘University and College Presidents’ Climate Change Statement of Action for Canada’ in 2008. The Sustainability Advisory Committee was formed, comprising faculty, senior administration and student representatives. A part-time Campus Sustainability Coordinator was hired in August 2007 to develop and support targeted sustainability-related activities and programmes (Simon Fraser University 2008). In 2010, senior administration through the Vice President Finance and Administration lent support to energy conservation efforts through the signing of a public Energy Commitment, setting formal goals to continue on a 2% reduction in energy consumption year over year and to support the provincial targets set for reducing province-wide emissions (Simon Fraser University 2011; Simon Fraser University 2013a).
SFU completed an inventory of its 2007 GHG emissions for the first time, to set a baseline for GHG management and to identify reduction opportunities. In 2009, Facilities Services created a position of full-time Sustainability Coordinator to support the implementation of strategic plan objectives and to manage and continue to expand the behaviour change programmes across SFU’s three campuses. In 2012, SFU funded a new Sustainability Office and established a Senior Sustainability Council, composed of a senior representative from each vice-presidential portfolio (Simon Fraser University 2013b).

SFU continued to implement a number of lighting and energy retrofits between 2008 and 2012. Work on the $50-million Shrum Chemistry major renewal capital project, which began in 2009, was completed in 2011. This major renewal capital project incorporated high performance energy management technologies such as low flow fume hoods and Direct Digital Controls (DDC) for air conditioning and lighting systems. Through participation in BC Hydro’s Continuous Optimization pilot programme, emissions for two buildings were each reduced by over 20%. Since then, SFU has put several more buildings through the COP.

In 2010, a partnership agreement was signed by the University with SFU Community Trust and Corix Energy to jointly fund, develop and implement a district energy system that would serve both SFU and the residential developments on Burnaby Mountain. In April 2011, Premier Christy Clark announced provincial funding (through PSECA) of $4.7 million for this proposed project (Simon Fraser University 2012b). Two smaller solar demonstration projects were installed at the SFU Burnaby campus: a solar thermal (hot water) project and a solar electric (photovoltaic array) were installed at the Facilities Services building. The energy data was collected to determine the potential for solar as a renewable source of energy at the Burnaby campus.
4.2.6  *Douglas College (DO)*

Douglas College did not seem to have undertaken special efforts in energy conservation, energy efficiency or GHG reduction in its campuses prior to the CNG mandate. No such major efforts before 2008 are indicated in its website or other publications, despite the College offering a short-term continuing education programme in Building Energy and Resource Management.

Beginning in 2008, DO created an Environmental Sustainability Task Force and commenced replacing incandescent light bulbs with compact fluorescent lamps (CFLs) and light emitting diodes (LEDs). DO also undertook installation of variable speed drives, additional insulation and upgrade of boiler burner controls and upgrades to the HVAC system, to the extent allowable within its operational budget. The reduction in its Annual Capital Allowance has apparently limited DO’s ability to pursue substantive capital initiatives to reduce its GHG emissions (Vancouver Community College 2013; Douglas College 2013).

From 2009 to 2012, DO continued to do lighting and energy efficiency retrofits. In 2010, as part of a re-roofing project, DO installed a green roof system on the third and fourth floor decks of its New Westminster campus. DO also worked with Siemens Building Technologies to develop an energy use baseline with data from 2009 to 2011. A draft baseline was compiled in 2012. DO’s GHG emissions inventory was calculated using SMARTTool from 2010 to 2012.

4.2.7  *Vancouver Community College (VCC)*

Like DO, VCC did not seem to have undertaken special efforts in energy conservation, energy efficiency or GHG reduction in its campuses prior to the CNG mandate. There are no reports of major efforts made before 2008, except for an energy audit in 2007 (Vancouver Community College 2013).
In 2008, VCC put in place an executive advisory group tasked to provide advice to the College administration on issues and initiatives related to conservation and sustainability. Its membership included a cross section of stakeholders, including students, faculty staff, management and volunteers (Vancouver Community College 2009). Feasibility studies, budget approval and project tenders for a lighting retrofit project for the Broadway Campus were initiated in 2008, with the actual project commencing and completing in 2009. Feasibility studies, budget approval and project tenders were initiated in 2008 for the installation of energy efficient hot water tanks at the Broadway Campus, with the actual project commencing in 2009. VCC also began other energy efficiency projects like installation of DCC for HVAC systems, replacement of standard motors with variable speed motors and replacement of exterior glazing with more energy efficient glazing.

VCC continued with lighting and energy efficiency projects from 2009 to 2012. During the first round of PSECA funding, VCC obtained $320,000 for the installation of energy-efficient hot water tanks at the College’s new building at the Downtown Campus (Ministry of Environment, B.C. 2013b).

VCC created and staffed a new position of Manager of Environment & Sustainability in November 2011 with a mandate to guide the College in integrating sustainability values and practices into VCC’s strategic and operation planning processes, the management of its resources and operations, facilities planning and design, research activities and curriculum. In 2012, through the Environment & Sustainability Advisory Group, VCC developed an Environment & Sustainability Plan with a vision to bring sustainability principles into the thinking, actions, culture and everyday operations of VCC. VCC also set a goal to reduce its carbon footprint by 10% below 2011 levels by 2016 (Vancouver Community College 2013). In order to meet this target, VCC will complete and implement a Strategic Energy Management Plan that will identify opportunities to reduce energy use and greenhouse gas emissions and
their associated costs. In 2012, VCC completed an Energy Management Assessment with BC Hydro in order to assess the energy management approach and identify priority areas for further action. VCC also conducted walk-through natural gas energy audits of both campuses (Vancouver Community College 2013).

### 4.3 Summary of Actions Taken

A tabulation of the more significant actions taken by the 4 selected case study organizations, grouped under major categories such as management commitment, change in institutional structure, lighting and energy efficiency retrofits, buildings and vehicles is given in Appendix B.

From this tabulation, the following are observed:

a) Prior to the CNG mandate in 2008, institutions were at different stages of pursuing energy conservation and efficiency or climate change action, ranging from UBC, which has a long history of energy conservation and energy efficiency efforts and established a Campus Sustainability Office since 1998, to the smaller institutions like DO and VCC which have not been very active.

b) Since the CNG mandate, the 4 institutions have reported an increase in activities and are planning to take more actions.

c) All 4 institutions are measuring at least their scope 1 and scope 2 GHG emissions, with UBC going beyond CNG requirements to track other scope 3 emissions such as commuting, travel and embodied emissions in buildings and SFU considering tracking of international business travel.

d) UBC and SFU have impressive lists of action taken, on the surface, but many of these are probably things they have already been working on before the CNG mandate, which they are able to accelerate because of the mandate. The expert interviews throw more light on whether this is the case.
e) DO and VCC did not appear to have undertaken any special efforts prior to the mandate, but since the mandate they have started lighting retrofits and small energy efficiency projects using their own funds. VCC received PSECA funding for one of their projects.

f) UBC has embarked on major infrastructure projects such as the BRDF and steam to hot water conversion project.

g) Overall, with the exception of UBC, progress seems to have slowed or stalled since 2011 when the ‘low-hanging fruits’ for energy efficiency have been harvested and no additional sources of external funding were available.

The expert interviews, which are reported in Chapter 5, help to corroborate what is actually happening on the ground in these institutions.

4.4 Emissions Data

4.4.1 Introduction

Not many PSOs in BC had inventoried their GHG emissions on their own prior to the CNG mandate. As noted in Section 4.3, PSOs are required to report their GHG emissions using SMARTTool beginning with the calendar year 2010. This marked the first time most PSOs in BC formally measured their GHG emissions. As such, with the exception of PSOs like UBC and SFU that commissioned their own GHG inventory studies in 2008 or earlier, other PSOs have only 3 years’ record of GHG emissions. Moreover, only scope 1 and scope 2 emissions, plus scope 3 emissions from paper are covered under CNG and calculated using SMARTTool. Emissions from business travel by core government ministries and departments, but not other PSOs, are also covered under CNG.
There are limitations to the overall coverage of the CNG mandate, as noted in Section 2.4 on boundaries and in previous research (Lau and Dowlatabadi 2011a)(Lau and Dowlatabadi 2011b). In addition, SMARTTool calculations are based on emission factors that are reviewed annually (Ministry of Environment, B.C. 2012g), but which may still underestimate emissions from sources such as imported electricity (Dowlatabadi 2011). Notwithstanding these, the available GHG data from PSOs is the most comprehensive to-date and conforms to the minimum recommendation by the GHG Protocol (WRI and WBCSD 2004) to include scope 1 and scope 2 emissions. So, while 3 years is probably too short a duration for us to discern a clear trend for PSO’s GHG emissions, they nonetheless offer a good source of data from which we can attempt to make some observations regarding the actual performance of PSOs under the CNG mandate, to supplement the picture on actions taken provided by the CNARs.

4.4.2 Public Sector Total Emissions and Offsets

During the first three years of reporting, total public sector emissions covered under CNG increased by 7.6% from 2010 to 2011, then dropped 3.3% in 2012, to end up 4.1% above the baseline 2010 level.

In their annual summary report for 2012, CAS also presented the figures on a ‘climate-normalized’ basis, where total emissions from the public sector decreased marginally by 1.3% from 2010 to 2012 (Please see Table 4.1 on the next page).
Table 4.1: BC Public Sector GHG Emissions 2010 – 2012

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Emissions</td>
<td>812,065</td>
<td>873,938</td>
<td>845,235</td>
</tr>
<tr>
<td>Change over 2010</td>
<td>+ 7.6%</td>
<td>+ 4.1%</td>
<td></td>
</tr>
<tr>
<td>Normalized Total</td>
<td>860,170</td>
<td>849,679</td>
<td>848,707</td>
</tr>
<tr>
<td>Emissions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change over 2010</td>
<td>- 1.2%</td>
<td>- 1.3%</td>
<td></td>
</tr>
</tbody>
</table>

Source: (Ministry of Environment, B.C. 2013c). Figures for 2010 and 2011 are updated as at May 2013 and reflect amendments not originally reported in the Climate Action Secretariat’s Carbon Neutral Government summaries of previous reporting years.

CAS explains that in order to control for variations in the climate, the ‘climate-normalized’ figures were derived by taking the average temperature profile for a 30-year period and calculating the number of days that required buildings to use energy to heat or cool temperatures above or below 15°C. This is referred to as ‘degree days’ and is commonly used as an indication of space heating or cooling requirements (Environment Canada 2013). The figures for the years under review are then compared to the baseline year to see if there was more or less energy required than ‘normal’ (Ministry of Environment, B.C. 2013c). Such ‘climate normalization’ using ‘degree days’ is reasonable since about 78% of total public sector GHG emissions are from buildings and the resultant figures are taken as an average for the entire public sector. However, the normalization adjustment might give a different result depending on how the 30-year average degree-day was computed, which weather stations within the whole of BC the temperature readings were taken from, or if a different threshold temperature was used instead of 15°C. Environment Canada cites a threshold temperature of 18°C (Environment Canada 2013), which would have called for a smaller adjustment to the 2011 and 2012 figures. There would also be a different ‘climate normalized’ figure for different
PSOs depending on the geographical locations of their facilities and individual emissions profile, so no firm conclusions can be drawn for individual PSOs unless such detailed information were incorporated in the calculation.

As for total offsets purchased for emissions from the public sector, they increased by 7.9% from 2010 to 2011, then dropped 4.2% in 2012, to end up 3.4% above the baseline 2010 level. On a ‘climate-normalized’ basis, total offsets purchased by the public sector decreased marginally by 2.6% from 2010 to 2012 (Please see Table 4.2 below).

**Table 4.2: BC Public Sector GHG Offsets 2010 – 2012**

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Offsets</td>
<td>727,647</td>
<td>785,379</td>
<td>752,303</td>
</tr>
<tr>
<td>Change over 2010</td>
<td></td>
<td>+ 7.9%</td>
<td>+ 3.4%</td>
</tr>
<tr>
<td>Normalized Total Offsets</td>
<td>775,651</td>
<td>761,181</td>
<td>755,665</td>
</tr>
<tr>
<td>Change over 2010</td>
<td></td>
<td>- 1.9%</td>
<td>- 2.6%</td>
</tr>
</tbody>
</table>

Source: (Ministry of Environment, B.C. 2013c). Figures for 2010 and 2011 updated as at May 2013 and reflect amendments not originally reported in the Climate Action Secretariat’s Carbon Neutral Government summaries of previous reporting years.

In summary, within the short period of time for which emissions data is available for the public sector, and bearing in mind the limitations of ‘climate normalization’ discussed above, it may perhaps be surmised that there is no significant reduction in GHG emissions for the public sector as a whole during the 3 years since CNG was mandated in BC.
4.4.3 Sectoral Comparison of Emissions and Offsets

Among the main sectors of the public sector, emissions performance varied slightly. As seen in Figure 4.1 and Table 4.3, total GHG emissions from the public sector increased by 3.8% from 2010 to 2012. Total emissions from Crown Corporations increased the least at 1.8%, while emissions from Health Authorities increased the most at 5.7%. GHG Emissions from Post-Secondary Institutions increased by 4.9%, being the median among the sectors, but above the average of the Public Sector.

GHG emissions from the Public Sector and all sectors except for Core Government were lower in 2012 compared to 2011. However, Core Government total emissions increased from 2010 through 2011 to 2012.

Figure 4.1: Total GHG Emissions by Sector 2010 – 2012

Sources: (Ministry of Environment, B.C. 2011; Ministry of Environment, B.C. 2012d; Ministry of Environment, B.C. 2013)
Table 4.3: Total GHG Emissions by Sector 2010 – 2012

<table>
<thead>
<tr>
<th>Sector</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2012-2010 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post Secondary</td>
<td>150,959</td>
<td>161,727</td>
<td>158,378</td>
<td>4.9</td>
</tr>
<tr>
<td>Health Authorities</td>
<td>217,331</td>
<td>231,691</td>
<td>228,548</td>
<td>5.2</td>
</tr>
<tr>
<td>School Districts</td>
<td>198,387</td>
<td>214,048</td>
<td>202,683</td>
<td>2.2</td>
</tr>
<tr>
<td>Crown Corporations</td>
<td>152,978</td>
<td>158,361</td>
<td>155,734</td>
<td>1.8</td>
</tr>
<tr>
<td>Core Government</td>
<td>94,494</td>
<td>98,212</td>
<td>99,868</td>
<td>5.7</td>
</tr>
<tr>
<td>Public Sector</td>
<td>814,149</td>
<td>864,040</td>
<td>845,211</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Sources: (Ministry of Environment, B.C. 2011; Ministry of Environment, B.C. 2012d; Ministry of Environment, B.C. 2013)

In terms of offsets purchased among the main sectors of the public sector, the pattern was slightly different compared to total emissions. As seen in Figure 4.2 and Table 4.4, offsets purchased by the Public Sector under CNG increased by 3.1% from 2010 to 2012. However, offsets by Post-Secondary Institutions held steady in 2012 compared to 2010, while offsets by Core Government increased the most at 5.8%. Similar to total emissions, offsets by the Public Sector and all sectors except for Core Government were lower in 2012 compared to 2011. Again, Core Government offsets purchased increased from 2010 through 2011 to 2012.

One of the reasons for the difference between total GHG emissions and offsets of Post-Secondary Institutions could be due to the increased use of biomass to replace natural gas in a number of institutions, notably UBC and UNBC. Under the CNGR, with subsequent clarifications through a series of policy decisions, emissions from the use of biomass and biofuel sources have to be reported but are not required to be offset (Ministry of Environment, B.C. 2012g).
Figure 4.2: Offsets Purchased by Sector 2010 – 2012

![Figure 4.2: Offsets Purchased by Sector 2010 – 2012](image)

Sources: (Ministry of Environment, B.C. 2011; Ministry of Environment, B.C. 2012d; Ministry of Environment, B.C. 2013)

Table 4.4: Offsets Purchased by Sector 2010 – 2012

<table>
<thead>
<tr>
<th>Sector</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2012-2010 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post Secondary</td>
<td>150,779</td>
<td>159,207</td>
<td>150,746</td>
<td>(0.0)</td>
</tr>
<tr>
<td>Health Authorities</td>
<td>217,135</td>
<td>231,472</td>
<td>228,349</td>
<td>5.2</td>
</tr>
<tr>
<td>School Districts</td>
<td>176,672</td>
<td>191,335</td>
<td>180,535</td>
<td>2.2</td>
</tr>
<tr>
<td>Crown Corporations</td>
<td>92,245</td>
<td>96,817</td>
<td>94,307</td>
<td>2.2</td>
</tr>
<tr>
<td>Core Government</td>
<td>92,951</td>
<td>96,678</td>
<td>98,361</td>
<td>5.8</td>
</tr>
<tr>
<td>Public Sector</td>
<td>729,782</td>
<td>775,509</td>
<td>752,298</td>
<td>3.1</td>
</tr>
</tbody>
</table>

Sources: (Ministry of Environment, B.C. 2011; Ministry of Environment, B.C. 2012d; Ministry of Environment, B.C. 2013)
4.4.4 Post-Secondary Institutions

Among the group of post-secondary institutions, emissions performance, as measured by offsets purchased in 2012 compared to 2010, is varied. While some recorded increases of close to 20%, a few had only single-digit increases and others even a decrease of 10 to 20% in their emissions (Please see Table 4.5 on the next page). The 4 case study organizations are highlighted in green. Overall, BC’s post-secondary institutions as a group performed slightly better than the public sector average.
Table 4.5: Quantity of Offsets Purchased by BC Post-Secondary Institutions

<table>
<thead>
<tr>
<th>Institution</th>
<th>2012 Total Offsets Purchased (tonnes)</th>
<th>2010 Total Offsets Purchased (tonnes)</th>
<th>Difference Total Offsets Purchased</th>
<th>% Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Columbia Institute of Technology</td>
<td>9,673</td>
<td>9,473</td>
<td>200</td>
<td>2.1</td>
</tr>
<tr>
<td>Camosun College</td>
<td>1,843</td>
<td>2,029</td>
<td>(186)</td>
<td>(9.2)</td>
</tr>
<tr>
<td>Capilano University</td>
<td>2,189</td>
<td>2,163</td>
<td>26</td>
<td>1.2</td>
</tr>
<tr>
<td>College of New Caledonia</td>
<td>2,700</td>
<td>2,256</td>
<td>444</td>
<td>19.7</td>
</tr>
<tr>
<td>College of the Rockies</td>
<td>829</td>
<td>832</td>
<td>(3)</td>
<td>(0.4)</td>
</tr>
<tr>
<td>Douglas College</td>
<td>2,039</td>
<td>1,960</td>
<td>79</td>
<td>4.0</td>
</tr>
<tr>
<td>Emily Carr University of Art &amp; Design</td>
<td>910</td>
<td>859</td>
<td>51</td>
<td>6.0</td>
</tr>
<tr>
<td>Justice Institute of BC</td>
<td>712</td>
<td>696</td>
<td>16</td>
<td>2.3</td>
</tr>
<tr>
<td>Kwantlen Polytechnic University</td>
<td>2,665</td>
<td>2,479</td>
<td>186</td>
<td>7.5</td>
</tr>
<tr>
<td>Langara College</td>
<td>1,567</td>
<td>1,762</td>
<td>(195)</td>
<td>(11.0)</td>
</tr>
<tr>
<td>Nicola Valley Institute of Technology</td>
<td>496</td>
<td>420</td>
<td>76</td>
<td>18.1</td>
</tr>
<tr>
<td>North Island College</td>
<td>1,145</td>
<td>1,132</td>
<td>13</td>
<td>1.2</td>
</tr>
<tr>
<td>Northern Lights College</td>
<td>2,003</td>
<td>1,786</td>
<td>217</td>
<td>12.2</td>
</tr>
<tr>
<td>Northwest Community College</td>
<td>1,702</td>
<td>1,421</td>
<td>281</td>
<td>19.8</td>
</tr>
<tr>
<td>Okanagan College</td>
<td>1,484</td>
<td>1,902</td>
<td>(418)</td>
<td>(22.0)</td>
</tr>
<tr>
<td>Royal Roads University</td>
<td>1,270</td>
<td>1,460</td>
<td>(190)</td>
<td>(13.0)</td>
</tr>
<tr>
<td>Selkirk College</td>
<td>1,423</td>
<td>1,575</td>
<td>(152)</td>
<td>(9.7)</td>
</tr>
<tr>
<td>Simon Fraser University</td>
<td>17,818</td>
<td>17,695</td>
<td>123</td>
<td>0.7</td>
</tr>
<tr>
<td>Thompson Rivers University</td>
<td>4,104</td>
<td>4,217</td>
<td>(113)</td>
<td>(2.7)</td>
</tr>
<tr>
<td>University of British Columbia-Vancouver</td>
<td>64,799</td>
<td>61,649</td>
<td>3,150</td>
<td>5.1</td>
</tr>
<tr>
<td>University of British Columbia - Okanagan</td>
<td>3,316</td>
<td>2,856</td>
<td>460</td>
<td>16.1</td>
</tr>
<tr>
<td>University of Northern British Columbia</td>
<td>2,167</td>
<td>5,688</td>
<td>(3,521)</td>
<td>(61.9)</td>
</tr>
<tr>
<td>University of The Fraser Valley</td>
<td>3,269</td>
<td>3,061</td>
<td>208</td>
<td>6.8</td>
</tr>
<tr>
<td>University of Victoria</td>
<td>14,156</td>
<td>15,506</td>
<td>(1,350)</td>
<td>(8.7)</td>
</tr>
<tr>
<td>Vancouver Community College</td>
<td>3,000</td>
<td>2,993</td>
<td>7</td>
<td>0.2</td>
</tr>
<tr>
<td>Vancouver Island University</td>
<td>3,346</td>
<td>3,070</td>
<td>276</td>
<td>9.0</td>
</tr>
<tr>
<td><strong>Post Secondary Total</strong></td>
<td><strong>150,625</strong></td>
<td><strong>150,940</strong></td>
<td><strong>(315)</strong></td>
<td><strong>(0.2)</strong></td>
</tr>
<tr>
<td><strong>Public Sector Total</strong></td>
<td><strong>752,303</strong></td>
<td><strong>727,647</strong></td>
<td><strong>24,656</strong></td>
<td><strong>3.4</strong></td>
</tr>
</tbody>
</table>
There could be a number of explanations for the differences in emissions of these institutions. First, the time period is extremely short, so we cannot expect to see any trend or draw meaningful conclusions yet. Second, variability of weather conditions in different regions of BC during these 3 years could account for some differences. Third, many of the institutions are still expanding their enrolment and bringing more buildings and facilities on stream, leading to an increase in energy use on campus and hence emissions. Fourth, some institutions have been pursuing energy efficiency retrofits or new infrastructure projects that lower GHG emissions, prior to the implementation of CNG. Their emissions pattern could be the result of these past efforts. Institutions that have embarked on emission reduction projects since 2008 may also start to see their projects bear fruit in terms of lower emissions, while others should see such reductions over the next few years.

4.4.5 Case Study PSOs

Figure 4.3 on the next page shows the quantity of offsets purchased by the 4 case study PSOs during the first 3 years of the CNG mandate. All 4 PSOs exhibited the same pattern, although the degree of variation was greater in UBC than the other 3. Offsets purchased were highest in 2011, and 2012 offsets were marginally higher than that in 2010 in all 4 PSOs.

Sources: Carbon Neutral Action Reports of all post-secondary institutions (2010 and 2012), (Ministry of Environment, B.C. 2011), (Ministry of Environment, B.C. 2013), (Ministry of Environment, B.C. 2013c) – Figures incorporate adjustments for errors due to under- or over-reporting of emissions by individual institutions in 2010.
Figure 4.3: Offsets Purchased by Case Study PSOs 2010 – 2012

<table>
<thead>
<tr>
<th>Year</th>
<th>DO</th>
<th>SFU</th>
<th>UBC</th>
<th>VCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1,960</td>
<td>2,993</td>
<td>1,960</td>
<td>1,960</td>
</tr>
<tr>
<td>2011</td>
<td>2,294</td>
<td>3,080</td>
<td>2,294</td>
<td>2,294</td>
</tr>
<tr>
<td>2012</td>
<td>2,039</td>
<td>3,000</td>
<td>2,039</td>
<td>2,039</td>
</tr>
</tbody>
</table>

Sources: CNAR of DO, SFU, UBC and VCC (2010 – 2012)

Figure 4.4 on the next page shows the GHG intensity for the case study PSOs over the 3-year period from 2010 to 2012. The intensity is represented by quantity of offsets purchased by the respective institutions, divided by the enrolment of students, which is based on their annualized full-time equivalent (FTE).
From the graph, we can see that UBC has the highest GHG emissions intensity per student, twice the amount of SFU. DO has the lowest GHG emissions intensity among the 4 case study PSO, at less than 15% that of UBC. The large disparities are likely due to the nature of their operations, with UBC and SFU being full-fledged research universities complete with student residences. UBC also has a sprawling campus at Point Grey, while SFU’s Burnaby Campus is more compact, with buildings situated much closer together. DO’s David Lam Campus in Coquitlam and VCC’s Broadway Campus are relatively new, with major expansions completed in 2008 and 2009, respectively.

Over this short period of time, the GHG emissions intensity for DO, SFU and VCC are on a downward trend, with 2012 intensity below that of 2010. UBC’s GHG emissions intensity was at the same level in 2012 compared to 2010.

Figure 4.4: Offsets Purchased Per Student by Case Study PSOs 2010 – 2012
4.5 Energy Consumption Data

4.5.1 Introduction

Since there are only 3 years of complete GHG emissions data for most PSOs, it would be useful to look at energy consumption data, which is generally tracked and available over a longer period of time. Although it would be ideal if energy consumption trends in all the selected PSOs could be examined, such data is only made available by UBC and SFU. Similar energy consumption data for DO and VCC is not available in the public domain.

The energy consumption and related GHG emissions data is provided primarily by UBC’s Campus Sustainability Office and SFU Facilities Services. Additional data on student enrolment and campus floor space are found on the websites of UBC Planning & Institutional Research and SFU Institutional Research and Planning. This section will look at energy consumption and GHG emissions of UBC and SFU in detail. The key data used in this analysis are given in Appendix C and Appendix D.

4.5.2 The University of British Columbia

UBC has been tracking its energy consumption for a long period of time. The more accurate or complete data appears to be from 2006 onwards, but data for 2000 is provided for reference. Since the bulk of GHG emissions are from combustion of natural gas and generation of electricity (offsite), we focus on these two main...
energy sources. As can be seen from Figure 4.5, UBC’s electricity consumption has been on a clear upward trend since 2000, which continues up to 2012, despite the CNG mandate. Natural gas consumption fluctuated from year to year, with no clear upward or downward trend from 2006 onwards.

**Figure 4.5: UBC’s Electricity and Natural Gas Consumption 2000 – 2012**

As for GHG emissions that are covered under CNG, they have been on a declining trend since 2000, although there have been fluctuations from 2006 onwards (See Figure 4.6). An important point to note about UBC’s GHG emissions in 2012 is that
total emissions were 68,794 tonnes CO₂e, which was higher even than the total emissions in 2011, at 67,842. But because 3,995 tonnes of these were from biomass, UBC was only required to purchase 64,799 tonnes of offsets for 2012.

One main category of GHG emissions, i.e. fleet emissions, showed a much more significant downward trend, decreasing by about 36% from 2006 to 2012.

**Figure 4.6: UBC’s GHG Emissions Covered by ‘Carbon Neutral Government’ and Fleet GHG Emissions 2000 – 2012**

Sources: UBC Campus Sustainability Office and Carbon Neutral Action Reports 2010 – 2012
Like many other post-secondary institutions in BC, UBC has been expanding over the last 12 years in response to population growth in BC and an influx of international students. Similarly, UBC’s physical stock of buildings and facilities has had to expand to serve the larger enrolment. Figure 4.7 below shows the increases in enrolment and total floor space over this period. Enrolment increased 40% from 2000 to 2012, while total floor space increased by 30%.

**Figure 4.7: UBC’s Total Floor Space and Enrolment 2000 – 2012**

![Graph showing increases in enrolment and total floor space over 2000-2012]

Sources: UBC Campus Sustainability Office, UBC Planning & Institutional Research ([http://www.pair.ubc.ca/statistics/students/students.htm](http://www.pair.ubc.ca/statistics/students/students.htm))
The increase in enrolment and building stock has been accompanied by an increase in electricity consumption intensity. **Figure 4.8** below shows that electricity consumption intensity per student and per square metre have both been increasing from 2006 to 2012.

**Figure 4.8: UBC’s Electricity Consumption Intensity 2006 – 2012**

Sources: UBC Campus Sustainability Office, UBC Planning & Institutional Research (http://www.pair.ubc.ca/statistics/students/students.htm)
Natural gas consumption intensity, however, has been decreasing over the same period (Figure 4.9). Natural gas consumption per student decreased by 17% from 2006 to 2012, while natural gas consumption per square metre decreased by 18%.

**Figure 4.9: UBC’s Natural Gas Consumption Intensity 2006 – 2012**

Sources: UBC Campus Sustainability Office, UBC Planning & Institutional Research (http://www.pair.ubc.ca/statistics/students/students.htm)
Given that the GHG intensity of electricity is much lower than that of natural gas in BC, these trends have culminated in decreasing trends in both GHG intensity per student and stationary GHG per square metre (See Figure 4.10 below).

**Figure 4.10: UBC’s GHG Emissions Intensity 2000 – 2012**

Sources: UBC Campus Sustainability Office, UBC Planning & Institutional Research
([http://www.pair.ubc.ca/statistics/students/students.htm](http://www.pair.ubc.ca/statistics/students/students.htm))
It should be noted here that there does not appear to be any discernible trend of reduction in either UBC’s energy consumption or GHG emissions since 2008 when the CNG mandate was announced, nor since 2010 when PSOs are required to purchase offsets for their remaining GHG emissions. Changes in energy consumption and GHG emissions seem to be part of longer-term trends in UBC.

4.5.3 Simon Fraser University

SFU Facilities Services provided energy consumption data for 2007, the year when its GHG inventory was done for the first time, and the years 2010 to 2012. Like UBC, we focus on two energy sources – natural gas and electricity, which account for the bulk of SFU’s GHG emissions. As can be seen in Figure 4.11 below, SFU’s electricity consumption increased from 2007 to 2010, but has been decreasing slightly since 2010. Natural gas consumption is on a slight downward trend over the period, with fluctuations from year to year, depending on heating and cooling requirements associated with the weather in that year.

Figure 4.11: SFU’s Electricity And Natural Gas Consumption 2007 – 2012

Source: SFU Facilities Services (Facilities Development Unit)
SFU’s GHG emissions that are covered under CNG have been on a declining trend (See Figure 4.12). Like UBC, SFU’s fleet emissions also showed a pronounced downward trend, with a reduction of about 74% from 2007 to 2012. The drop seems most pronounced from 2007 to 2010, when the carbon tax first came into effect. The drop from 2010 to 2012 was not as steep, in comparison to the earlier period.

Figure 4.12: SFU’s GHG Emissions Covered by ‘Carbon Neutral Government’ and Fleet GHG Emissions 2007 – 2012

Sources: SFU Facilities Services (Facilities Development Unit)
SFU’s expansion in terms of enrolment and physical stock of buildings and facilities were rapid during recent years. Figure 4.13 below shows the increases in enrolment and total floor space since 2005. Enrolment increased 31% from 2005 to 2012, while total floor space increased by 35%.

**Figure 4.13: SFU’s Total Floor Space and Enrolment 2005 – 2012**

Sources: SFU Facilities Services Campus Space Inventory (http://www.sfu.ca/fs/Campus-Facility-Profiles/Campus-Space-Inventory.html); SFU Institutional Research and Planning (http://www.sfu.ca/irp/enrollments/EnrollmentDashboard.html)
The increase in enrolment and building stock has been accompanied by an increase in electricity consumption, as noted earlier in Figure 4.11. However, although electricity consumption intensity per square metre has been increasing slightly, Figure 4.14 shows that electricity consumption intensity per student has been decreasing from 2007 to 2012.

**Figure 4.14: SFU’s Electricity Consumption Intensity 2007 – 2012**

Sources: SFU Facilities Services (Facilities Development Unit); SFU Facilities Services Campus Space Inventory [http://www.sfu.ca/fs/Campus-Facility-Profiles/Campus-Space-Inventory.html]; SFU Institutional Research and Planning [http://www.sfu.ca/irp/enrollments/EnrollmentDashboard.html]
Like UBC, SFU’s natural gas consumption intensity has also been decreasing. Natural gas consumption per student decreased by 22% from 2007 to 2012, while natural gas consumption per square metre decreased by 17%.

**Figure 4.15: SFU’s Natural Gas Consumption Intensity 2007 – 2012**

Sources: SFU Facilities Services (Facilities Development Unit); SFU Facilities Services Campus Space Inventory (http://www.sfu.ca/fs/Campus-Facility-Profiles/Campus-Space-Inventory.html); SFU Institutional Research and Planning (http://www.sfu.ca/irp/enrollments/EnrollmentDashboard.html)
Overall, SFU’s GHG emissions intensity per student and stationary GHG per square metre have been decreasing over time (See Figure 4.16 below).

Figure 4.16: SFU’s GHG Emissions Intensity 2007 – 2012

Sources: SFU Facilities Services (Facilities Development Unit); SFU Facilities Services Campus Space Inventory (http://www.sfu.ca/fs/Campus-Facility-Profiles/Campus-Space-Inventory.html); SFU Institutional Research and Planning (http://www.sfu.ca/irp/enrollments/EnrollmentDashboard.html)
Given the limited amount of data available for SFU’s energy consumption and GHG emissions, it cannot be concluded whether there is any discernible trend of reduction in either SFU’s energy consumption or GHG emissions since 2008 when the CNG mandate was announced, nor since 2010 when PSOs are required to purchase offsets for their remaining GHG emissions.

4.6 Summary of Quantitative Analysis

During the 3 years from 2010 to 2012, when PSOs in BC are mandated to purchase carbon offsets for their emissions covered under CNG, there was no significant reduction in GHG emissions for the public sector as a whole. However, sectoral performance was varied, ranging from increases of 1.8% to 5.7%. Emissions from post-secondary institutions increased by 4.9% over the period, being the median among the sectors, but above the average of 3.8% for the Public Sector. In terms of offsets purchased, the quantity purchased by post-secondary institutions held steady in 2012 compared to 2010, compared to an increase of 3.1% for the Public Sector.

Emissions performance of individual PSOs over this period showed wider variations. For example, while some post-secondary institutions recorded increases of close to 20%, a few had only single-digit increases and others even a decrease of 10 to 20% in their emissions. Among the 4 case study organizations, offsets purchased by SFU and VCC held steady between 2010 and 2012, while offsets purchased by UBC and DO increased by 5.1% and 4.0%, respectively, over the same period. Their GHG emissions intensity, however, are on a downward trend, except for UBC, which held steady from 2010 to 2012.

A closer look at the energy consumption and GHG emissions data of UBC and SFU shows that total electricity consumption continues to rise while natural gas
consumption fluctuates, with a slight downward trend in SFU. UBC’s electricity consumption intensities per student and per square metre have both been increasing from 2006 to 2012, but SFU’s electricity consumption intensity per student has been decreasing from 2007 to 2012. Natural gas consumption intensities in both UBC and SFU show clear downward trends over time.

Total GHG emissions covered by the CNG mandate have been decreasing in UBC and SFU over a longer period from 2000 (for UBC) and 2007 (for SFU). One main category of GHG emissions, i.e. fleet emissions, showed a much more significant downward trend after 2007, which is consistent with the findings of a study on carbon tax mentioned in Chapter 1 (Elgie 2012). In both institutions, GHG emissions intensities showed a more marked decline than total GHG emissions over this longer period than from 2010 to 2012.

There does not appear to be any discernible change in the trend of reduction in either institutions’ energy consumption or GHG emissions since 2008 when the CNG mandate was announced, nor since 2010 when PSOs are required to purchase offsets for their remaining GHG emissions. Changes in energy consumption and GHG emissions seem to be part of longer-term trends in UBC and SFU.

As a comparison, the draft 2010 Community Energy and Emissions Inventory (CEEI) reports show that GHG emissions from residential, commercial and small/medium industrial buildings in the City of Vancouver decreased by 6.3%, while that in the City of Burnaby decreased by 6.1% from 2007 to 2010 (Ministry of Environment, B.C. 2013d). Population increased in Vancouver by 5.4% and in Burnaby by 5.8% between 2007 and 2010. Please see Tables 4.6 and 4.7 on the next page.
### Table 4.6: Comparison of GHG Emissions in 2007 and 2010

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2010</th>
<th>Percentage Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>UBC</td>
<td>61,090</td>
<td>58,353</td>
<td>-4.5</td>
</tr>
<tr>
<td>SFU</td>
<td>19,410</td>
<td>17,695</td>
<td>-8.8</td>
</tr>
<tr>
<td>City of Vancouver Buildings</td>
<td>1,209,584</td>
<td>1,132,845</td>
<td>-6.3</td>
</tr>
<tr>
<td>City of Burnaby Buildings</td>
<td>466,943</td>
<td>438,432</td>
<td>-6.1</td>
</tr>
</tbody>
</table>

Sources: UBC Campus Sustainability Office, SFU Facilities Services (Facilities Development Unit), (Ministry of Environment, B.C. 2013d).

### Table 4.7: Comparison of Enrolment and Population in 2007 and 2010

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2010</th>
<th>Percentage Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>UBC</td>
<td>37,589</td>
<td>40,961</td>
<td>+9.0</td>
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<tr>
<td>SFU</td>
<td>22,081</td>
<td>25,278</td>
<td>+14.5</td>
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<tr>
<td>City of Vancouver</td>
<td>610,136</td>
<td>642,843</td>
<td>+5.4</td>
</tr>
<tr>
<td>City of Burnaby</td>
<td>214,919</td>
<td>227,389</td>
<td>+5.8</td>
</tr>
</tbody>
</table>

5. **Expert Interviews**

5.1 **Introduction**

A letter of invitation ([Appendix E](#)) was sent to each of the 4 selected case study organizations in March 2013. SFU and UBC agreed to participate. Director of Facilities Services of DO replied that they are unable to participate in this study. VCC did not respond at all, despite numerous reminders.

Key personnel from the 2 selected institutions that agreed to participate in the study, i.e. UBC and SFU, were interviewed during May and June of 2013. A total of 10 interviews were conducted. All the interviewees are intimately involved in coordinating or implementing actions in response to the CNG mandate, and most of them are also involved in or support the decision-making process for infrastructure projects that impact on the GHG emissions of their organization. The list of interviewees is given in Table 5.1 on the next page. All interviewees signed the consent form, a sample of which is given in [Appendix F](#).
Table 5.1: List of Interviewees

**UBC**

<table>
<thead>
<tr>
<th>Functional Area/Department</th>
<th>Designation</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campus &amp; Community Planning</td>
<td>Assistant Vice President</td>
<td>Nancy Knight</td>
</tr>
<tr>
<td>Infrastructure Planning</td>
<td>Managing Director</td>
<td>John Metras</td>
</tr>
<tr>
<td>Building Operations</td>
<td>Managing Director</td>
<td>David Woodson</td>
</tr>
<tr>
<td>UBC Sustainability Initiative</td>
<td>Associate Provost, Sustainability</td>
<td>Prof. John Robinson</td>
</tr>
<tr>
<td>University Sustainability Office</td>
<td>Director, Operational Sustainability</td>
<td>Orion Henderson</td>
</tr>
</tbody>
</table>

**SFU**

<table>
<thead>
<tr>
<th>Functional Area/Department</th>
<th>Designation</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finance &amp; Administration</td>
<td>Vice President Finance &amp; Administration</td>
<td>Dr Pat Hibbitts</td>
</tr>
<tr>
<td>Facilities Services</td>
<td>Chief Facilities Officers</td>
<td>Larry Waddell</td>
</tr>
<tr>
<td>Facilities Services/Facilities Operations</td>
<td>Director of Maintenance &amp; Operations</td>
<td>Sam Dahabieh</td>
</tr>
<tr>
<td>Facilities Services/Facilities Development</td>
<td>Development Sustainability Manager</td>
<td>Wendy Lee</td>
</tr>
<tr>
<td>Sustainability Office</td>
<td>Director, Sustainability Office</td>
<td>K.C. Bell</td>
</tr>
</tbody>
</table>
All the interviews were recorded with a digital voice recorder and transcribed verbatim. The findings from the interviews are reported below according to the main topics or headings as identified in the interview protocol (Appendix G). Where appropriate and useful, quotations from the interviews are used, without identifying the interviewee.

5.2 Actions Taken prior to the Mandate

The first set of questions pertained to major climate change or related actions undertaken by the case study organizations prior to the mandating of CNG, and which parts of the organization were involved in or responsible for such actions.

The interviewees from UBC highlighted that UBC has a long history of sustainability efforts, of which climate change action was only one part of the larger sustainability agenda. From the establishment of the Campus Sustainability Office in 1998, energy reduction projects and lighting retrofits were driven by this Office, with active support and participation of the Building Operations team. The most extensive effort was the EcoTrek programme, a $39-million investment in upgrades to lighting systems, building heating, ventilation, air-conditioning systems and upgrades to the campus steam system. This project essentially led to the University achieving its target of reducing academic GHG emissions in 2007 to 6% below 1990 levels, which was Canada's Kyoto Protocol target.

During this period, there was some tracking done of building-related GHG emissions, but it was not a comprehensive inventory that included all properties, such as off-campus properties, nor scope 3 emissions or fleet emissions. According to one interviewee, “[In] January 2008, nobody knew even what our greenhouse gas footprint was, let alone what the major factors were.” Although this statement is an exaggeration, it does emphasize the point that awareness of GHG emissions from
UBC and the importance placed on reducing them were much lower then compared to now.

According to the interviewees from SFU, SFU has been actively pursuing reduction of its utility usage, particularly energy, since around the Middle East Oil Embargo in 1976. SFU’s Facilities Services Department had done a lot of small and incremental projects to reduce energy consumption, using whatever internal funds were available, as well as funding from agencies such as BC Hydro. Energy conservation and efficiency and cost savings were the focus, rather than any explicit focus on reducing carbon emissions.

SFU had invested in several rounds of lighting retrofits for the main Burnaby Campus, starting with de-lamping projects at the beginning, resulting in very significant savings to their electricity bills even as the Campus expanded. The Campus has one of the largest hot water district energy systems in the Lower Mainland. Renewals and upgrades of the boilers and associated equipment had ensured that they are now operating at very high efficiencies compared to the industry average for natural gas heating systems. SFU also made an early decision at the Burnaby Campus not to air-condition people, only equipment. This has saved the University a lot of money, energy and carbon output.

All of the SFU interviewees were of the opinion that SFU had already made so much progress during the last 3 decades on its energy consumption, before the CNG requirement came into place, that all the 'low hanging fruit’ had already been harvested. It was therefore “getting more difficult to address energy conservation without taking more dramatic, expensive steps”.

5.3 Changes since the Mandate

Next, the interviewees were asked to list major new actions that their organization has undertaken since CNG was mandated, and whether there has been any change in whom or which department is responsible for such actions. The interviewees were also asked whether the organization has identified opportunities for significant reduction of emissions that are not covered by the mandate.

According to the UBC interviewees, at about the same time that the BC Provincial Government announced the CNG initiative, UBC was working on a new climate action plan. This plan and its aggressive emission reduction targets were later approved by the UBC Board of Governors and announced by the UBC President in 2010. Several of the interviewees were of the opinion that the carbon tax and CNG legislation played a big role in getting the Board’s endorsement for the Climate Action Plan (CAP) and the emission reduction targets. They also facilitated the subsequent approval of over $150 million in capital projects as part of the implementation of the CAP, which has placed UBC on track to reach their 2015 GHG reduction targets².

The 3 main projects in the CAP are (a) the steam to hot water conversion project, “which not only does GHG reductions and energy savings and therefore financial savings, but also provides the platform of hot water for other kinds of low-carbon generation”; (b) the Bioenergy Research and Demonstration Facility (BRDF); and (c) the Continuous Optimization Programme (COP), which is looking at the existing infrastructure and trying to improve the energy performance of that infrastructure with retrofit projects. These, and other smaller projects, demonstrate a “much

² Given its actual emissions performance from 2007 to 2012 (i.e. reduction of only 0.6%), which included the commencement of operation of the Bioenergy Research and Demonstration Facility in September 2012, it is unclear whether UBC would be able to reduce emissions by 33% by 2015.
higher level of investment in GHG reduction projects in the last 4 years than ... ever in UBC’s history.”

Most of the UBC interviewees believe that CNG and carbon pricing have been positive for UBC’s climate change efforts. Besides helping to strengthen the business case for infrastructure or capital projects (more on this in Section 5.4), they have also reinforced and supported the path that UBC was moving towards, such as cementing the minimum requirement that all new buildings and major renovations must be LEED-Gold certified, so that “when there is a government mandate, ... it becomes non-negotiable. And it doesn't become a situation where you're trading off sustainability for other elements.” This has enabled UBC to incorporate the LEED-Gold requirements and energy use intensity targets into the UBC Technical Guidelines for building developments. Building Operations is also able, as the leases for their vehicles roll over, to replace the old vehicles with more efficient vehicles and look for opportunities to fuel-switch to electric, biodiesel or natural gas vehicles, where appropriate.

UBC has completed a comprehensive GHG inventory that includes scope 3 emissions. Having the data allows UBC at least to know the magnitude of the issue, and there have been various attempts to create programming to reduce these scope 3 emissions, such as what the TREK programme is doing to reduce air travel, and “development of a Live-Work-Learn community at UBC, so people who work at UBC can also live here, ... result in reduced transportation travel.” UBC is also measuring embodied emissions and looking at reducing the embodied energy of buildings. However, there is not as much emphasis and political will to manage these scope 3 emissions compared to scope 1 and 2 emissions that are directly under UBC's control and covered under CNG.
In terms of organizational responsibilities for climate action, one major piece is the creation of the UBC Sustainability Initiative (USI) in 2010 to integrate operational sustainability goals and initiatives with academic research and teaching within the University. This “has been sort of a step change in UBC’s engagement with sustainability, and the climate programme is part of that”. The Campus Sustainability Office is still responsible for monitoring operational emissions from the campus, although it has come under the Campus and Community Planning Department since 2009. Building Operations is also still responsible for the operational aspects of managing emissions, while UBC Infrastructure Development is responsible for the planning and development of campus facilities, buildings and infrastructure, with a mandate to try to make these buildings as sustainable as possible, and minimize the carbon footprint and the energy use of those facilities.

With the passage of CNG legislation, SFU has added a focus on GHG emissions to its energy conservation and efficiency effort, which it did not have before. SFU engaged a consultant to develop and document its GHG inventory, as well as identify opportunities to reduce these emissions. SFU also plans to begin to quantify emissions from international travel, either by students enrolled in exchange programmes or overseas field schools or other things, and by faculty and staff traveling to conferences and other things on university business.

However, SFU has not yet developed a comprehensive climate action plan that specifically addresses GHG emissions reduction. It maintains a target to reduce energy use by 2% a year. At the same time, they have a general goal to meet the provincial requirement to reduce their carbon output by 2020. SFU is also considering the creation of an energy management plan, so that “rather than being a series of ad hoc interventions and opportunities taken as they arise, there would be a more conscious, thoughtful plan which things would be laid out and prepared for rather than just addressed as money comes available.”
Unlike UBC, SFU has not undertaken a major new infrastructure project since CNG was mandated. They have been undertaking a study on replacing or supplementing their natural gas central heating plant with a biomass heating plant, as part of a district energy system with the private residential community development on Burnaby Mountain, but a decision has not been taken to proceed.

According to the interviewees, the major renovation projects undertaken since 2008 were not made as a direct result of the CNG mandate, but rather to meet needs that they have in terms of retrofits or renewal of infrastructure or programmatic needs. However, these renovations were subjected to the standard requirement for LEED-Gold certification, which was imposed together with the CNG mandate. The other projects were tweaking of systems rather than major overhauls, and include projects done under BC Hydro’s COP.

One interviewee observed that CNG has not made much of a difference to SFU’s climate actions or energy conservation efforts so far, because SFU is already “a real leader in energy reduction type of projects” before CNG. Another two have observed that the new central heating plant, if it was decided that it would proceed, would be the one key project that would be directly influenced by the CNG mandate, specifically because of the potential to switch fuels to drastically reduce GHG emissions.

From an organizational perspective, climate action now comes under the portfolio of the newly established Sustainability Office. In the past, sustainability efforts were largely decentralized and so was the responsibility for reducing energy consumption. Monitoring of GHG emissions was not a responsibility within the organization, prior to the GGRTA. Now, because the Sustainability Office is reporting GHG emissions, they go to Facilities Services and everybody else to collate the data and issue the reports. Notwithstanding that, Facilities Services Department still has
a huge role to play, since they control the systems that generate a lot of the carbon emissions.

5.4 Decisions on Infrastructure Projects

The next set of questions sought to understand the decision-making process for infrastructure projects that would significantly impact on the organization’s GHG emissions, including the important factors considered in evaluating such projects, how they are funded, and whether the requirement for an annual public report on actions taken had influenced the organization’s response to the mandate. Further, the interviewees were asked whether the mandate has made it easier for the organization to justify and decide on infrastructure projects that substantially reduce GHG emissions, and conversely, whether the mandate has made it harder to justify and decide on infrastructure projects that substantially increase GHG emissions.

In both UBC and SFU, major infrastructure projects above a certain dollar quantum have to be approved by the respective Board of Governors before they can proceed. Smaller projects, on the other hand, are undertaken and funded through the operational budgets of the facilities departments, i.e. UBC Building Operations and SFU Facilities Services. As such, these smaller projects are typically done whenever internal funds are available.

The major difference between UBC and SFU is the size of their internal funds. UBC has a sizeable amount of working capital, which it has deployed to finance infrastructure projects. A prime example is the steam to hot water conversion project. Ten million out of the total project cost of $88.3 million is funded by UBC through their Infrastructure Impact Charges, or basically the development cost charges collected from new developments on campus. The balance of the project,
$78.3 million, is financed by an internal loan and the debt servicing for that loan is essentially paid entirely out of the energy and operational savings derived from implementing the project, comprising commodity energy cost savings, operational savings and avoided maintenance costs. A substantial part of the savings on the energy commodity side is the avoidance of carbon tax and carbon offsets.

In evaluating infrastructure projects, interviewees from UBC and SFU cite the economic returns or financial payback as one of the major factors that are considered. This encompasses the business case for the project, which takes into account the operational needs and lifecycle costs, including energy costs, carbon tax and carbon offsets over the lifetime of the project. Given the low cost of natural gas in recent years and very low cost of electricity in BC, the carbon tax and carbon offset components therefore constitute a significant portion of the overall costs. Related to these are the risks of energy cost fluctuations and changes in the carbon tax rate and carbon offset price.

Besides economic considerations, operational concerns are also looked at very seriously in deciding whether to implement an infrastructure project. For example, for SFU’s proposed biomass plant, factors considered include risks to the availability and cost of biomass supply, weather conditions that may disrupt fuel supply and the business relationship arrangements for the project if it involves a third party provider. Technology risks and the higher cost of alternative energy supplies are also high on the list of considerations for infrastructure projects that aim to reduce GHG emissions from fossil fuels. In UBC, the risk of technology obsolescence is leading to a preference for projects with shorter payback periods.

Although SFU has not decided to proceed with a major infrastructure project since the mandating of CNG, they have reported an increase in overall awareness of GHG emissions in their decision-making process. By assigning a cost to GHG emissions,
the CNG mandate and carbon tax have provided a direct link “between the cost of using carbon and the environmental impact, ... in a quantifiable way and it added cost to us as a disincentive to continue emitting.” Also, within the context of “an institution where the government has been steadily reducing its funding for a decade, and where priorities are typically not directed at operational issues but at the teaching and research side of things, ... things like replacing light bulbs or turning down the heat, those were things that were not at the front of mind for the institution. So what Carbon Neutral Government, what the Act did was it pushed them to the forefront, so they had a more equal place at the table.”

Similarly, one interviewee from UBC observed that “the carbon tax and public sector carbon neutral legislation raised the profile significantly, such that it was a line item in Board reports, whereas I don’t think it ever was before. So it serves to concentrate the mind, ... and people, you know, understood what are the taxes there for and what it’s meant to do. It’s really meant to affect that long term decision-making.” Moreover, “CNG has heightened the focus on finding low-carbon sources of energy for the campus as a whole, just because there’s a financial imperative to try to reduce the carbon offset cost and carbon tax cost.”

The planning process around infrastructure has apparently undergone some changes in UBC, although not necessarily as a result of CNG alone. One interviewee mentioned that new tools and processes about sustainability have entered the planning process and many have now become mandated, so that it is actually part of the standard process. The more of these get incorporated, the more sustainability becomes built in, instead of something that has to be fought for separately. Another example of the difference in planning is that, “in advance of any new facility being built, looking at, ... where is it being sited and are there any unique opportunities for that particular site that that building can take advantage of, from a heat-sink, heat-
source standpoint ... that kind of conversation happen early on in the planning stage of any new building, it's something that is done now, that wasn't done before.”

When asked whether the CNG mandate would discourage infrastructure projects that would drastically increase GHG emissions, interviewees agree that these “don’t really factor in into decisions around expansion of infrastructure to support learning or research”. For instance, “We would never make a decision not to build a student residence or an academic building because it was going to push up our GHG, we will never do that. We will just try to build it as efficiently as we can.”

An example, provided by one of the interviewees, of a perverse impact of the CNG mandate is the case of a co-generation plant on campus. From an economic standpoint, a natural gas co-generation plant would burn more natural gas, increasing the carbon footprint and incur higher carbon tax and carbon offsets. Moreover, the electricity produced by a co-generation plant can already be provided inexpensively by BC Hydro. However, putting aside the uniqueness of being in the province of BC, where hydro-electricity is cheap and relatively GHG-free, it would make sense scientifically to have a co-generation plant on campus to provide both thermal and electrical energy at higher efficiency. This example, according to the interviewee, indicates that the existing policies are actually working against the right decision.

As for the budget or account from which carbon offsets and carbon tax are paid, most of these are paid by UBC Building Operations and SFU Facilities Services. Carbon tax is paid by users directly, either at the pumps or via the utilities accounts, whereas carbon offsets are paid centrally by the operational departments (i.e. Building Operations and Facilities Services) from their operational budgets. Both UBC and SFU also appear to treat both of these as part of the total costs of their
operations or projects, and do not adopt a different approach or strategic response to each.

Most interviewees from UBC and SFU do not believe that the requirement for annual public reports of actions taken has an influence on their organization’s response to the CNG mandate, except for one interviewee who has observed that certain operational departments do take these reports very seriously, with the head of department personally reviewing the contents of these reports.

5.5 Major Constraints

Interviewees were then asked to list the major constraints holding back decisions on emissions reduction infrastructure projects, and whether the CNG mandate and related programmes have changed any of these constraints. In particular, interviewees were asked whether the payment for carbon offsets and carbon tax has been at the expense of infrastructure projects or other core operations.

All interviewees cited availability of funding or access to capital for infrastructure projects as the major constraint. Within this is the limited capacity of public organizations to take on additional debt through external borrowing. Several interviewees attributed this to the rule change that the provincial government has brought about, which included debt from post-secondary institutions within the overall provincial debt ceiling, such that these institutions are not allowed to take on additional debt unless approved by the provincial government. Without access to external funding, these organizations are limited to pursue only those infrastructure projects that they can fund internally or from donations. These infrastructure projects have to compete against other university priorities to gain internal capital funding. In particular, SFU cited this as one of the main factors holding back their decision on the proposed biomass plant, despite the promise of about $4.7 million
from PSECA if they proceeded with this project. Nonetheless, there are recent indications that SFU may be prepared to move ahead to explore this project further, subject to the government’s approval for it to take on the additional debt. On the other hand, UBC, which has a larger pool of working capital and Board endorsement to pursue aggressive emissions reduction targets, has managed to go ahead with several large infrastructure projects that will drastically reduce emissions, without hitting its debt ceiling.

Another major constraint cited by some interviewees is low energy prices in the province, which makes it harder to build up a business case for infrastructure projects that depend on energy savings. In this regard, the carbon tax and requirement to purchase carbon offsets has been a great help to some projects, assuming that the policy of carbon pricing remains in place over the life of the project. Conversely, the recent announcement by the BC Liberal Government to freeze carbon tax rates for the next 5 years ("flattening of the carbon pricing regime") is not helping to encourage more such infrastructure projects.

SFU interviewees also point to the lack of options in their case, since they have already “picked the low-hanging fruits” and the “carbon output for the size of our campus, and for the intensity of use of our campus, is pretty small to begin with.” About 80% of their current GHG emissions come from heating and the primary source for heating is natural gas. As such, for SFU to make any significant dent in their carbon output, the only two options are looking at the amount of heat or the fuel source. The primary way to reduce the quantity of heat is by improving energy efficiency incrementally, which in SFU’s case takes huge investment but gives small returns. Another way to reduce the amount of heat is to reduce the temperature but “you can only turn the temperature down so much before ... it just becomes unreasonable.” Hence the other option is look at the source of fuel for the central
heating plant. But this will cost even more money, which the University does not currently have.

Other constraints cited include technology risks, complexities and uncertainties in the regulatory regime for district energy, and “other practical and pragmatic issues that are part of ... the implementation”.

In general, more of the interviewees are of the view that the payment for carbon tax and carbon offsets means less money for emission reduction activities and projects, less utility or building maintenance or any other programmes or activities of the organizations. However, they are not able to specify which of these areas are affected since they are all part of the operational budget. Almost all of the SFU interviewees believe that while the CNG programme applies regulatory pressure to act to reduce emissions, the carbon offsets are taking a lot of money out of the institution, which makes it harder because they could have invested these instead in infrastructure projects or other things that would reduce their emissions.

5.6 Resources and Support Mechanisms

The next set of questions focused on the availability of resources to fund infrastructure projects. These include possible re-direction of internal funds, new sources of external funding and potential savings generated by these projects. Another series of questions were directed at the level of staffing or expertise related to GHG emissions accounting, monitoring and reduction, including the use of faculty or research expertise within the organizations. Interviewees were also asked which support mechanisms provided by the Provincial Government or other government agencies were most helpful to their organization and what other support mechanisms they think would help their organization to implement infrastructure projects that would drastically reduce emissions.
UBC was not successful in its application for PSECA grants, but it has managed to secure significant funding from government agencies, including federal grants, for its BRDF project primarily because of the research component. As a result, UBC only had to put up about one third of the capital for this project. UBC also partnered with private sector partners Nexterra and General Electric in the BRDF project, an opportunity that has “opened up with the carbon mandate”. Other possible new funding opportunities involving industry partnership to reduce GHG emissions are being explored with Industry Canada and NRCan.

UBC has benefited from smaller funding from BC Hydro and FortisBC for various projects, as well as partial funding for their community energy manager and an energy specialist who does the GHG accounting. On its own, Building Operations have been building expertise around energy conservation, and “there has probably been quite significant increase in the number of kind of professionals at UBC who have a mandate to reduce the University's GHG emissions.” The CNG mandate was the driver around the carbon accounting, leading to UBC becoming more sophisticated regarding energy use and GHG emissions. Furthermore, UBC has taken the opportunity to partner with researchers on campus, particularly from the Sauder School of Business and the Clean Energy Research Centre, as well as hired students from these programmes to help. A recent graduate from the Clean Energy Research Centre now works for Building Operations.

SFU interviewees highlighted that “if government really wants to get serious about reducing emissions, they have to invest money in reducing emissions” and “infrastructure grants that were specific to carbon reduction, that would be a big help”. SFU has applied for a PSECA grant for the proposed biomass plant and $4.7 million were approved towards the plant. This grant helps bolster the biomass option but SFU has yet to decide whether to proceed with the project. SFU is also considering setting aside savings into a resolving fund, in the region of $5 million,
which they can tap into for smaller projects to reduce their energy consumption. The Facilities Service Department had, in the past, borrowed about $5 million internally for their lighting retrofit project, which they have been repaying over the years.

Regarding expertise, SFU has hired one full-time sustainability coordinator. BC Hydro also provides funding for energy specialists. Other than that, the extra workload has been absorbed within the existing staff levels. SFU has not been able to get the academic side involved as much as they could have.

As for other support mechanisms that might be helpful, interviewees suggested that more grants for infrastructure projects, like the PSECA grants, would be helpful. They also suggested that the province should provide leadership in low-carbon generation, in terms of driving down the costs, sorting out the legal issues and undertaking public education. Moreover, it would be helpful if the province or the BC Utilities Commission could clarify the regulatory environment around district energy systems.

5.7 Innovations and Learning

The last set of questions aimed to find out what major innovations the organizations have made in climate change action, and if these were motivated by the CNG mandate. Interviewees were asked to describe how their organization has tapped expertise from other PSOs or shared lessons learnt with other organizations.

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3 SFU has just set up the Sustainable Utilities Revolving Fund (SURF), which is a fund that supports energy and water initiatives that generate cost savings. SURF is a self-replenishing fund where cost savings are measured and used to replenish the fund for the next round of investments. For more details, see [http://www.sfu.ca/fs/Green-Services/SURF/Default.html](http://www.sfu.ca/fs/Green-Services/SURF/Default.html).
To most of the UBC interviewees, the biggest innovation is the so-called ‘Campus as a Living Lab’ concept. This arises from the recognition that the UBC Vancouver Campus is in a very unique position, because UBC owns all the buildings and all the land, so they can try things out on the campus, which can then be applied elsewhere. It is a major effort to integrate the academic and research areas that have world-leading experts in particular areas, with the operational needs on campus such as producing heat or producing electricity, plus third party companies that is trying to commercialize or demonstrate a new system or technology. This has begun to transform the way operational department work and collaborate with researchers, as they work closely to solve operational problems. In this way, “the operational side becomes part of an academic agenda, which raises its profile and its stature” and in turn, boosts operational staff morale.

Another major innovation cited by interviewees is the way the University has gone about engaging its stakeholders, particularly students and residents. By setting very stringent emission standards and setting up a monitoring system to address their concerns, UBC was able to gain acceptance and support for the BRDF, as part of the wider agenda for GHG reduction and energy use reduction in UBC.

Although it was being planned before the CNG mandate, the new CIRS building at UBC, one of North America’s most sustainable buildings, has “set a high standard for building systems and what we can potentially incorporate into future developments.” It has helped pioneer some new planning and design processes, such as the integrated design process, which are now embedded in the technical guidelines and become a standard requirement at UBC. One interviewee also observed that leveraging on the experience with energy transfer between CIRS and its neighbouring building, “there has been a shift to a much more integrated thinking around energy usage and thinking about it on a large campus-wide scale”
rather than on a building scale\(^4\), utilizing the hot water district energy system that is being put in place.

Feedback from SFU interviewees indicates that they do not consider their climate actions to be particularly innovative, as they have adopted what is tested and commonly available in the industry.

Both UBC and SFU have looked at the experiences of other post-secondary institutions outside of BC. For example, UBC looked at University of California Irvine and University of Washington for their experience on green laboratories, while SFU has studied the experiences of UBC, UNBC and Dockside Green (in Victoria, BC) with biomass plants. The American Association for Sustainability in Higher Education (AASHE) group has also been cited as a good resource for sustainability, both for planning policy and projects. This is usually where a lot of higher education institutions go to share their experiences.

Within BC, one forum is the Climate Action Secretariat Advisory Committee, comprising representatives from the various sectors like health authorities, schools districts and post-secondary education. This is a forum for information sharing and inputs about PSO concerns. Both UBC and SFU have also benefitted from BC Hydro’s energy manager or energy specialist programme, where they have tried to build a community around these professionals via regular conferences, meetings and online tools for sharing best practices. Beyond that, it appears that there is little structured sharing among post-secondary institutions; rather they tend to be on a one-on-one

\(^4\) A review of the actual performance of energy transfer between CIRS and its neighbouring building during the early stages of its operation shows that it has fallen far short of its performance goals and intended system functioning. The design process was also fundamentally flawed, and many improvements could be made along the entire lifecycle of the building, from design through operations. These lessons learnt are being applied to future developments.
basis between operational staff or academics with common research interests. Interviewees noted that the institutions have very different scales of operation and access to resources internally, so what works for one may not be applicable to others. Similarly, there tends to be more interaction across sectors, such as between post-secondary and health authorities of similar sizes, or between post-secondary institutions and municipalities with similar circumstances or opportunities for collaboration. An example is the series of workshops on district energy, hosted by UBC with municipalities and the regional district in the Lower Mainland.

Through the USI, UBC also taps expertise from an advisory group that draws on experts from around the province, from other agencies and representatives from the Fraser Basin, the Vancouver Airport Authority, from a range of different environmental groups, David Suzuki Foundation, and the Pacific Institute for Climate Solutions (PICS).

Generally, interviewees are of the view that since the CNG mandate, there has been increased know-how in GHG reduction within their organization, although there was a learning phase at the beginning where some struggled to understand what they were required to do and report. In the case of UBC, the implementation of large and complex infrastructure projects to reduce GHG emissions has called for a major training initiative for operational staff to prepare them to operate the new equipment and control systems. Several interviewees also noticed an increase in the number of private firms and consultancies doing energy planning and analysis work, and that the CNG mandate “has had a huge impact to stimulate the local knowledge base.”
5.8 Others

Finally, the interviewees were asked to mention anything else that they thought were relevant to the topic, and any other personal opinion or other perspectives they would like to share.

In general, UBC’s enthusiasm for CNG and GHG reduction is reflected in the following quote:

“I think British Columbia has absolutely been a leader in what it’s done in taking a position with regards to the carbon tax and carbon neutrality. UBC, through its President and its executives, its Board, has also taken a leadership position in taking on projects and doing things that typically would not have been done, if it hadn’t been for the mindset that has been created in the province and the focus.”

However, several interviewees from both UBC and SFU commented on the large amount of work involved in preparing the annual reports (CNAR) and collation and data entry for SMARTTool in the initial submissions. Some also suggested that instead of channeling the offset moneys to the private sector, they should be made available to PSOs for emission reduction projects or research. One interviewee opined that the key issue is to encourage innovation, particularly in emission reduction technologies or low-carbon generation, and was not sure that BC’s approach using the CNG mandate has been able to encourage the innovation that is needed, although it has done “a reasonable job in raising awareness”.

5.9 Observations

The interviews confirmed that UBC and SFU both have a long history of energy conservation and energy efficiency efforts, and they remain committed to pursue such efforts as part of their climate action or wider sustainability agenda, using their own internal or operational funding. Since the mandate, the institutions have also
added a focus on GHG emissions to their energy focus, which now covers all their campuses, sites and sources.

Interviewees from both UBC and SFU agree that carbon pricing in the form of the carbon tax and carbon offsets required under the CNG mandate has been beneficial in raising awareness within the organizations of the need for climate mitigation actions. Carbon pricing also helps to tilt the balance in business case evaluations towards infrastructure projects that drastically reduce GHG emissions, since the avoidance of carbon tax and carbon offsets can represent significant savings over the lifetime of such projects. Given the current low prices of natural gas, the combined cost of the carbon tax and carbon offsets add about 25% to the total cost of natural gas consumption.

With the strong commitment and support from the Board of Governors and top management, plus its larger pool of internal funding and external research funding from government and private sources, UBC has managed to proceed with several major infrastructure projects that are expected to drastically reduce its GHG emissions over the next few years and help to achieve its aggressive GHG reduction targets. Interviewees have credited the CNG mandate, among other factors like leadership, organizational culture and track record, as contributing to the Board’s endorsement of an aggressive climate action plan and subsequent approval of major emission reduction infrastructure projects.

In contrast, SFU has not yet been able to make a decision on a proposed central heating plant despite a promise of $4.7 million from the PSECA. Unlike UBC, SFU does not have a comprehensive climate action plan that specifically addresses GHG emissions, nor has it set firm targets for reducing these emissions.
Organizationally, UBC has taken a ‘step change’ in sustainability and climate action by creating the USI, which brings together the academic and operational sides of the university into planning and development of campus facilities. SFU recently established a Sustainability Office with full-time staff, but it seems too early to tell what impact this will have on sustainability and climate change efforts, and in particular, planning and renewal of campus facilities, which are still largely driven by the Facilities Services Department.

Access to funding remains the major constraint hindering large emissions reduction infrastructure projects. The CNG mandate and carbon pricing has helped UBC to proceed with the steam to hot water conversion project by increasing the potential savings with which the project is substantially funded. However, they are as yet not sufficient to enable SFU to proceed with their proposed central heating plant, since there are other operational concerns and financial risks to consider. Moreover, the payment for carbon tax and carbon offsets represent a significant drain to the finances of both UBC and SFU, which might be at the expense of other operational or capital needs and priorities.
6. Discussion

6.1 Introduction

This chapter discusses the findings and observations gleaned from Chapters 2, 4 and 5 with respect to the propositions and research questions posed in Chapter 3. Some limitations of this study that should be noted are discussed in Section 6.6, together with some thoughts on how the methodology used can be improved for future studies.

6.2 Propositions Tested

6.2.1 Proposition 1

P1: BC’s CNG mandate, together with the carbon tax, have made it significantly easier for post-secondary institutions to justify and decide to implement infrastructure projects that substantially reduce GHG emissions.

The CNARs and other documents from the BC Government and case study PSOs show that since the CNG mandate was announced in late 2007, most PSOs have taken actions towards reducing their GHG emissions, including infrastructure projects such as lighting and energy efficiency retrofits. The two smaller case study organizations, DO and VCC, undertook lighting retrofits and small energy efficiency projects like installation of DCC in HVAC systems, high-efficiency hot water boilers and variable speed motors, using mainly their internal funding. These are projects that larger institutions like UBC and SFU have already done during previous rounds of efficiency upgrades.
Although many of these projects are not done specifically to address energy consumption or GHG emissions, PSOs have taken the opportunity within renovation projects or new building developments to increase their energy efficiency or reduce energy consumption. Whether these are small or large-scale projects, they should reduce energy consumption and GHG emissions, if not absolutely, at least compared to a ‘business-as-usual’ scenario where PSOs grow their services to cater to a larger population in BC or increased economic activities. However, for many PSOs, progress in climate action seems to have slowed or stalled since 2011 when the ‘low-hanging fruits’ for energy efficiency have been harvested and no additional sources of government grants or external funding were available.

During the expert interviews, the CNG mandate and carbon tax were cited as beneficial to the decisions for infrastructure projects, especially in the case of UBC. Carbon pricing helps to tilt the balance in business case evaluations towards infrastructure projects that drastically reduce GHG emissions, since the avoidance of carbon tax and carbon offsets can represent significant savings over the lifetime of such projects. An example is UBC’s steam to hot water conversion project where the CNG mandate and carbon pricing has helped by increasing the forecast amount of energy savings from higher efficiency and lower distribution losses, and the potential savings are used to fund the bulk of the project cost.

Although since the CNG mandate, UBC has embarked on several major infrastructure projects such as the BRDF and steam to hot water conversion project, the decisions to proceed with these major infrastructure projects were not made solely, or even primarily because of the CNG mandate or carbon pricing. Rather, there were a host of motivations, including operational needs, academic or research objectives and the strong emphasis on sustainability in general. What the carbon tax and carbon offset cost did was tilt the balance in economic evaluation, especially
when the natural gas prices and electricity rates are very low in BC, making it easier for the decision makers to approve the projects.

SFU has not decided to go ahead with any major infrastructure project since CNG was mandated. A couple of major renewal or retrofit projects were undertaken, but they were decided before the mandate or were not specifically undertaken in order to reduce energy consumption or GHG emissions. Nonetheless, with the CNG mandate and provincial requirement for major construction or retrofits to be LEED-Gold certified, these projects were brought to that minimum standard, with the result that the buildings did become more energy efficient.

Although SFU interviewees indicated that the CNG mandate might not have much direct influence on the decision for the proposed central heating plant, compared to other factors, they mentioned that it has certainly raised awareness among decision-makers and made the explicit cost of carbon emissions a part of the conversation. In this sense, the mandate has made it slightly easier for SFU to justify and decide to implement infrastructure projects that substantially reduce GHG emissions.

6.2.2 Proposition 2

P2: Shortage of funding remains as the major constraint holding back infrastructure projects that substantially reduce GHG emissions in these institutions.

All interviewees from the two case study organizations cited availability of funding or access to capital for infrastructure projects as the major constraint hindering these projects. The issue of funding encompasses the overall limited pool of funds for the post-secondary sector, operational funding shortfalls within individual
institutions and the prohibition to incur additional debt for capital projects through external borrowing. DO also mentioned in several of its CNARs that the reduction in its Annual Capital Allowance has had an impact on the College's ability to pursue substantive capital initiatives to reduce GHG emissions.

Besides funding, another major constraint cited by some interviewees is low energy prices in the province, which makes it harder to build up a business case for infrastructure projects that depend on energy savings. In this regard, the carbon tax and requirement to purchase carbon offsets has been a great help to some projects, assuming that the policy of carbon pricing remains in place over the life of the project.

Bureaucratic inertia and lack of awareness and communication, identified by (Webster and Moore 2009) in their earlier study, appear to be less of a constraint now compared to at the time of that study, which is within one and a half years after the CNG mandate was announced. The combination of emphasis placed by the provincial government on legislating its GHG targets and CNG requirements, the initial establishment of the CAS under the Premier’s Office and publicity surrounding the CNG programme have contributed to raise awareness within PSOs. This is especially so among those involved in the process of measuring and accounting for GHG emissions and financing the payment of carbon tax and carbon offsets. Decision-makers, who have to decide on infrastructure projects that significantly impact GHG emissions, are generally more aware of the costs tagged to such emissions. For example, UBC’s CAP, which was endorsed by the Board of Governors, estimated that the cost of paying the provincial carbon tax and procuring carbon offsets for the next 25 years has a net present value of $50 million (University of British Columbia 2010). The requirement for annual public reports under CNG (i.e. CNAR) also puts some pressure on PSOs to take action to reduce
their GHG emissions, although opinions differ as to the extent that this requirement influences the actions of organizations.

Other constraints cited include technology risks, complexities and uncertainties in the regulatory regime for district energy, and other practical and pragmatic issues associated with the implementation of the mandate.

In general, more of the interviewees are of the view that the payment for carbon tax and carbon offsets means less money for emission reduction activities and projects, utility payments, building maintenance or any other programmes or activities of the organizations. However, they are not able to specify which of these areas are affected since they are all part of the operational budget. Almost all of the SFU interviewees believe that while the CNG programme applies regulatory pressure to act to reduce emissions, the carbon offsets are taking a lot of money out of the institution, which makes it harder because they could have invested these instead in infrastructure projects or other things that would reduce their emissions.

6.2.3 Proposition 3

P3: Support mechanisms of the CNG mandate have helped to address the major constraints hindering emission reduction infrastructure projects.

Document analysis did not offer much indication that support mechanisms of the CNG mandate have helped to a great extent to address the major constraints hindering emission reduction infrastructure projects. But the interviews did reveal how PSOs have benefited from support mechanisms provided as part of the CNG programme or existing support mechanisms offered by other provincial or federal government agencies.
PSECA funding was granted to almost 250 energy projects in schools, hospitals, post-secondary institutions and other government agencies across the province. Many more project applications were submitted but not supported, due to the limitation of funds to a total of $75 million over 3 years. Without a detailed investigation, it is unclear how many of the projects that were granted PSECA funds would have gone ahead even without the grants, and how many other projects that did not receive PSECA grants proceeded nonetheless despite not getting these grants.

Among the 4 case study organizations, only VCC obtained partial funding from PSECA, which facilitated the installation of energy-efficient hot water tanks at the College’s new building at the Downtown Campus. The promise of PSECA grants of up to $4.7 million was, however, as yet not sufficient to enable SFU to proceed with their proposed central heating plant, since there are other considerations such as higher capital cost compared to conventional systems, operational concerns and financial risks. Although UBC was unsuccessful in its application for PSECA funds, it was able to secure significant funding from other government agencies, including federal grants, for its BRDF project primarily because of the research component. As a result, UBC only had to put up about one third of the capital for this project.

Although unrelated to the CNG mandate, the federal KIP programme has helped to fund some large infrastructure projects at post-secondary institutions in BC, including all 4 case study PSOs, such that they were able to undertake renovation or upgrading of buildings, which also improved their energy efficiency.

Another support mechanism that has helped many PSOs is SMARTTool, especially the smaller PSOs that do not have the resources to develop a GHG inventory on their own. This has enabled all PSOs to measure or calculate emissions that are covered by the mandate. However, for those that had commissioned GHG inventories on
their own, such as UBC and SFU, they did not find SMARTTool to be that useful. Instead, it resulted at the beginning in additional work to reconcile different figures, and extra cost for the software, until the provincial government waived the cost for SMARTTool in 2012.

An ongoing support mechanism that is provided by BC Hydro and FortisBC is co-funding to hire energy managers or energy specialists. This has been helpful to UBC and SFU to build up its internal expertise in energy and GHG management. At the same time, this provides a platform for energy manager and energy specialists from different organizations to share experiences, lessons, best practices and knowledge about new technologies. BC Hydro and FortisBC also funds feasibility studies on alternative energy and other emissions reduction infrastructure projects.

Another set of support mechanisms is the learning networks that these organizations belong to, whereby they share technical and operational knowledge and experiences from implementing projects. One such network for post-secondary institutions is AASHE. The CAS has also set up new networks such as the Climate Action Secretariat Advisory Committee, a forum for information sharing and inputs about PSO concerns, comprising representatives from the various sectors like health authorities, schools districts and post-secondary education.

6.3 Research Question 1

RQ1: Has the CNG mandate changed decision-making processes and outcomes for new or retrofit infrastructure projects that significantly reduce GHG emissions? How and why?
Although the procedures for evaluating infrastructure projects and the decision-making process has not changed substantially, the priorities and factors for consideration have been influenced by the CNG mandate. By requiring PSOs to be ‘carbon neutral’ and setting an explicit cost for carbon emissions in the form of carbon offsets (in addition to the carbon tax), the CNG mandate has changed decision-making processes for infrastructure projects in 2 ways:

(a) It has raised the priority, within the decision-making process for infrastructure projects, for consideration of ‘sustainability’ in general, and for reducing carbon emissions in particular; and

(b) It has tilted the balance in economic evaluations of projects (i.e. business case) towards options that reduce GHG emissions or have lower emissions.

At the same time, the provincial government has also set a minimum standard of LEED-Gold certification for all major new construction or retrofit of buildings.

The extent to which the mandate has changed decision processes varies among organizations, from those that place high priority on reducing GHG emissions as an integral part of its primary mission, to those that have to cater to competing operational and other priorities within a limited budget. In the case of UBC, the above factors have contributed to the Board of Governor’s approval of major infrastructure projects including the CIRS Building, BRDF and steam to hot water conversion project, as well as participation in the Continuous Optimization Programme. These projects represent a higher investment in GHG reduction projects during the last few years than at any comparable period in UBC’s history. Not many other PSOs have embarked on such major infrastructure investments, but this shows that given the right set of circumstances, it is possible for organizations to take action to transform their GHG profile. UBC has also institutionalized some of the sustainability measures within their planning and development process by
incorporating minimum requirements into their Technical Guidelines and specifying energy intensity targets for new buildings.

Besides infrastructure investments, some PSOs have signaled a greater commitment to ‘sustainability’, of which climate action is one aspect. Both SFU and VCC have established within their organizations new positions to focus on sustainability. They are also working within their organization to formulate targets or plans for managing energy usage and GHG emissions. However, it is too early to tell whether they will be able to mobilize the organization to undertake more concrete steps to reduce emissions, including infrastructure projects that will transform their emissions profile.

Ultimately, the outcomes should be evaluated using the quantity of GHG emitted by the organizations over time. Based on the quantitative data available so far, i.e. GHG emissions reported by PSOs from 2010 to 2012, there is no clear trend towards significant reduction in the total public sector GHG emissions covered by the CNG mandate. Similarly, at the sectoral and organizational levels, the emission levels also did not indicate any sustained reduction over this period.

A closer look at the energy consumption and GHG emissions data of two of the case study organizations, UBC and SFU, shows that total electricity consumption continues to rise while natural gas consumption fluctuates, with a slight downward trend in SFU. Total GHG emissions covered by the CNG mandate have been decreasing in UBC and SFU over a longer period from 2000 (for UBC) and 2007 (for SFU), which is consistent with emissions from the province as a whole and emissions from the municipalities in which the main campuses of UBC and SFU are located. Emissions from UBC and SFU fleets showed a much more significant downward trend after 2007.
In both institutions, GHG intensities showed a more marked decline than total GHG emissions over the longer period than from 2010 to 2012. The intensities of natural gas consumption in both UBC and SFU show clear downward trends over time, as did SFU’s electricity consumption intensity per student, but UBC’s electricity consumption intensity per student and per square metre have both been increasing from 2006 to 2012. There does not appear to be any discernible change in the trend of reduction in either institutions’ energy consumption or GHG emissions since 2008 when the CNG mandate was announced, nor since 2010 when PSOs are required to purchase offsets for their remaining GHG emissions. Changes in energy consumption and GHG emissions seem to be part of longer-term trends in UBC and SFU, rather than an effect of the carbon tax or CNG mandate.

Moving forward, with the completion of major infrastructure projects, UBC’s emissions are expected to be drastically reduced in the next few years. Its target is to lower emissions by 33% by 2015, compared to 2007 levels. Also, if SFU proceeds with its proposed central heating plant, it may reduce up to 80% of its current GHG emissions. For other PSOs, it remains to be seen whether they are able to secure the necessary funds to enable them to undertake infrastructure projects that will transform their emissions.

6.4 Research Question 2

RQ2: What support mechanisms helped or would help decision-making in favour of infrastructure projects that substantially reduce GHG emissions?

Following from the discussion in Section 6.2.3, it can be surmised that funding in the form of capital grants from PSECA and research grants from various government agencies and third parties have been most useful to PSOs in enabling them to proceed with infrastructure projects that significantly reduce GHG emissions.
However, it should be noted that these funding or grants form only a portion of total project cost, so PSOs need to secure the rest of the funds in order for the project to go ahead. The ability to do the latter depends heavily on the internal resources that the PSOs can access, so large organizations tend to have an edge in this while most small organizations have few options when they are faced with tight budgetary situations like in the past few years. As most infrastructure projects that can transform an organization’s emissions profile are likely to require large amounts of funds relative to the size of funds that the organizations can routinely set aside, they are likely to need other sources of funding.

Allowing PSOs to borrow externally to finance such infrastructure projects could be one alternative that may work. However, since the change in rules that included debt from post-secondary institutions within the overall provincial debt ceiling, many of these institutions are not allowed to take on additional debt unless approved by the provincial government. A clarification of the rules with respect to energy saving or emissions reduction capital projects might help more PSOs to implement projects that ultimately result in savings, that can in turn pay back the debt that they incur by taking on these projects.

Another support mechanism that is helpful is the networks that allow PSOs to share lessons and experiences. UBC highlighted that workshops it has hosted with several municipalities have benefitted all participants. Where it makes sense, more such fora or networks should be encouraged among post-secondary institutions and other PSOs, especially those facing similar challenges in developing or implementing emissions reduction infrastructure projects.
6.5  The Boundary Question

6.5.1  Expanding the Boundary

Section 2.4 has earlier highlighted the importance of policy boundaries for the CNG mandate. While the current coverage of the CNG is a good start, it may be timely now, after 3 years of tracking PSO’s GHG inventory using SMARTTool, to consider extending the mandate’s coverage to include the reporting of more scope 3 emissions. This expansion would enable the mandate to achieve a wider reach, thereby opening up more opportunities for emission reduction and greater scope for innovation both within and beyond the public sector. Conversely, the omission of scope 3 emissions from PSOs’ GHG inventories may leave a large gap in their overall GHG reduction potential. Arguably, while the public sector contributes less than 2% of the direct GHG emissions in BC, involving the PSO supply chain in GHG reductions may be an effective way of beginning to get the rest of BC involved in climate mitigation. By going beyond the boundaries of the current provincial mandate, many areas where PSOs can reduce emissions through their own planning, purchasing and contracting supply chains may be revealed. This will in turn unleash a powerful mechanism for creating a positive spillover from this mandate, spurring the greening of the supply chain far beyond the direct emissions of the public sector. A policy adjustment that expands reporting to include scope 3 GHG emissions would also guard against PSOs choosing to reduce their Scope 1 and 2 emissions by contracting out services. By having to report Scope 3 emissions, the PSO would need to reveal the emission intensity of its contractors, thereby forcing contractors not only to report their emissions but also to try to reduce them.

6.5.2  Business Travel Emissions

Under the CNG mandate, only core government ministries and agencies are required to report and offset emissions from business travel. CAS has reported that core
government has reduced business travel emissions by 60% from 2008 to 2009. “This reduction is partially because of cutbacks in ministry travel budgets”. However “the use of on-line collaborative tools like LiveMeeting, Communicator and enhanced video-conferencing” has mitigated the impact of such reduced travel “on ministries’ abilities to deliver public services.” (Ministry of Environment, B.C. 2010)

The reported drop in emissions from 2008 to 2009 has not been verified by an in-depth investigation. But actual business travel expenses by core government were cut by 50% in FY2008/09, which coincided with a recession in BC, compared to a cut of only 8.5% in FY2001/02 during the previous economic downturn. It is possible that the inclusion of business travel under CNG for the core government may have motivated a reduction in business travel and increased use of alternatives like on-line meetings. However, it is also possible that travel expenses have been shifted to other cost accounts to avoid the requirement to purchase carbon offsets for business travel emissions, and this accounting ‘leakage’ out of the policy boundary has contributed to a reduction in reported emissions from business travel.

Since 2009, core government’s business travel emissions have been flat (See Figure 6.1 on the next page), even as total emissions from the sector rose 5.7% from 2010 to 2012 (Table 4.3).

If indeed the CNG mandate has influenced the core government to significantly reduce business travel without affecting effectiveness of its operations, it may also be feasible for other BC PSOs and local governments to similarly reduce their business travel through an expansion of the mandate to cover this category of scope 3 emissions. The New South Wales government in Australia already includes business travel emissions within its carbon neutrality coverage (Department of Environment & Climate Change, NSW Government 2009).
Figure 6.1: Core Government Business Travel Emissions 2008 – 2012

Sources: (Ministry of Environment, B.C. 2010; Ministry of Environment, B.C. 2011; Ministry of Environment, B.C. 2012d; Ministry of Environment, B.C. 2013)

6.5.3 The Case of The University of British Columbia

The GHG inventory of the University of British Columbia Vancouver Campus (UBC-V) provides an interesting case that demonstrates the significance of assessing scope 3 emissions relative to total emissions. In Table 6.1 on the next page, we note that the CNG mandate covers about 49% of UBC-V’s total estimated emissions in 2012. The only scope 3 emissions covered under the mandate (i.e., from paper usage) account for 0.5%. A significant proportion of the remaining 51% of emissions come from commuting (25%), staff and faculty travel (16%) and embodied impacts of buildings and infrastructure (9%), which are not included in mandatory reporting or offsets. The percentage of total emissions not covered by the CNG mandate has
increased from 47% in 2007 to 51% in 2012. Moreover, while UBC-V’s emissions covered by the mandate decreased 0.6% from 2007 to 2012, emissions not covered increased by 17.5% (Please see Figure 6.2 on the following page).

Table 6.1: UBC Vancouver Campus GHG Emissions Inventory 2012

<table>
<thead>
<tr>
<th>Scope</th>
<th>Component</th>
<th>GHG Emissions (tCO₂e/yr)</th>
<th>Covered in mandate?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Core Buildings</td>
<td>39,400</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Other Buildings</td>
<td>14,215</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Fleet</td>
<td>1,253</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>Core Buildings</td>
<td>3,887</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Other Buildings</td>
<td>1,389</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>Paper</td>
<td>572</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Staff and Faculty Travel</td>
<td>19,772</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Solid Waste</td>
<td>1,930</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Commuting</td>
<td>30,757</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Building Lifecycle</td>
<td>11,705</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td><strong>Total estimated emissions</strong></td>
<td><strong>124,879</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total emissions covered by the mandate</strong></td>
<td><strong>60,715 (49%)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total emissions not covered by the mandate</strong></td>
<td><strong>64,164 (51%)</strong></td>
<td></td>
</tr>
</tbody>
</table>

Source: (University of British Columbia 2013)
Figure 6.2: UBC’s In-Scope vs. Out-Of-Scope GHG Emissions 2007 – 2012

Source: (University of British Columbia 2013)

Although the challenges associated with estimating scope 3 emissions mean that the figures in UBC’s inventory may not be as accurate as its scope 1 and 2 emissions, it is obvious that scope 3 emissions comprise a very significant proportion of total emissions that UBC could potentially control or influence. However, as pointed out
in the interviews, there is not as much emphasis and political will to manage these, compared to that for scope 1 and 2 emissions that are directly under UBC’s control and covered under CNG.

The major actions that UBC has undertaken and continues to pursue illustrate the importance of exploring all options that can reduce not just scope 1 and 2 emissions, but also scope 3 emissions. UBC has developed and is continuing to develop additional on-campus housing for students and employees, which substantially reduces the number and proportion of persons who need to commute. Furthermore, a broad range of services and shops are now available in and around the campus, reducing the need for on-campus and neighbouring households to travel. The average number of trips per person has decreased 14% from 1997 to 2010. On-campus housing, fewer parking spaces and greater use of the internet are all contributing factors to this change (University of British Columbia 2011). Under the current regulations, these actions neither create credit to UBC for reducing commuting emissions nor credit for the smaller GHG footprint of more efficient housing on campus. Moreover, because the new housing is located on campus, their scope 1 and 2 emissions are reportable and create emission liabilities at $25 per tonne of CO$_2$e emitted.

UBC is planning to further expand student housing on campus by 7,000 beds (University of British Columbia 2012b). These will provide a host of benefits for students, but will also increase the ‘local’ scope 1 and 2 emissions under UBC’s current reporting mandate. Since all new residential construction at UBC must comply with the Residential Environmental Assessment Program (REAP) guidelines, housing at UBC will use approximately 15% less energy than Canada’s Model National Energy Code for Buildings (MNECB), which in itself outperforms all provincial building codes. As such, scope 1 and 2 emissions at the new on-campus housing will be much lower compared to existing off-campus housing that these
students would otherwise rent. Moreover, commuting will be drastically reduced as a result of more students being accommodated on campus. An illustrative comparison of the impacts, similar to the one first used in (Lau and Dowlatabadi 2011a) is given in Table 6.2 on the next page.

The decrease in commuting by having 7,000 more students live on campus will cut scope 3 emissions by an estimated 5,740 tonnes of CO$_2$e per year (0.82 tonnes per student multiplied by 7,000 students) or 17.1% of emissions from commuting. Overall, this initiative will cut BC’s GHG emissions by over 7,210 tonnes per year (1.03 tonnes per student multiplied by 7,000 students). However, the current boundary setting changes what should be a net GHG reduction credit of 7,210 tonnes per year into a 4,410 tonnes per year penalty resulting in an additional offset liability of $110,250 per year due to the extra scope 1 and 2 emissions on campus. The overall economic disincentive to UBC for housing these 7,000 students on campus (by summing the additional offset liability and the foregone credit) would be about $290,500 per year. Thus, the current reporting boundaries discourage initiatives like this that result in a reduction of overall provincial emissions$^5$.

$^5$ The reduction in overall emissions is even more significant when we take into account the increase in faculty, staff and family members, as well as other residents, who will be housed in both UBC and private residential developments within these new campus neighbourhoods.
Table 6.2: Comparison of Impacts from UBC Students Living Off-Campus and On-Campus

<table>
<thead>
<tr>
<th></th>
<th>Living Off Campus</th>
<th>Living On Campus</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential emissions per student</td>
<td>0.84</td>
<td>0.63</td>
<td>See note (i).</td>
</tr>
<tr>
<td>(tonnes/year) [a]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commuting emissions per student</td>
<td>0.82</td>
<td>0</td>
<td>See note (ii).</td>
</tr>
<tr>
<td>(tonnes/year) [b]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual emissions (tonnes/year) [a+b]</td>
<td>1.66</td>
<td>0.63</td>
<td>Accounting for all emissions within the province. Emissions are actually reduced by 1.03 tonnes/year for each student living on-campus vs. off-campus.</td>
</tr>
<tr>
<td>Emissions under current reporting</td>
<td>0</td>
<td>0.63</td>
<td>Only scope 1 and 2 emissions are currently included.</td>
</tr>
<tr>
<td>(tonnes/year)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current offset liability per student</td>
<td>0</td>
<td>$ 15.75</td>
<td>To be paid by UBC to PCT, at $25/tonne.</td>
</tr>
<tr>
<td>Proposed offset liability per student</td>
<td>0</td>
<td>-$ 25.75</td>
<td>Proposed credit for reduction of overall emissions by 1.03 tonnes/year.</td>
</tr>
</tbody>
</table>

Notes:

(i) Based on residential sector emissions from Table 4 of the *BC GHG Inventory Report 2010* (Ministry of Environment, B.C. 2012e), BC’s population in 2010 (Statistics Canada 2013), and assuming emissions from UBC on-campus housing are 75% of the emissions from the average BC housing.

(ii) Based on emissions from commuting (33,540 tonnes) in UBC’s 2010 GHG inventory (University of British Columbia 2013) and commuting population of 41,000 which is the FTE enrolment in 2010 from UBC Planning & Institutional Research (http://www.pair.ubc.ca/statistics/students/students.htm).

6.5.4 Cost of Expanding Mandate Coverage

The cost of creating the more complete GHG inventory at UBC is zero, as the previous inventory completed in 2008 and updated since then already reflects a wide range of scope 3 emissions. The cost of having other organizations expand
their reporting from their current boundaries to include a wide range of scope 3 emissions is estimated to be between 1 to 5 thousand dollars depending on the size and complexity of the organization.

An alternative for such organizations is to market their innovative GHG reductions beyond the scope of the BC government mandate as carbon offsets. However, such an action not only requires the incremental cost of an inventory or audit, it would also incur validation and verification costs of at least $5,000 and transaction costs for the offsets at $5 per tonne or more. Thus, while the offset route is potentially available to government organizations who have innovative GHG reduction strategies that cannot be captured under the CNG mandate, the cost of realizing these initiatives are far higher and prohibitively so for all but the largest projects (greater than 1,000 tonnes per year).

In 2012, UBC made a proposal to the PCT for a programmatic offset approach where a coordinated action results in numerous, smaller widely distributed emission reduction activities, such as the example of policies that influence staff and student commuting to and from UBC. The proposal was, however, not taken up by PCT.

### 6.6 Limitations

#### 6.6.1 Effect and Attribution

This research is not a controlled experiment, but an evaluation of a natural experiment, a contemporary phenomenon within some real-life context (Yin 2009), to which the researcher has no control. In particular, changes in GHG emissions may result from many possible factors, including the level of activity, changes in the stock of physical infrastructure, variations in weather, as well as policy changes. As noted in another study, it is challenging to accurately identify the GHG reductions
that result specifically from information and outreach programmes without confounding effects (Nancy Olewiler 2012).

Soon after the CNG mandate was announced, BC, like the rest of the world, entered a period of economic recession. Although BC's economy bounced back somewhat in 2010, its growth rate is still relatively mild. The recession and consequent drop in economic activity, as well as enforced austerity in government budgets compared to previous years, could partly explain an added focus on reducing energy consumption to lower operational expenses, leading to a reduction in GHG emissions from 2008 to 2010.

In this study, there is another real challenge to separate the impacts of the CNG mandate from that of the carbon tax. Both the carbon tax and CNG mandate were announced at the same time as part of the provincial government's climate action plan (Ministry of Environment, B.C. 2008), although the carbon tax was implemented first in July 2008. From 2010 to 2012, both the carbon tax and CNG mandate exist concurrently and probably influence the decisions and behaviour of PSOs. Most interviewees who responded to the question of whether their organization differentiated between the carbon tax and CNG did not think that decision-makers make a distinction between them. To them, they are part of the additional cost the organization must pay for emissions. In business case evaluations, the cost of carbon tax and carbon offsets are added together from 2010 onwards, although assumptions regarding changes in their rates may differ.

Hence, even though changes in GHG emissions from the BC public sector or individual public organizations are observed over the period of study, they may not be caused by the policies in place, such as the carbon tax or CNG mandate. As discussed earlier in this chapter, there are many factors that decision-makers take into consideration in deciding on an infrastructure project. While the CNG mandate
may have influenced the decision on certain projects in favour of those that would lead to emission reductions, it is impossible to attribute any one project or any one decision to the mandate.

6.6.2 Small Sample Size

The sample size for this study is small. Due to the overall resource and time constraint for this study, as well as lack of response from smaller post-secondary institutions as case studies, only 4 institutions were included in this study and interviews were conducted for only 2 of these institutions. Other post-secondary institutions in the Lower Mainland, including BCIT, Langara College and Capilano University were also approached to be case studies, but none of them responded positively. The limited number of interviews conducted at only 2 organizations is a weakness of this study.

A strength of the study, however, is that because the events and actions taken by organizations in response to the CNG mandate are either recent or still happening, most of the interviewees are themselves the key players, have been and are intimately involved and therefore have personal knowledge and understanding of the rationale behind the events and actions. As such, the interviews conducted with UBC and SFU are very useful, and the interviewees were open and helpful in answering all the questions posed to them, to the best of their knowledge. The responses of interviewees from UBC and SFU are also sufficiently diverse to provide very rich and nuanced information, thus offering some valuable insights about the challenges faced by the two organizations and the different ways they chose to respond.

As for the potential benefit of interviewing personnel from the smaller institutions such as DO and VCC, based on the short list of actions taken by DO and VCC, it is
anticipated that even if interviews were conducted with them, the answers may not have been drastically different from that of SFU.

6.6.3 Short Time Period

The CNG mandate is a relatively new programme and is still evolving, as early lessons are learnt and applied. Given that the CNG mandate is in its early stage of implementation, with GHG accounting and monitoring being new to all but a few PSOs, it is not surprising that there is a scarcity of available data, especially on GHG emissions. The emissions data that is available covers only 3 years, which is not sufficient to enable us to discern trends in these emissions, as there are large variations between organizations and sectors. Some of the organizations have emissions data over a longer period of time, but data prior to 2007 are likely to be incomplete and based on different assumptions, which makes comparison across organizations and over time a hazardous task.

Energy consumption data, in general, have been kept over a longer period of time. Again there are questions of data comprehensiveness, since this was not necessarily a high priority in the past. Institutions may not have kept complete records for all owned and leased properties, especially properties that are outside their main campuses. Other organizations may also not be willing to reveal details of their energy consumption in the public domain.

6.6.4 Potential Bias and Self-Selection

Efforts have been taken to identify the most relevant stakeholders and personnel involved in implementing the CNG mandate and the infrastructure decision-making process. The key personnel in the case study organizations were also asked to suggest other relevant interviewees. A few potential interviewees identified in the UBC organization did not respond to the request for interview. However, it is judged
that adequate coverage of the topics has been achieved with those that are actually interviewed.

However, the eventual list of personnel from the case study organizations who are interviewed may be subjected to bias and self-selection. It is possible that those who agreed to be interviewed may already have a positive inclination towards the CNG mandate, while those who declined may not have such a positive inclination or have a negative inclination towards the mandate. It is noted that the interviewees from UBC were unanimously supportive of UBC’s efforts in climate mitigation and generally positive regarding the impact of the CNG mandate. In contrast, most interviewees from SFU have some reservation about the mandate, although they are conscious of its beneficial impacts in advancing the sustainability and energy conservation agenda.
7. Conclusion

7.1 Effectiveness of CNG Mandate

This study has evaluated the effectiveness of the CNG mandate in terms of its influence on decision-making for emissions reduction infrastructure projects and impact on PSO’s GHG emissions.

The study has found that the mandating of ‘carbon neutrality’ for the public sector and setting of a price for carbon emissions have generally made it easier for the case study PSOs to propose and justify infrastructure projects, by tilting the balance in business case evaluations in favour of projects that drastically reduce emissions. The provincial requirement for LEED-Gold certification for all major public sector new construction and renovation has also set a minimum standard that helps raise energy efficiency of buildings over time. An increase in awareness and communication among major stakeholders and higher priority given to energy efficiency and climate change action have contributed to some institutional changes that may provide an added push to these efforts in some organizations.

But the major constraint that hinders such infrastructure projects remains the lack of funding. Where PSOs have internal funding, or were able to obtain funds with the help of PSECA, other provincial or federal government grants or third party financing, they were able to proceed with these infrastructure projects. Otherwise, PSOs have to rely on their operational budget to fund small energy efficiency or retrofit projects. The channeling of offset money from PSOs and out of the public sector further compounds the difficulty of finding funds within their tight operational budgets for such projects.
Support mechanisms provided by the provincial government or other government agencies, while helpful, are not critical driving forces in decision-making on infrastructure projects. Nonetheless, the learning among PSOs and other public organizations like municipalities have benefited all participants and should be further encouraged.

Given the long lead time and large capital outlay often required for major infrastructure projects that can transform an organization’s GHG profile, and the limited amount of funding made available to PSOs for emissions reduction infrastructure projects, it is not surprising that available GHG emissions data from the public sector as a whole have not shown significant reduction over the first 3 years that PSOs have had to purchase offsets for their emissions. However, some PSOs have already been able to drastically reduce their emissions over this period, partly owing to projects and efforts taken prior to the CNG mandate. Several other PSOs that managed to proceed with major infrastructure projects during the past few years should see their GHG emissions being reduced within the next few years.

7.2 Potential Applications and Significance of Research

The commitment to a ‘carbon neutral’ public sector is one of the key pillars of the BC government’s aggressive plan to project a leadership position on climate change action. The CNG mandate, in effect, puts a price on the remaining GHG emissions that PSOs are unable to reduce. This large present and future liability seems to have spurred action on the part of some PSOs to work towards reducing their GHG emissions, especially when they consider infrastructure projects that will have a significant and lasting impact on their future emissions.

This study has provided a systematic evaluation of the impacts of the mandate and offered some insights on its influence on infrastructure investments by post-
secondary institutions. It has highlighted some possible strategies that the case study PSOs have adopted, which other PSOs can explore in their quest for more funds to invest in infrastructure projects that will help them to significantly reduce their emissions. The lessons learnt from this evaluation are likely to be useful in helping to improve and fine-tune the policy in BC, especially as PSOs and local governments continue to face the challenge of reducing their carbon emissions.

The CNG mandate also has potential impacts far beyond the core government and PSOs covered by the mandate. By helping to improve our understanding of the decision processes and trade-offs faced by these PSOs, and pointing out implementation difficulties encountered during the first few years, this study can inform future policy design to avoid pitfalls encountered here and enhance its effectiveness in mitigating climate change. It can also help strengthen support mechanisms, including educational and capacity-building strategies, so that PSOs are provided with the assistance and tools they need. The insights gathered will also be very useful, if and when a similar mandate is extended to or adopted by other organizations, sectors or jurisdictions.

### 7.3 Policy Recommendations

#### 7.3.1 Provision of Funds for Infrastructure

Following from the conclusions in the Section 7.1, if the BC provincial government is serious about climate change action and want to help PSOs, it needs to set aside more funds in its annual budget to enable PSOs to undertake infrastructure projects that will transform their emissions profile. The government has already made a start with PSECA from 2008 to 2011, but much more needs to be provided.
Another way to channel funds to the public sector is to take back from PCT more of the surplus funds that are not used to buy offsets from the private sector, and make these available to the public sector for emission reduction infrastructure projects. The scheme could be along similar lines to the CNCP for school districts starting in 2012, but extended to all PSOs.

A third way is to leverage more on external funding for PSOs by relaxing the debt ceiling in cases where PSOs can show that potential energy savings over the lifetime of the projects will be sufficient to pay back the loans required for the projects.

7.3.2 Expansion of Mandate Coverage

An expansion of the CNG mandate to widen its reporting coverage is timely now. As mentioned in Section 6.5.2, CAS has reported that core government ministries and agencies have reduced business travel emissions by 60% from 2008 to 2009 and maintained emissions at this level through to 2012. It is reasonable to expect some reductions in other PSOs if the mandate is similarly extended to cover their business travel emissions, even if the percentage of reduction may not be as big as that for the core government due to different operational needs.

An extension of the CNG mandate to cover business travel for all PSOs can be implemented relatively quickly, since the methodology and SMARTTEC software are already available and being used by core government ministries and agencies for 5 years. If there is a need to ease the financial burden on PSOs, they can be mandated to start reporting these emissions first, with the requirement to purchase offsets phased in over a period of, say 3 years.
CAS and Shared Services BC should also lead a team of PSOs to work on quantifying other major scope 3 emissions besides paper and business travel. UBC’s GHG inventory shows that scope 3 emissions not covered by the CNG make up half of total emissions, so it is obviously an area for the public sector to focus on next. UBC has already taken the lead to measure these other emissions, and other PSOs can learn from its experience. Prime candidates for inclusion in reporting include staff, student or customer commuting, embodied emissions in buildings and solid waste.

7.3.3 Expansion of Learning

PSOs have reported on the benefits of learning from each other’s experiences in implementing the mandate and sharing lessons. CAS should continue to focus on providing more learning opportunities for PSOs and encouraging more learning networks among PSOs. Perhaps additional funding can be set aside by CAS to enable PSOs to conduct more learning fora or workshops both within sectors and across sectors.

7.4 Potential Future Research

This research should be considered as one in a series of studies evaluating the CNG mandate, beginning with the work by (Webster and Moore 2009). Investing in infrastructure to transform an organization’s GHG emissions profile is a long-term process that requires leadership, support by stakeholders and large capital outlay. Follow-up research that continues to monitor and compare PSO emissions and track infrastructure investments and their results can help to create awareness of the benefits of such investments and help build support for future investments.

If the opportunity arises, it would be useful to conduct interviews with stakeholders in the smaller post-secondary institutions and PSOs, to supplement the findings of
follow up comparison of GHG emissions and energy consumption as well as interviews with UBC and SFU would also be useful in 3 to 4 years’ time, to evaluate the progress made over a longer period of time.

It would also be interesting to benchmark the reported public sector emissions against provincial-level emissions for similar organizations. Since about 78% of total public sector emissions in 2012 were from buildings (Ministry of Environment, B.C. 2013), the most comparable provincial data would be emissions from stationary combustion sources in the commercial and institutional sector. A comparison can also be made between public sector fleet emissions and provincial emissions from road transportation. Unfortunately, the latest GHG inventory report for BC provides data only up to 2010 (Ministry of Environment, B.C. 2012e). It is noted that between 2000 and 2010, emission from stationary combustion sources in the commercial and institutional sector in BC decreased by 27%, while provincial emissions from road transportation increased by 4.8%. During the same period, population in BC increased by 12% (BC Statistics 2013a) while GDP increased by 54.7% (BC Statistics 2013b). When provincial GHG inventory data is available in a few years time, they should be compared against GHG data of the public sector.

Another worthwhile direction for future research is to explore and possibly quantify the spillover impacts from the CNG mandate. The most common spillovers referred to in discussions of climate policy include substitution effects, ‘carbon leakage’, diffusion of technological innovations (Sijm et al. 2005) and policy learning (Hoberg 1991; Dolowitz and Marsh 1996). Previous research have shown that environmental regulations may lead to a higher demand for specific environmental technologies or provide new market niches for the manufacturing and service sectors (Maier and Sedlacek 2005). Arising from the CNG mandate, there is also a sizeable opportunity for BC businesses to supply carbon reduction credits to the public sector and
beyond (N. Olewiler 2009). Each of these spillovers could provide interesting areas for detailed exploration.
Bibliography


SPP Research Papers. University of Calgary School of Public Policy.

Rabe, Barry G. 2008. “States on Steroids: The Intergovernmental Odyssey of

Rivers, Nicholas, and Brandon Schaufele. 2013. “Salience of Carbon Taxes in the


Appendices

Appendix A: List of Documents Reviewed for Document Analysis

BC Government


Douglas College


Simon Fraser University

Simon Fraser University. 2009. “Sustainability Advisory Committee Annual Report 2009”.

170
Simon Fraser University. 2012. “Sustainability Advisory Committee Annual Report 2012”.

University of British Columbia

UBC Campus Sustainability Office. 2009. “Energy and Climate Management Case Study.”
University of British Columbia. 2012. “UBC 2012/13 Operating Budget - Presentation to the Board of Governors.”

Vancouver Community College


## Appendix B: Summary of Climate Action

### Prior to 2008

<table>
<thead>
<tr>
<th>Management Commitment</th>
<th>University of British Columbia-Vancouver (UBC-V)</th>
<th>Simon Fraser University (SFU)</th>
<th>Douglas College (DO)</th>
<th>Vancouver Community College (VCC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In 1990, UBC signed the Talloires Declaration, a 10-point action plan for incorporating sustainability into higher education.</td>
<td>In 1990, SFU was also one of the early signatories of the Talloires Declaration.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Institutional Structure | In 1998, UBC was the first university in Canada to open a campus sustainability office, whose mission is to enable, support and coordinate efforts that bring together students, faculty, staff, and the community to lead the transformation to a sustainable campus. | |

| Greenhouse Gas (GHG) Inventory / Energy Audit | UBC established a Technical Advisory Committee of academic, operations, staff and student members in 2007 to measure its GHG emissions. The initial inventory used the World Resources Institute Greenhouse Gas Protocol to quantify 2006 emissions, which included direct and indirect emissions (Scope 1 and Scope 2), and optional emissions (Scope 3). | |

| Climate Action Plan | In 2006, UBC published Canada's first campus-wide sustainability strategy after a consultation process with 20 departments, all faculties, all major student organizations, and over 100 individuals. | | |

An energy audit was completed in 2007.
Prior to 2008 (Cont’d)

<table>
<thead>
<tr>
<th>UBC-V</th>
<th>SFU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting Retrofit</td>
<td>SFU Burnaby campus’ $3 million lighting retrofit program was carried out between 2003 and 2005, saving 5,995,000 kWh of energy per year.</td>
</tr>
<tr>
<td>Electrek, completed in 2002, retrofitted lighting in the 30 largest Core Academic buildings at UBC.</td>
<td>Every year, energy retrofit projects that have passed business case analysis are implemented by Facilities Operations. Examples of past projects include additional thermal insulation to the underside of exposed concrete floors and addition of heating controls and variable frequency drives to improve performance. In the past two decades, SFU’s energy conservation strategies and PowerSmart initiatives have resulted in more than $25 million in cost avoidance.</td>
</tr>
<tr>
<td>UBC launched EcoTrek (2001-2008), the largest energy and water retrofit at a Canadian campus at the time. The $39 million EcoTrek programme retrofitted 80 large and 200 smaller core academic buildings totaling approximately 6.7 million square feet of building space and resulted in approximately $4.2 million in energy savings and 8,000 tonnes in emissions reduction annually.</td>
<td>An energy performance baseline was established in 1998. In 2007, UBC reached its Kyoto targets, reducing GHG emissions from academic buildings to 6 per cent below 1990 levels, despite a 35 per cent growth in floor space and a 48 per cent growth in student numbers.</td>
</tr>
</tbody>
</table>

Buildings

An energy performance baseline was established in 1998. In 2007, UBC reached its Kyoto targets, reducing GHG emissions from academic buildings to 6 per cent below 1990 levels, despite a 35 per cent growth in floor space and a 48 per cent growth in student numbers.
In 2008

<table>
<thead>
<tr>
<th>Management Commitment</th>
<th>University of British Columbia-Vancouver (UBC-V)</th>
<th>Simon Fraser University (SFU)</th>
<th>Douglas College (DO)</th>
<th>Vancouver Community College (VCC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UBC initiated and led the signing of the ‘University and College Presidents’ Climate Change Statement of Action for Canada’ by President Stephen Toope and five other BC university and college presidents.</td>
<td>SFU renewed its commitment to taking action on the environment by signing the ‘University and College Presidents’ Climate Change Statement of Action for Canada’.</td>
<td>SFU renewed its commitment to taking action on the environment by signing the ‘University and College Presidents’ Climate Change Statement of Action for Canada’.</td>
<td>The VCC Board of Directors requested formal quarterly progress reports from Management with respect to conservation and sustainability efforts.</td>
<td></td>
</tr>
<tr>
<td>Institutional Structure</td>
<td>The Sustainability Advisory Committee (SAC) was formed, comprising of faculty, senior administration and student representatives.</td>
<td>The ‘Environmental Sustainability Task Force’ (ESTF) was created to bring forward short-term and long-term initiatives to promote the environmental sustainability of the College.</td>
<td>The College put in place an executive advisory group on campus sustainability. This group took on the task of providing advice to College administration on issues and initiatives related to conservation and sustainability. Its membership includes a cross section of stakeholders, including students, faculty staff, management and volunteers.</td>
<td></td>
</tr>
<tr>
<td>Greenhouse Gas (GHG) Inventory</td>
<td>Completed inventory of 2007 GHG emissions.</td>
<td>Completed an inventory of its 2007 GHG emissions to set a baseline for GHG management and to identify reduction opportunities. This inventory was done by a consultant and findings were verified by a third party. SFU also implemented SMARTTool reporting of its 2007 GHG emissions.</td>
<td>Issued a Purchase Order for a consultant to initiate a review of baseline GHG emissions.</td>
<td></td>
</tr>
</tbody>
</table>
In 2008 (Cont’d)

<table>
<thead>
<tr>
<th>Climate Action Plan</th>
<th>UBC-V</th>
<th>SFU</th>
<th>DO</th>
<th>VCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>UBC commenced development of a comprehensive climate action plan for the UBC Vancouver campus. This plan was to establish a vision for climate action, GHG emissions reductions targets, action/implementation strategies, and a management system for implementation, reporting and monitoring.</td>
<td>Lighting projects included installation of LED fixtures, replacement of 32W fixtures with 28W fixtures and installation of occupancy sensors in public washrooms and classrooms.</td>
<td>Reduced electrical consumption by conversion from T12 fluorescent tubes to T8 LED tubes and converted 153 incandescent bulbs in the theatre dressing rooms to CFLs.</td>
<td>Re-lighting retrofit project for the Broadway campus using more energy efficient equipment and T8’s, electronic ballasts, occupation sensors &amp; LED emergency exit lights. Feasibility studies, budget approval and project tenders were initiated in 2008 with the actual project commencing in 2009.</td>
<td></td>
</tr>
</tbody>
</table>

Lighting Retrofit |
In 2008 (Cont’d)

<table>
<thead>
<tr>
<th></th>
<th>UBC-V</th>
<th>SFU</th>
<th>DO</th>
<th>VCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Efficiency Retrofit</td>
<td>Expansion of direct digital control (DDC) systems to improve efficiencies in existing HVAC systems, improve control strategies such as space zoning, time of day usage patterns, and partial shutdowns during under-utilized time periods.</td>
<td>Reduced electrical consumption by installation of variable speed drives, chiller plant design optimization, adding Energy Mizers to vending machines and addition of solar screens to the concourse to reduce cooling costs. Also upgraded the boiler burner controls, addition of insulation and on-going upgrades to the computerized HVAC system.</td>
<td>Installation of energy efficient hot water tanks. Feasibility studies, budget approval and project tenders were initiated in 2008 with the actual project commencing in 2009. Also commenced installation of direct digital controls (DCC) for HVAC systems, replacement of standard motors with variable speed motors, upgraded air compressors to higher efficiency types and replaced exterior glazing with more energy efficient glazing.</td>
<td></td>
</tr>
<tr>
<td>Buildings</td>
<td>Project UBC ReNew retrofitted/renewed 10 academic buildings to LEED silver certified standards.</td>
<td>LEED ratings are used to guide decisions in renovation. Building system audits of two buildings were undertaken through BC Hydro’s Continuous Optimization Programme.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vehicles</td>
<td>12 electric vehicles and 4 hybrid vehicles were added to the fleet of 450. In addition, all diesel vehicles are fuelled with ~ 20% bio-diesel mixture.</td>
<td>A small electric truck was purchased by Facilities Operations as a pilot project.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In 2008 (Cont’d)

<table>
<thead>
<tr>
<th>Demonstration Projects</th>
<th>UBC-V</th>
<th>SFU</th>
<th>DO</th>
<th>VCC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UBC initiated an alternative energy feasibility study that aimed to identify ways to reduce GHG emissions associated with the UBC Steam Plant, and generate carbon tax and carbon neutral mandate cost savings.</td>
<td>Two solar demonstration projects were installed at SFU Burnaby campus: a solar thermal (hot water) project and a solar electric (photovoltaic array) were installed at the Facilities Services building. The energy data was collected to determine the potential for solar as a renewable source of energy at the Burnaby campus.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In 2009

<table>
<thead>
<tr>
<th>Management Commitment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>University of British Columbia-Vancouver (UBC-V)</strong></td>
</tr>
<tr>
<td>As a member of the Association of Canadian Community Colleges, the College became a signatory to the ‘Pan-Canadian Protocol for Sustainability’ on August 12, 2009.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Institutional Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>University of British Columbia-Vancouver (UBC-V)</strong></td>
</tr>
<tr>
<td>Facilities Services hired a full-time Sustainability Coordinator to support the implementation of strategic plan objectives and to manage and continue to expand the behaviour change programmes across SFU's three campuses. The Sustainability Advisory Committee provided a supportive forum for connecting and building an institution-wide network and to promote a broad understanding of the actions that can be taken to help reduce emissions and energy consumption.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Greenhouse Gas (GHG) Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Completed inventory of 2008 GHG emissions.</strong></td>
</tr>
</tbody>
</table>
In 2009 (Cont’d)

<table>
<thead>
<tr>
<th>Energy Audit</th>
<th>UBC-V</th>
<th>SFU</th>
<th>DO</th>
<th>VCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audits for the Continuous Optimization Pilot programme were conducted on two building complexes.</td>
<td></td>
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</tr>
<tr>
<td>Climate Action Plan</td>
<td>Completed the UBC-Vancouver Climate Action Plan, which sets aggressive targets to reduce Vancouver campus-wide GHG emissions to levels that exceed provincial requirements.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Lighting Retrofit</td>
<td>Three buildings were re-lamped from 32W T8 to 25W T8 bulbs.</td>
<td>The Student Residence buildings underwent a major lighting retrofit to save electricity. Lighting replacement programmes continued to replace exterior lighting with LEDs and to change out fixtures from 32W to 28W for further savings.</td>
<td>Reduced electrical consumption by converting 30 incandescent flood lights to LED fixtures.</td>
<td>Completed lighting retrofit for the entire Broadway Campus using more energy efficient equipment, T8's, electronic ballasts, occupation sensors and LED emergency exit lights.</td>
</tr>
<tr>
<td>Energy Efficiency Retrofit</td>
<td>The UBC ReNew project improved insulation and replaced single-pane windows with double-pane windows in the Biosciences building complex. Two buildings and two parkades had HVAC upgrades.</td>
<td>Upgraded building controls to replace pneumatic systems with electronic ones, to change constant speed motors to variable speed motors, adding variable speed controls wherever possible.</td>
<td>Installation of 9 freezer/cooler curtains (estimated savings 85,000 kWh/year) and 4 Variable Speed Drives, upgrade of 42 pneumatically controlled variable air volume (VAV) boxes to be DDC controlled.</td>
<td>Completed DDC installation at the Broadway Campus.</td>
</tr>
</tbody>
</table>
In 2009 (Cont’d)

<table>
<thead>
<tr>
<th>UBC-V</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Buildings</strong></td>
<td>The Major Renewal of Shrum Chemistry Building was launched in 2009, and the project targeted LEED Gold certification. Energy projects implemented by Facilities Services focused on improving building systems automation for better monitoring and operational control of energy use. Through participation in BC Hydro's Continuous Optimization pilot programme, emissions for two buildings (Applied Sciences and South Sciences Buildings) were each reduced by over 20%. Studies of Cumulative Sum (CUSUM) trend lines for energy consumption in individual buildings were developed to help identify areas for energy improvements.</td>
<td></td>
<td>Began the installation of energy-efficient hot water tanks at the College's new building at the Downtown Campus.</td>
</tr>
<tr>
<td>As of 2009, all new construction and major renovations will achieve a minimum of LEED Gold. Lifecycle costing is used in all new construction and major renovation projects. Also installed Pulse real-time metering system software in 9 buildings, which allows energy baselines to be developed for individual buildings.</td>
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<tr>
<td><strong>Vehicles</strong></td>
<td>Acquired 8 electric utility vehicles. Six 4-cylinder vans were purchased to replace six 8-cylinder vans.</td>
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</tr>
<tr>
<td><strong>Demonstration Projects</strong></td>
<td>The feasibility of a new district heating plant for the Burnaby campus continued to be studied throughout the year.</td>
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<tr>
<td>A biomass gasification project is planned for the campus. In 2009, committees were formed to move the project through the approval process and to secure funding grants.</td>
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</tbody>
</table>
In 2010

<table>
<thead>
<tr>
<th>Management Commitment</th>
<th>University of British Columbia-Vancouver (UBC-V)</th>
<th>Simon Fraser University (SFU)</th>
<th>Douglas College (DO)</th>
<th>Vancouver Community College (VCC)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>On March 24 2010, UBC President Stephen Toope announced UBC’s Climate Action Plan, committing UBC to aggressive reduction targets for campus-wide GHG emissions. Compared to 2007 levels, GHG emissions will be reduced 33 percent by 2015, 67 percent by 2020, and 100 percent by 2050, exceeding provincial targets. UBC also demonstrated leadership by including strategies for reducing optional Scope 3 emissions for food, procurement, business travel and commuting.</td>
<td>Senior administration through the VP Finance and Administration lent support to energy conservation efforts through the signing of a public Energy Commitment, setting formal goals for the institution to continue on a 2% reduction in energy consumption year over year and to support the provincial targets set for reducing province-wide emissions.</td>
<td></td>
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</tr>
<tr>
<td>Institutional Structure</td>
<td>In January 2010, UBC President Stephen Toope announced the creation of the UBC Sustainability Initiative (USI), which aims to promote and coordinate sustainability efforts in teaching and learning, research and campus operations.</td>
<td>The SFU Sustainability Advisory Committee worked with the Academic Subcommittee to start a review of sustainability curriculum, and to find ways to link teaching with campus operations and community engagement. Key partnerships were formed between the Sustainability Advisory Committee, the Faculty of Environment, and the Pacific Institute for Climate Solutions (PICS) as well as student groups (Sustainable SFU).</td>
<td>The College President formed a ‘Environmental Sustainability Initiative’ team.</td>
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</tbody>
</table>
In 2010 (Cont’d)

<table>
<thead>
<tr>
<th>Energy Audit</th>
<th>UBC-V</th>
<th>SFU</th>
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<th>VCC</th>
</tr>
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<tbody>
<tr>
<td><strong>Commissioned Stantec Engineering to complete a Heating Plant Efficiency Report. The findings of the report identified opportunities to reduce both carbon emissions and energy costs.</strong></td>
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<table>
<thead>
<tr>
<th>Lighting Retrofit</th>
<th>UBC-V</th>
<th>SFU</th>
<th>DO</th>
<th>VCC</th>
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<tbody>
<tr>
<td>Three buildings were re-lamped from 32W T8 to 25W T8 bulbs.</td>
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<tr>
<td><strong>At the New Westminster campus, reduced electrical consumption by reducing over-lamping in 10 washrooms and installed LED pot lights in the washroom entrance vestibules.</strong></td>
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<table>
<thead>
<tr>
<th>Energy Efficiency Retrofit</th>
<th>UBC-V</th>
<th>SFU</th>
<th>DO</th>
<th>VCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Launched BC Hydro’s Continuous Optimization programme, which will be implemented in 72 core academic buildings to achieve an estimated 10% reduction in energy consumption and GHG emissions by 2015. In 2010, two pilot buildings underwent upgrades and energy performance baselines were developed for 17 additional buildings. A Monitoring, Targeting and Reporting system was developed to ensure that buildings would meet energy performance targets.</td>
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<tr>
<td><strong>• Connected the Gymnasium and Academic Quadrangle into the DDC system. Monitoring of building energy performance through the DDC system and building energy real-time dashboards enabled prompt corrective action on day-to-day issues. Ongoing internal support for energy management through monthly meetings of the Energy Committee to regularly review energy performance and generate new ideas for energy savings.</strong></td>
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<tr>
<td>• Implemented DDC heat recovery programming for the main air-handling units at the Coquitlam campus. Retrofit 19 VAV boxes from pneumatic to DDC control.</td>
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<tr>
<td><strong>• Replacement of the atrium glass and skylights of the Downtown Campus with high-efficiency glass. Upgrades to the building envelope at the Broadway Campus to reduce heat loss and improve energy efficiency.</strong></td>
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</table>
In 2010 (Cont’d)

<table>
<thead>
<tr>
<th>UBC-V</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Efficiency Retrofit (Cont’d)</strong></td>
<td>• Renew of Buchanan complex was completed. As part of BioSciences Renew, windows were upgraded from single to double glazing and insulation was improved.</td>
<td>• Work on the $50 million Shrum Chemistry major renew capital project begun in 2009 continued through 2010. Single glazed window were replaced with sealed units.</td>
<td>• Replaced boilers at the Broadway campus with high-efficiency units. Upgrade of the domestic hot water system at the Downtown Campus in order to reduce energy and water consumption.</td>
</tr>
<tr>
<td><strong>Buildings</strong></td>
<td>Incorporated additional requirements into its Technical Guidelines such that all new construction and major renovations will achieve a minimum of LEED Gold. All new construction must now achieve an energy performance 42% below Canada’s Model National Energy Code for Buildings (MNECB).</td>
<td>Two capital projects underway were registered for LEED certification, ensuring high energy standards would be incorporated in these new/renewed buildings.</td>
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</tr>
<tr>
<td><strong>Vehicles</strong></td>
<td>Purchase of 4 more electric trucks.</td>
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</tr>
<tr>
<td><strong>Demonstration Projects</strong></td>
<td>A partnership agreement was formed with SFU Community Trust and Corix Energy to jointly fund, develop and implement a district energy system that would serve both SFU and UniverCity residents.</td>
<td></td>
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</tr>
<tr>
<td><strong>Funding Request</strong></td>
<td>Funding for the proposed district energy system for the Burnaby campus was sought through the Public Sector Energy Conservation Agreement (PSECA). A PSECA application for solar thermal installations at the Gymnasium (Pool) and Library was unsuccessful.</td>
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In 2011

<table>
<thead>
<tr>
<th>Management Commitment</th>
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In the fall of 2011, VCC launched a new 3-year Strategic Plan with a vision expressed through shared values, one of which is that VCC respects the environment and seeks to reduce its environmental impact.

Institutional Structure

| A Community Energy Manager was hired in 2011 and was developing Energy Management Plans for ancillary buildings (e.g. housing and athletics facilities). The UBC Climate Action Plan Working Groups (Development and Infrastructure, Energy Supply and Management, Fleet, Transportation (Commuting), Business Travel and Procurement, and Food) involved over 40 staff campus-wide to implement the Plan, approved by the Board of Governors in 2010. | Formation of the SFU Sustainability Network, with founding partners comprised of the Sustainability Advisory Committee, Facilities Services, Pacific Institute for Climate Solutions (PICS), Sustainable SFU, and the Faculty of Environment. Additionally, the creation of joint Building Energy Committees for 2 buildings, comprising building users, facilities operations staff and sustainability support staff has been a successful model for ongoing dialogue on ways to improve building energy performance. | Created and staffed a new position of Manager of Environment & Sustainability in November 2011 with a mandate to guide the College in integrating sustainability values and practices into VCC's strategic and operation planning processes, the management of its resources and operations, facilities planning and design, research activities and curriculum. |
In 2011 (Cont'd)

<table>
<thead>
<tr>
<th>Energy Audit</th>
<th>UBC-V</th>
<th>SFU</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Energy Audit</td>
<td>Conducted energy assessments in 14 buildings through the Fortis BC Energy Assessment Programs to determine the opportunities for natural gas saving.</td>
<td>Replaced light fixtures with new high efficiency type; replaced some outdoor parking light fixtures and other exterior fixtures with LED; converted lecture halls from incandescent to LED with new dimmers; installed motion sensors in offices, classrooms and washrooms.</td>
<td>Reduced electrical consumption by replacing about 100 T12 with T8 lamps in the 3rd &amp; 4th floor corridors of the North building at New Westminster campus. At the David Lam campus, replaced 100 75-watt bulbs with 10-watt LED bulbs.</td>
<td></td>
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</tbody>
</table>

| Lighting Retrofit                   | Replaced light fixtures with new high efficiency type; replaced some outdoor parking light fixtures and other exterior fixtures with LED; converted lecture halls from incandescent to LED with new dimmers; installed motion sensors in offices, classrooms and washrooms. |                                              |                                              |                                                                                                                                 |

| Energy Efficiency Retrofit          | • Completed Phase 1 of one of the steam to hot water conversion project that will replace 14 km of aging steam system piping infrastructure, reduce emissions by 22% and save up to $4 million a year in operational and energy costs. | • Under the Energy Management program, several energy efficiency projects were carried out across the Burnaby campus and 6 buildings were re-commissioned through the BC Hydro Continuous Optimization Programme. | • At the New Westminster campus, replaced the summer hot water boiler with a high-efficiency condensing boiler. At the David Lam campus, added draft damper controls onto the boilers. The draft dampers improve burner efficiency and reduce standby losses through idle boilers. | • DDC have been installed in selected floors at the Downtown Campus, enabling heating and cooling functions to be automatically controlled in order to achieve greater energy efficiency. |
In 2011 (Cont'd)

<table>
<thead>
<tr>
<th>Energy Efficiency Retrofit (Cont'd)</th>
<th>UBC-V</th>
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</tr>
</thead>
<tbody>
<tr>
<td>• The Continuous Optimization ‘Building Tune-up’ programme was retro-commissioning 72 buildings to reduce emissions in core buildings by 10%. A pilot in two buildings was completed in 2011 and achieved 21% energy savings in those buildings. Investigation of the next phase of 17 energy-intensive laboratory buildings was also completed. A pre-feasibility study was completed in 2011 to identify strategies that could be implemented with simple payback of 5 years or less to reduce energy use related to ventilation and fume hoods in laboratory spaces. Renew of Biological Sciences West and South was completed. As part of BioSciences Renew, windows were upgraded from single to double glazing and insulation was improved.</td>
<td>Work on the $50 million Shrum Chemistry major renewal capital project, which began in 2009, was completed in 2011. This major renewal capital project incorporated high performance energy management technologies such as low flow fume hoods and DDC for air conditioning and lighting systems. Also completed in 2011 was the major capital project of Podium 2 Expansion in the Surrey campus.</td>
<td>At both campuses, completed DDC demand ventilation programming for the main air-handling units. The programming &amp; associated CO₂ sensors will control fresh air makeup to reduce heat loss during the winter months.</td>
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<tr>
<th>Buildings</th>
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</thead>
<tbody>
<tr>
<td>• A pilot monitoring, targeting and reporting system was implemented in 2011. Energy reports will be distributed to departments as their buildings move through the continuous commissioning programme.</td>
<td>Expanded energy database by collecting and separating out energy consumption data for every building to set benchmarks and allow performance of individual buildings to be looked at in more detail.</td>
<td></td>
<td>Gathering baseline energy consumption information.</td>
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In 2011 (Cont'd)

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</table>
| • The Centre for Interactive Research on Sustainability (CIRS), a regenerative building that includes waste heat recovery from a neighbouring building, solar PV, ground-source heating and on-site wastewater treatment, opened in November 2011.  
• A study was completed in 2011 to recommend absolute energy performance targets for UBC buildings including student residences, offices, classrooms and laboratory spaces. UBC now sets an Energy Density Target for each new building project, that the design team must meet or exceed. | | | |
| Vehicles | | Purchased a fourth electric van as part of the fleet to replace a gasoline powered older van. | |
| Demonstration Projects | The UBC Bioenergy Research and Demonstration Project, a partnership with Vancouver-based Nexterra and General Electric, broke ground in February 2011. This will eliminate 9% of campus GHG emissions per year by reducing natural gas consumption used for generating steam. | | Two renewable energy demonstration projects were completed in 2011: solar thermal heating and solar photovoltaic. | |
In 2011 (Cont'd)

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Funding</td>
<td>In April 2011, Premier Christy Clark announced provincial funding (PSECA) for a new biomass energy plant at SFU. $4.7 million in funding will be provided to support the partnership between SFU, the SFU Community Trust and Corix Utilities to build a proposed district energy system for Burnaby campus and UniverCity. The proposed high efficiency heating plant will use woody biomass from construction wood waste as the primary fuel source.</td>
<td>The reduction in the Annual Capital Allowance has had an impact on Douglas College's ability to pursue substantive capital initiatives to reduce GHG emissions. As the reduction of the Annual Capital Allowance continues for 2012, new GHG reduction initiatives will impacted.</td>
<td></td>
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<tr>
<td>Management Commitment</td>
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<td>Douglas College (DO)</td>
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<tr>
<td>SFU demonstrated its commitment to sustainability by funding a new Sustainability Office and establishing a Senior Sustainability Council.</td>
<td>VCC's goal is to reduce its carbon footprint by 10% below 2011 levels by 2016. In order to meet this target, VCC will complete and implement a Strategic Energy Management Plan that will identify opportunities to reduce energy use and greenhouse gas emissions and their associated costs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Institutional Structure</td>
<td>The SFU Sustainability Office was created, and a Senior Sustainability Council (SSC), composed of a senior representative from each Vice-Presidential portfolio, was established.</td>
<td></td>
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<tr>
<td>Energy Audit</td>
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In 2012 (Cont’d)

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<tbody>
<tr>
<td>Climate Action Plan</td>
<td>The Senior Sustainability Council, supported by the Sustainability Office, began the development of a Sustainability Strategic Plan for the university that will address social, economic and environmental sustainability. The Plan is expected to be approved in 2013.</td>
<td></td>
<td>In 2012, through the Environment &amp; Sustainability Advisory Group, VCC developed an Environment &amp; Sustainability Plan with a vision to bring sustainability principles into the thinking, actions, culture and everyday operations of VCC.</td>
</tr>
<tr>
<td>Lighting Retrofit</td>
<td>Replaced existing lighting with more efficient lighting during classroom renovations in Academic Quadrangle and RC Brown Hall. Replaced all old incandescent lighting in Images Theatre with new high-end LED light fixtures, as part of the theatre upgrade.</td>
<td>At the New Westminster campus, reduced electrical consumption by replacing T12 with T8 lamps in the 1st and 2nd floor corridors of the North &amp; South buildings and the 3rd floor South corridors. Furthermore, added Wattstopper occupancy sensors to deactivate nonemergency corridor lights, when there is no pedestrian traffic.</td>
<td>New LED exit lights and LED panel lights installed in stairways at the Downtown campus.</td>
</tr>
</tbody>
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In 2012 (Cont'd)

<table>
<thead>
<tr>
<th>Energy Efficiency Retrofit</th>
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</tr>
</thead>
<tbody>
<tr>
<td>• Completed Phases 2 and 3 of one of the steam to hot water conversion project.</td>
<td>Renovation of the Discovery 1 building was completed to LEED Commercial Interiors standards.</td>
<td>At the New Westminster campus, upgraded 3 pneumatically controlled VAV boxes to DDC control.</td>
<td>Completed energy retrofit projects including partial roof replacement at Downtown Campus, DDC installation on floors 4 and 5 of Downtown Campus Tower Building, replacement of Broadway Building A walk-in cooler and make-up air handling units optimization completed for Broadway Building B.</td>
<td></td>
</tr>
<tr>
<td>• A pilot for the Continuous Optimization Programme in two buildings was completed. The next phase of implementation was underway in 17 buildings, and investigation of 40 more buildings was in progress.</td>
<td></td>
<td>• At the New Westminster campus, replaced a 50 hp motor with a premium efficiency motor (94.5% vs. 92.4% for standard efficiency).</td>
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<tr>
<td>New energy performance requirements for new construction and major renovations were written into the Sustainability section of the Technical Guidelines.</td>
<td>Nine more buildings were connected to the Building Energy Dashboard display system.</td>
<td>Energy performance baselines were created for 4 more buildings in the Burnaby campus, and energy projects identified through the Continuous-Optimization programme were implemented in these same 4 buildings, including the installation of Variable Frequency Drives into existing fan systems and carbon dioxide sensors in the fan systems to better control ventilation.</td>
<td>Worked with Siemens Building Technologies to develop an energy use baseline. Provided data from 2009 to 2011. A draft baseline has been compiled using RETScreen.</td>
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In 2012 (Cont'd)

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</thead>
<tbody>
<tr>
<td>Vehicles</td>
<td>Purchase of 5 electric-drive Smart cars and 2 Stromer electric bicycles with trailers for trades staff who travel around campus without heavy loads.</td>
<td>Building and Grounds purchased 1 newer, more fuel-efficient van.</td>
<td></td>
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</tr>
<tr>
<td>Demonstration Projects</td>
<td>In September 2012, UBC opened the $34 million Bioenergy Research and Demonstration Facility.</td>
<td>Created 9 pilots for virtualizing activities between SFU's 3 campuses, including: virtualizing classrooms so that students at multiple campuses can attend the same class; virtualizing executive and administrative committee meetings; and installing virtual capabilities in the Faculty of Education, the Library and Continuing Studies to facilitate virtual course attendance.</td>
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<tr>
<td>Funding Request</td>
<td></td>
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<td></td>
<td>Applied to BC Hydro's Energy Manager Program.</td>
</tr>
<tr>
<td>Others</td>
<td>Reduced emissions related to paper below 2011 levels by 20%. IT has seen a 20% decrease in printing since 2009.</td>
<td></td>
<td></td>
<td>Emissions from the use of paper were reduced by 10%.</td>
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## Appendix C: UBC-Vancouver Energy and GHG Data

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</thead>
<tbody>
<tr>
<td>Electricity (kWh)</td>
<td>153,960,152</td>
<td>176,968,516</td>
<td>179,949,859</td>
<td>188,362,958</td>
<td>194,217,931</td>
<td>193,171,570</td>
<td>200,846,636</td>
<td>212,382,957</td>
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</tr>
<tr>
<td>Natural Gas (GJ)</td>
<td>1,014,976</td>
<td>1,118,804</td>
<td>1,110,506</td>
<td>1,063,488</td>
<td>1,019,870</td>
<td>1,134,526</td>
<td>1,062,483</td>
<td></td>
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</tr>
<tr>
<td>GHG covered by CNG</td>
<td>64,153</td>
<td>63,381</td>
<td>61,090</td>
<td>62,470</td>
<td>60,580</td>
<td>58,353</td>
<td>63,803</td>
<td>60,715</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Enrolment (Annualized FTE)</td>
<td>30,506</td>
<td>32,457</td>
<td>33,377</td>
<td>35,466</td>
<td>36,185</td>
<td>37,009</td>
<td>37,285</td>
<td>37,589</td>
<td>38,855</td>
<td>40,349</td>
<td>40,961</td>
<td>41,598</td>
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<td>GHG from stationary sources ** (tonnes CO₂e)</td>
<td>60,193</td>
<td>58,120</td>
<td>60,130</td>
<td>58,840</td>
<td>56,230</td>
<td>61,955</td>
<td>58,890</td>
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<td>Total Floor Space (m²)</td>
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<td>1,092,857</td>
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<td>1,274,138</td>
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<td>1,374,224</td>
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<td>GHG per student (tonnes CO₂e)</td>
<td>2.10</td>
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<td></td>
<td>1.70</td>
<td>1.63</td>
<td>1.61</td>
<td>1.50</td>
<td>1.42</td>
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<tr>
<td>Stationary GHG per m² (tonnes CO₂e)</td>
<td>0.059</td>
<td>0.049</td>
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<tr>
<td>Gasoline (Litre)</td>
<td>601,121</td>
<td>530,490</td>
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<td>494,947</td>
<td>499,315</td>
<td>391,722</td>
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<td>B20 biodiesel (Litre)</td>
<td>243,144</td>
<td>104,384</td>
<td>170,540</td>
<td>119,486</td>
<td>117,508</td>
<td>114,134</td>
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<td>Fleet GHG (tonnes CO₂e)</td>
<td>1,973</td>
<td>1,496</td>
<td>1,689</td>
<td>1,431</td>
<td>1,263</td>
<td>1,253</td>
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* Excludes Off-Campus Properties; ** Excludes Off-Campus Properties and Biomass

Sources: UBC Campus Sustainability Office; UBC Planning & Institutional Research (http://www.pair.ubc.ca/statistics/students/students.htm)
Appendix D: SFU Energy and GHG Data

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<td>Electricity (kWh)</td>
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<td>76,144,297</td>
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<td>Natural Gas (GJ)</td>
<td>306,817</td>
<td>289,688</td>
<td>305,237</td>
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<td>GHG covered by CNG (tonnes CO₂e)</td>
<td>19,410</td>
<td>17,695</td>
<td>18,741</td>
<td>17,818</td>
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<tr>
<td>Enrolment (Annualized FTE)</td>
<td>20,188</td>
<td>20,907</td>
<td>22,081</td>
<td>23,004</td>
<td>24,163</td>
<td>25,278</td>
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<td>GHG from stationary sources (tonnes CO₂e)</td>
<td>18,113</td>
<td>17,079</td>
<td>18,133</td>
<td>17,312</td>
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<td>Total Floor Space (m²)</td>
<td>313,892</td>
<td>337,027</td>
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<td>381,242</td>
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<tbody>
<tr>
<td>GHG per student (tonnes CO₂e)</td>
<td></td>
<td></td>
<td>0.88</td>
<td>0.70</td>
<td>0.71</td>
<td>0.67</td>
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<tr>
<td>Stationary GHG per m² (tonnes CO₂e)</td>
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<td>0.049</td>
<td>0.043</td>
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<th>2010</th>
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<tbody>
<tr>
<td>Gasoline (Litre)</td>
<td>88,538</td>
<td>73,781</td>
<td>62,409</td>
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<td></td>
</tr>
<tr>
<td>B20 biodiesel (Litre)</td>
<td>30,000</td>
<td>38,165</td>
<td>34,144</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Fleet GHG (tonnes CO₂e)</td>
<td></td>
<td>940</td>
<td>288</td>
<td>283</td>
<td>245</td>
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Sources: SFU Facilities Services (Facilities Development Unit); SFU Facilities Services Campus Space Inventory (http://www.sfu.ca/fs/Campus-Facility-Profiles/Campus-Space-Inventory.html); SFU Institutional Research and Planning (http://www.sfu.ca/irp/enrollments/EnrollmentDashboard.html)
Appendix E: Letter of Initial Contact

The University of British Columbia

Institute for Resources, Environment & Sustainability
4th Floor, 2202 Main Mall
Vancouver, BC Canada V6T 1Z4

March 21, 2013

Dr. Pat Hibbitts
Vice President Finance & Administration
Simon Fraser University

Dear

Evaluation of British Columbia’s Carbon Neutral Government Mandate

We are conducting an independent evaluation of the effectiveness of British Columbia’s Carbon Neutral Government (CNG) mandate. The British Columbia (BC) government is the first major jurisdiction to declare that it has achieved ‘carbon neutral’ operations since 2010. This initiative offers an excellent opportunity to study whether mandating public sector organizations (PSOs) to be ‘carbon neutral’ is an effective policy within an overall strategy to drastically reduce greenhouse gas (GHG) emissions from these organizations. While carbon taxes and their impacts have been widely studied, unfunded environmental mandates on the public sector are relatively understudied. We believe that there are many lessons that can be learned from this initiative.

The study will examine the CNG mandate’s effectiveness in achieving significant, sustainable reduction of GHG emissions in four academic institutions. It will focus on how organizational decisions on infrastructure projects have and continue to be influenced by the mandate, including factors that facilitate or hinder such decisions and innovative solutions that have been adopted. The study aims to recommend additional support mechanisms to assist academic institutions as well as other PSOs to achieve the desired outcomes of the mandate, and share lessons learnt with other organizations, sectors or jurisdictions.
We would like to invite your organization to participate in this study. Besides an analysis of quantitative data by the researchers, this study will entail interviews of key stakeholders in your organization. The interviewees are likely to be senior administrators or managers in functional areas such as finance and administration, infrastructure or campus development, facilities management and sustainability. They would be intimately involved and knowledgeable about your organization's response to the CNG mandate, evaluation of infrastructure projects that affect GHG emissions, major constraints encountered and opportunities that have arisen.

The interviews will be conducted by Kim Lau from the Institute for Resources, Environment & Sustainability (IRES) of the University of British Columbia (UBC). Kim has had extensive experience in public policy formulation and corporate planning in several government organizations. This project is supported by funding from the Social Sciences and Humanities Research Council (SSHRC), Pacific Institute for Climate Solutions (PICS) and the U.S. National Science Foundation.

The participation of your organization, and your personal support for our study will enable us to obtain your organization's valuable perspectives and extremely useful insights, which will potentially be very helpful to other public organizations trying to reduce their GHG emissions.

We would really appreciate it if you could let us know via email at [email protected]. If your organization agrees to participate, we will send individual emails or letters to invite the identified interviewees to take part. If you have any questions, please feel free to contact Kim at [email protected].

Thank you in advance.

Yours sincerely,

Hadi Dowlatabadi (Principal Investigator)
Professor & Canada Research Chair in Applied Mathematics and Integrated Study of Global Change
Institute for Resources, Environment & Sustainability
University of British Columbia

Kim Lau (Co-Investigator)
Joseph-Armand Bombardier Scholar
Institute for Resources, Environment & Sustainability
University of British Columbia
Appendix F: Consent Form

The University of British Columbia

Interview Consent Form

Assessment of British Columbia's Carbon Neutral Government Mandate

Principal Investigator: Prof. Hadi Dowlatabadi
Canada Research Chair in Applied Mathematics and Global Change
Institute for Resources, Environment & Sustainability
University of British Columbia
Tel: [Number]
Email: [Email]

Co-Investigator: Kim Y. Lau
M.A. Candidate
Institute for Resources, Environment & Sustainability
University of British Columbia
Tel: [Number]
Email: [Email]

Sponsors: Joseph-Armand Bombardier Canadian Graduate Scholarship (CGS)
Pacific Institute for Climate Solutions (PICS)
National Science Foundation, through the Climate Decision Making Center (CDMC) at Carnegie Mellon University

Purpose of Research:

This research study is a systematic assessment of responses and impacts arising from British Columbia's Carbon Neutral Government mandate. It is conducted as part of a Master's thesis. The study will examine the effectiveness of the mandate through its impacts on public sector organizations (PSOs), focusing on how this mandate affects organizational
decisions on infrastructure projects, factors that facilitate or hinder such decisions, support mechanisms and innovative solutions. The objectives of the study are to assess the effectiveness of the mandate in achieving significant, sustainable reduction of greenhouse gas (GHG) emissions, recommend additional support mechanisms to assist PSOs to achieve the desired outcomes of the mandate, and examine the applicability of this mandate and draw lessons for other sectors or jurisdictions.

Interview Procedure:

During the interview, you will be asked to answer some questions regarding your organization's response to the Carbon Neutral Government mandate, evaluation of infrastructure projects that affect GHG emissions, major constraints encountered and opportunities that have arisen, and support mechanisms that helped or would help in responding to the mandate. The interview will be audio-recorded. It is estimated to take about one hour. However, you are free to expand on any part of the topic or talk about related ideas.

Consent:

Your participation in this study is entirely voluntary. You may refuse to participate or withdraw from this study at any time, requesting that the information you provided earlier not be included in this study. If there are any questions you feel you cannot answer or that you do not feel comfortable answering, please indicate this to the interviewer and he will move on to the next question.

If you wish any of your comments to be anonymous, please indicate so and every effort will be taken to conceal your identity, such as amalgamating your comments with others, or masking the organization or position that you are working at, as much as possible. Sensitive and confidential information will be kept secure and will not be shared outside the research team, unless with your consent, or in a form which is acceptable to you.

You will be given an opportunity to review the transcript or summary of the interview, and comment on relevant draft findings and recommendations, papers and journal articles, if you wish.

Your signature below indicates that you have received a copy of this consent form for your own records.

Your signature indicates that you consent to participate in this study.

___________________________________________________________
Signature                                                  Date

___________________________________________________________
Name (Please Print)
Appendix G: Interview Protocol

Assessment of British Columbia’s Carbon Neutral Government Mandate

{Note: This interview script is aimed primarily at administrators and managers of the case study public sector organizations (PSOs). It will be slightly modified, as appropriate, for interviews of other stakeholders and organization representatives.}

Introduction and Permission

As mentioned in the consent form that you have signed, this interview will be audio-recorded. Can I have your permission to turn on the recorder and proceed with the interview? Thank you.

This is a study to systematically assess the effectiveness of British Columbia’s carbon neutral government (CNG) mandate through the responses of and impacts on public sector organizations (PSOs). In particular, the study will focus on how this mandate affects decisions on infrastructure projects, factors or support mechanisms that facilitate or hinder such decisions, and innovative solutions that have been adopted.

During the interview, you will be asked questions regarding:

a) Your organization’s response to the CNG mandate;
b) Evaluation of infrastructure projects that affect greenhouse gas (GHG) emissions;
c) Major constraints encountered, and opportunities that have arisen;
d) Support mechanisms that helped or would help in responding to the mandate.

This interview is estimated to take about one hour; however, please feel free to expand on any part of the topic or talk about related ideas.

Your participation in this study is entirely voluntary. At any point of this interview, you may choose to withdraw from the study and request that the information you provided earlier not be included in this study. Also, if there are any questions you feel you cannot answer or that you do not feel comfortable answering, please indicate this and we will move on to the next question.

Do you have any questions before we begin?
I. Actions taken prior to the CNG Mandate

1. What major actions did your organization undertake in terms of climate change action, prior to the CNG mandate in 2008?

[Prompts: Did your organization complete a GHG inventory prior to 2008? Set targets and have a comprehensive plan for reducing energy use or GHG emissions? Implemented a major energy efficiency or conservation programme?]

2. Which parts of the organization were involved or responsible for such actions? Were these action parties operating under formalized organizational structures or processes?

[Prompt: Was a person, department or committee responsible for monitoring and reducing GHG emissions? Energy use?]

II. Changes since the Mandate

3. What major new actions have your organization taken since CNG was mandated?

[Prompts: Did your organization complete a GHG inventory? Set targets and formulated a comprehensive plan for reducing energy use or GHG emissions? Implemented a major energy efficiency or conservation programme?]

4. Has there been any change in whom or which department is responsible for climate change action (or sustainability) and monitoring of GHG emissions?

5. Has your organization identified opportunities for significant reduction of emissions not covered by the mandate? Is action being taken to reduce these emissions? If not, why not?

[Prompt: emissions from employee business travel, employee commuting, building lifecycle and waste may make up a large proportion of total emissions]

III. Decisions on Infrastructure Projects

6. In general, how are infrastructure projects that involve emissions reduction funded? Is there a different process for new versus retrofit projects?

7. When evaluating infrastructure projects that either increase or decrease GHG emissions, what factors matter most to your organization?
8. Does your organization differentiate between energy and GHG planning?

9. Since CNG was mandated, what changes have occurred within your organization, if any, in the planning and decision-making process for infrastructure projects?

10. Has the mandate made it easier for your organization to justify and decide to implement infrastructure projects that substantially reduce GHG emissions? Conversely, has the mandate made it harder for your organization to justify and decide to implement infrastructure projects that substantially increase GHG emissions?

[Prompts: Has the CNG mandate made any difference to (i) the priority for reducing emissions covered by the mandate (i.e. liable for offsets) and (ii) the balance of decisions pertaining to GHG reduction projects in your organization?]

11. Can you cite an example of an infrastructure project that has been approved thanks mainly to the CNG mandate? Can you cite an example of an emission-reduction infrastructure project that has not been approved, despite the CNG? Why?

12. From which budget or account are offsets and carbon tax paid? Did the CNG mandate result in a different approach or strategic response in your organization compared to that of the carbon tax?

13. Does the requirement for an annual public report on actions taken (i.e. the Carbon Neutral Action Report) influence your organization’s response to the mandate?

IV: Constraints

14. What are the major constraints holding back decisions on emission-reduction infrastructure projects? Please rank them in order of importance.

15. Has the CNG initiative and related programs changed any of these constraints?

16. Has the payment for carbon tax and carbon offsets been at the expense of infrastructure projects or core operations?
V: Resources and Support Mechanisms

17. Which budgets or accounts are used to fund your organization’s response to the mandate? Are funds in this budget or account re-directed from other budgets?

18. Since the mandate, did your organization manage to get new or additional resources/funding for GHG reduction projects (e.g. PSECA funds)? Did the additional resources/funding exceed the amount of carbon offsets and carbon tax your organization had to pay so far?

19. What happens if there are surplus funds or savings generated by these initiatives/responses?

20. Since CNG was mandated, has there been a significant change in the level of staffing or expertise related to GHG emission accounting, monitoring or reduction? What about in the area of infrastructure or energy planning and implementation? How are academics and researchers involved?

21. Are there areas of expertise within your organization that need to be augmented in order to better undertake emission reduction infrastructure projects? Did your organization hire a consultant or get external expertise to address these areas, e.g. identify and/or design emissions reduction infrastructure projects?

22. Which support mechanism provided by the Provincial Government or other government agencies, as part of the CNG programme, is most helpful to your organization?

   [Prompts: SMARTTool, funding for energy manager, PSECA project funding, training of personnel]

23. In your opinion, what other support mechanisms or policy changes would help your organization to implement infrastructure projects that would drastically reduce emissions?

VI: Innovations and Learning

24. What major innovations have your organization made in climate change action? Are any of these motivated by the CNG mandate?

25. Is your organization able to tap expertise from other public sector organizations in BC or elsewhere? Has your organization shared lessons learned with other organizations?
26. From your perspective, has the mandate generated increased know-how in GHG reduction in your organization, and in BC overall?

Closing

a) Is there anything else we have not covered?

b) Are there any personal opinions you wish to express or other perspectives you would like to share?