A Study on Carbon Pricing: Halifax Chamber of Commerce

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February 2009

Executive Summary

This report provides an overview of several plans to reduce the emission of those gasses responsible for contributing to climate change, and then evaluates each plan's efficacy in achieving those reductions. It is framed by an overview of Halifax's population and industry, with a focus on Halifax business' carbon footprint. The report is divided into an in-depth look at each of the reduction plans and a case study of each. The paper concludes with an overall appraisal of Halifax's options in regard to reducing greenhouse gas emissions.

The overview of Halifax includes thorough statistics on the employment and education of workers within the municipality, their major employers, and the dominant industries in which they work. The section also discusses the carbon usage of Halifax, as well as presenting an outline of challenges Halifax will face in the municipality's attempt reduce emissions.

This report defines and analyzes three distinct carbon emission reduction strategies: Intensity Reduction, Cap and Trade, and Carbon Taxation. Each section discusses the theoretical foundation of the strategy, current implementations, as well as its praises and criticisms. Intensity Reduction seeks to reduce carbon emissions proportionally to the GDP; Cap and Trade seeks to reduce emissions through the issuance of vouchers to be traded or sold between businesses; and Carbon Taxation seeks to increase the cost of greenhouse gas producing goods or services through government tax thereby discouraging their use.

Ultimately, each strategy presents opportunities for Halifax, but also many potential pitfalls. Intensity Reduction may fail to reduce the absolute emissions in a region. Cap and Trade may be effective at reducing the emissions, but the administration of such a scheme may be cost-prohibitive on the municipal level. Carbon Taxation could lead to costs being directly passed on to consumers, increasing both the cost of living as well as damaging local business. However, each method could also further Halifax's goals towards reducing greenhouse gas emissions. To increase the practicality of these examples, case studies are included to demonstrate the implementation and repercussions of the adoption of each method.

This account concludes that each of these methodologies would be difficult to implement in their current forms at the municipal level. However, were Halifax to become a participating member in a larger network of states or nations dedicated to reducing greenhouse gas emissions, the outcomes could be very positive. As such, this paper could be used to inform Halifax's endorsement of prospective provincial, national, or international carbon emission reduction programs.

Contents

Introduction

Climate change is now a widely accepted concern for governments, businesses, and ordinary citizens. The urgency of the environmental crisis and how best to address it has become a paramount concern for corporate and political leaders. Climate change is caused by greenhouse gas (GHG) emissions, many of which result from certain human activities such as power generation, transportation, and waste disposal.

A number of emission reduction plans have been proposed and in many cases, enacted. However, grand scale emissions reductions programs are initially costly, and require considerable adjustment to current practices. Three approaches have been widely debated, and in some cases, implemented: GHG Intensity Reduction Standards, Cap-and-Trade, and the Carbon Tax.

While each plan shares a similar objective, they all differ in methodology. GHG Intensity Reduction Standards mandates emission intensity reductions on behalf of individual industries, while cap-and-trade systems place hard caps on the emissions of industries, countries, or organizations and subsequently issue permits to each member of the group to emit a certain portion of the total allowable emissions. Members of the regulated group can often trade amongst themselves to ensure compliance with emissions regulations. Lastly, the carbon tax system places a tax on carbon fuels, predominantly fossil fuels, which emit large volumes of GHG when burned.

Each system has been implemented over the past two decades to varying degrees and in different jurisdictions. In many cases, the implementation of these plans has not been easy; jurisdictions have struggled not only with implementation challenges, but with political ramifications and sustaining competitive advantage.

In Canada, the regulation of GHG has only occurred at the provincial level. To date, Nova Scotia has avoided any form of GHG emission regulation, arguably due to its reliance on coal. While Nova Scotia has been unaffected to date, it is probable that some form of regulation will be implemented either at the provincial or federal level in the not-so-distant future.

Halifax businesses find themselves in a unique position with respect to the possible regulation of GHG emissions. A large portion of the Halifax economy is founded on the import/export industry and tourism, both of which are closely associated with considerable fuel consumption. The Halifax electricity market is also fuelled mainly by coal, which is associated with high greenhouse gas emissions. As such, Halifax and its businesses find themselves uniquely vulnerable to the possible regulation of GHGs.

In light of this situation, the following paper has been prepared to discuss various approaches to GHG regulation, and the potential implications of each method for Halifax businesses. First, carbon accounting and GHG reporting will be discussed, as such systems make serious demands on both business and governments, and such systems often accompany whatever form of GHG regulation is chosen. Next, the Halifax context will be discussed in more detail, followed by a closer examination of each of the GHG regulation tools. A case study of the application of each of these tools in other jurisdictions will be discussed, and examined in light of the similarities with the Halifax context. Finally, the report will make recommendations for how Halifax businesses might best anticipate GHG regulation in its various forms.

1.0 Carbon Accounting and Greenhouse Gas Reporting

All carbon tools discussed in this paper (cap and trade, carbon tax, intensity reduction) require rigorous standards of GHG accounting. The burden of increased GHG accounting and reporting should not be underestimated, from the perspective of either government or industry, when considering the implementation of further carbon regulation.

The Federal government, through the Statistics Act and the Canadian Environmental Protection Act, collects information on the GHG emissions of "large emitters," defined as any facility emitting over 100kT of CO_2E each year (1, 2). Alberta, who recently introduced carbon control legislation, also requires reporting by large emitters (3). Large emitters in Alberta must also achieve a 12% reduction in the emissions intensity of their facility from that of the baseline year. Tracking progress towards this target requires annual reporting by these facilities.

GHG accounting and reporting can be a time intensive and expensive process, requiring coordination among many parties and a broad range of technical expertise (4, 5, 6, 7). The process may involve examining the complete life cycle of an industrial process to track emissions. Furthermore, more stringent reporting mechanisms may require businesses to report on indirect as well as direct emissions. This may require coordinating with other businesses or associated individuals. Some systems also distinguish between modes of GHG emission, for example biomass combustion may need to be accounted for separately from fugitive emissions of industrial processes (8). A high degree of precision and organization is required to meet such reporting requirements.

A second major challenge of implementing GHG reporting mechanisms is coordinating among jurisdictions. While the federal government has implemented a preliminary reporting mechanism for large emitters, provinces such as Alberta and BC are ramping up the reporting requirements to match their increased regulation of carbon emissions (9). At this developmental stage, businesses are at risk of facing

a confusing or even contradictory regulatory environment while jurisdictions struggle to maintain alignment.

Finally, GHG reporting may require divulging information that may be judged to be proprietary or competitive. This poses a confidentiality risk for companies that are obligated to report. In many jurisdictions, businesses can apply for confidentiality (i.e. no external publication) of their results, however the government is not bound to grant such requests (3).

While businesses struggle with the additional burden of GHG reporting, jurisdictions are well advised to slowly ramp up the level of regulatory enforcement. For example, a year grace period was implemented in Alberta where companies reported, but did not yet need to show reductions in their emissions (3). Reporting is often a sufficiently difficult task in the first year that the focus is not yet on making reductions to emissions.

In conclusion, business requires a consistent regulatory context, early warning of coming regulation, and both technical and management assistance to implement the increased accounting and reporting that will be required under any new carbon control regime.

2.0 Overview of Halifax Regional Municipality

2.1 Introduction

Prior to discussing the potential impact of GHG regulation, the following section will set the context by examining the composition of the Halifax economy.

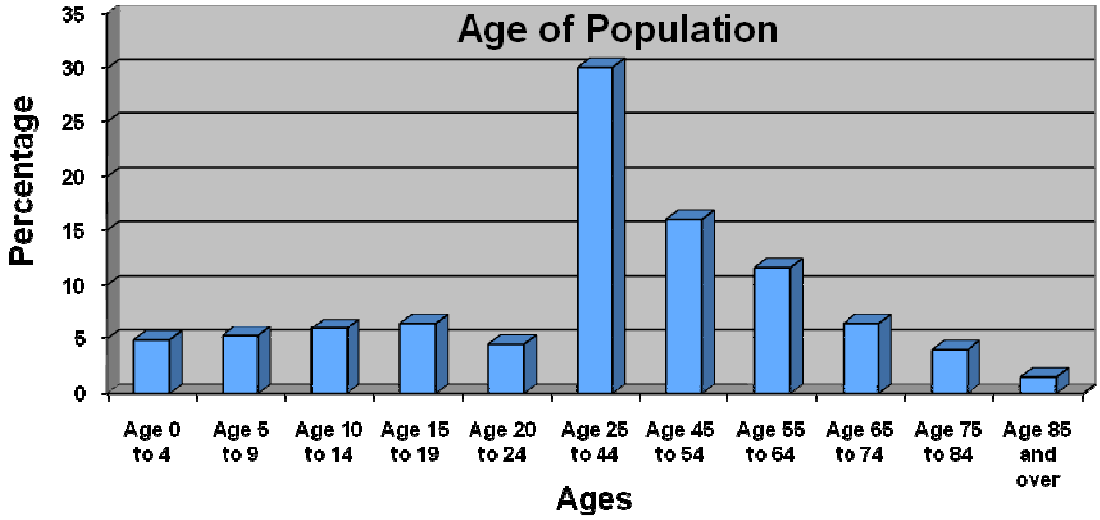
The Halifax Regional Municipality (HRM) has a population of 373 000 (1) making it the largest city in Atlantic Canada. In 1996, HRM was formed through the amalgamation of the former cities of Dartmouth, Halifax and the town of Bedford and the rural municipality of the county of Halifax. Businesses are predominantly located in downtown Halifax and the work force is 90% service industry oriented (2). This report will discuss businesses in Halifax and the challenges they may face (either because of their industry or because they are situated in Halifax) if the government were to introduce a GHG emissions reductions program.

2.2 Halifax Regional Municipality

In September 2008, the unemployment rate of HRM was 5.3%, the lowest rate in 30 years, and the labour force size was 219,400 with a population growth between 2001 and 2006 of 3.8% (3). The Labour Force Market Survey data indicates that Halifax's labour market continued to resist recessionary pressures until the end of December (4). In January, the unemployment rate increased to 5.6%. Halifax has a

relatively young population with 50% of the population being less than 40 years of age. With six degree granting institutions having an enrolment of 30,000 students, the city is populated by 81.1 post-secondary students per 1,000 people - three times the national average.

Figure 2.1: Population of Halifax



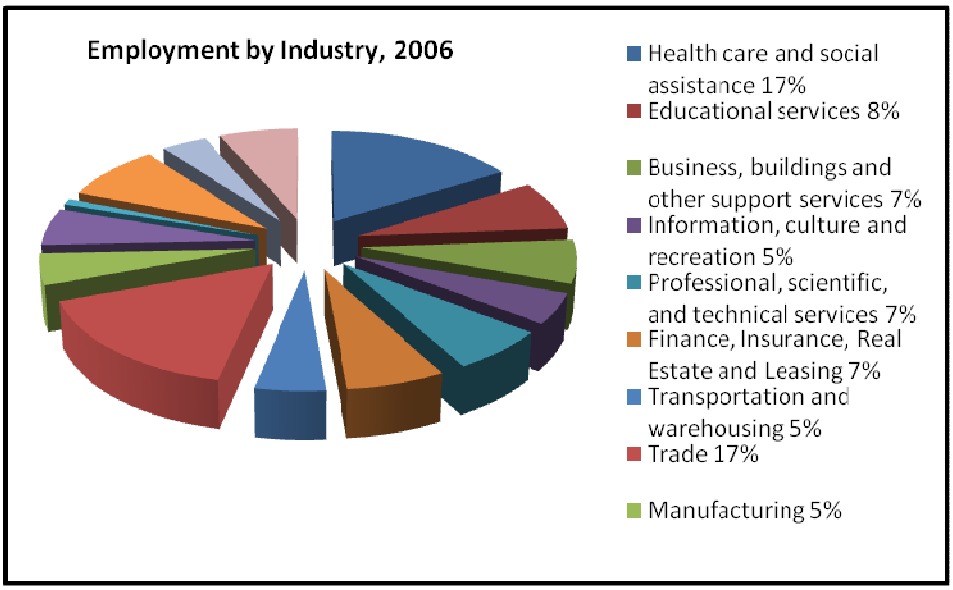
(5)

Halifax has an educated workforce with 63% of the working-age population holding trade, college, or university qualifications (5). However, Halifax may not be attracting enough immigrants, may be losing students when they graduate, and is constantly challenged by skilled labour leaving the Maritimes for either Ontario or Alberta (6). These trends could result in a decline in the overall population.

2.3 Industry Statistics

The economy is primarily based on the public sector (health care and social services, education services, the military, federal and provincial public administration) and other services (finance, real estate and leasing and import/export service). The telecommunications, retail trade, customer service, aerospace and aviation, financial services, gambling, shipbuilding and repair, marine cargo handling and health care industries comprise Halifax's major employers. Specifically, Aliant, Nova Scotia Power, Atlantic Superstore (Loblaws), Staples, Xerox Teleweb Centre, Minacs Worldwide, provide the largest volume of private sector employment to Haligonians. Other major public sector employers in the health services, education and the Canadian Forces sectors are: Capital Health, Dalhousie University, and the Department of National Defence (7). See the chart below for a breakdown of employment of industry.

Figure 2.2: Employment by Industry, 2006



(8)

The HRM has 1200 small and medium sized enterprises, with 20 or fewer employees. These types of firms are responsible for nearly half of the country's contribution to global climate change (9). Nearly everything that goes into companies' operations emits GHG, both directly, through daily commuting and business trips, and indirectly, through the demand for electricity to run lights and equipment (10).
Heavy industries in Halifax include the Imperial Oil Refinery, which produces low sulphur gasoline. This refinery is located in Eastern Passage and was upgraded in 1996 to produce a more efficient process for the purposes of remaining internationally competitive with other oil refineries.

Tourism, university education, health treatment, public administration, trade and professional services all draw money into Nova Scotia from out of province. Approximately 1.57 million tourists visit each year to the HRM (11), including several cruise ships that dock at Pier 20 in downtown Halifax. Other services produced here and exported include banking, insurance, engineering, business support and computer software design. The following table outlines population and labour market statistics for Halifax County by industry:

Figure 2.3: Community Profile for Halifax County

	Halifax County	Nova Scotia	Canada
Population and Earnings			
Population, 2006 Census	372,858	913,462	31.6M
Population, 2001 Census	359,183	908,007	30.0M
% Change	3.8%	0.6%	5.4%
Median earnings, FTFY*	$ 40,247	$ 36,917	$ 41,401
Labour force activity			
Participation rate	68.9%	62.9%	66.8%
Employment rate	64.5%	57.2%	62.4%
Unemployment rate	6.3%	9.1%	6.6%
Experienced labour force, by industry			
Primary Resources	1.7%	5.8%	5.3%
Construction	5.5%	6.4%	6.3%
Manufacturing	5.2%	8.9%	11.9%
Wholesale trade	4.1%	3.5%	4.4%
Retail trade	11.9%	12.5%	11.4%
Finance and real estate	6.4%	4.6%	5.9%
Health and social services	11.7%	11.7%	10.2%
Educational services	7.8%	7.4%	6.8%
Business services	20.7%	17.3%	18.4%
Other services	25.0%	21.9%	19.4%

(1)

2.4 Exports

Exports of the region include fish and fish packaging (Clearwater), electronic components (Satlantic), rubber (Michelin), wood (Barrett Lumber Co.), beer (Oland's) and shipping (Halifax Shipyards).

2.5 Electricity

The Nova Scotia Power (NSP) generating plant is located in Dartmouth, and provides electricity to the HRM. It was originally designed as a coal fired station, but was converted to oil and more recently to dual-firing, making it capable of utilizing both oil and natural gas. This action allows NSP to adjust for price fluctuations of

fuel costs (coal, oil, gas). However, most of Nova Scotia's generation capacity is coal-fired (approximately 53%)(13). The other methods of power generation are natural gas and/or oil together which comprise29% of capacity, and hydro and wind production which provide 18% of capacity (13). By 2010, NSP is mandated to produce 5% of its energy from a renewable resource, with wind turbines as the most likely source (13).

2.6 Shipping and Transportation

Halifax's current market position in shipping is to lighten and top-up ships that are entering and exiting the Port of New York. Halifax is vulnerable to lose market share should New York enhance its shipping capacity by dredging more of their harbour.

HRM is the eastern terminus of the CN Railroad, which provides direct freight service to Montreal, Toronto, and Chicago for cargo arriving at either of the Port of Halifax's two container terminals. CN operates rail lines around both the east and west sides of the harbour, serving Halifax and Dartmouth respectively. The Halifax Port gains a competitive advantage through CN Rail's fast service to the industrial heartland of the Midwest United States (14). However, CN rail has reduced its daily service to the Port of Halifax from two trains to one, as container traffic at the Port continues to decrease. The reduced train service has cut the business of the Halifax Port Authority considerably (15). This trend could result in the use of more trucks to transfer containers from the Halifax Port to other markets on the continent which in turn would result in higher GHG emissions (16, 17).

Transportation by Halifax workers to their place of employment is also a potentially significant source of GHGs. The median commute to work is 6.5 km and over 25% of Halifax workers walk or bike to work (18). Halifax has the highest percentage of people using public transit among benchmark cities at 11.9 % (19).

2.7 GHG Emissions

The most common sources of GHG emissions from businesses are: company owned combustion facilities, physical or chemical processing, and transportation combustion. Other sources of carbon emission include the generation of electricity; indirect emissions such as those from employee travel; the supply chain; and the disposal or use of the company's products or services.

A large concern for businesses in Halifax is the fossil fuels that are burned to heat buildings. Traditionally the majority of business heated their buildings by burning bunker oil and their electricity was generated from burning coal, both of which have large GHG emissions. CO_2 emissions are measured per unit of energy (or Btu):

> "natural gas emits the least CO_2 of any fossil fuel when burned, and coal the most, with petroleum [oil] products such as gasoline occupying the middle range. Generally, a Btu from coal produces 30% more carbon dioxide equivalents than a Btu from oil, and 80% more than from natural gas. A carbon tax would likely follow these proportions, taxing coal somewhat more heavily than petroleum products, and much more than natural gas" (20).

A solution to burning fuel that emits high volumes of carbon dioxide is the Sable Island natural gas project. It enabled transferring Halifax's main power plant and industries from burning coal and bunker oil to natural gas. Unfortunately, there is a limited distribution of infrastructure for natural gas in Nova Scotia, because the slate in HRM requires additional capital to lay the necessary pipes. However, the pipeline that has been laid across the bottom of the harbour has allowed large businesses to change their methods of producing heat to natural gas. The Nova Scotia Department of Energy and Environment Canada launched a community-energy system on the peninsula. The $47-million system will have a co-generation plant (co-generation is 45% more efficient than traditional single-cycle power stations) that produces electricity using clean natural gas instead of traditional bunker oil. The system will provide steam and hot water to Dalhousie University, Saint Mary's University, and four hospitals in Halifax under the Capital Health Authority. Additionally, the change will reduce annual GHG emissions by more than 125,000 tonnes each year. With most large employers situated in downtown Halifax, (21), about 80 percent of downtown office buildings have been connected to natural gas (22). Heritage Natural Gas services 2,000 homes and business in the Halifax and Amherst region.

2.8 Trends in Business and Development

The health services, financial services, and technology sectors are currently growing. For example, several finance companies such as Butterfield Fund Services recently came to Halifax and is creating jobs in the financial services market by outsourcing back office work. Research In Motion (RIM) has recently expanded its operations to Halifax and is expected to increase staff to 1200 from the current level of 500 by 2010 to support the infrastructure for RIM products.

HRM promotes their Regional Plan, "HRMbyDesign" through city planning that encourages mixed retail, commercial and residential spaces downtown that will both encourage living downtown, attract tourists and offer retail shops. One of the successful examples of this type of mixed space is Bishops Landing. To contrast this mixed usage downtown there are also shopping centres to service customers in the suburbs. The big box store trend continues to be popular with the creation of a second power centre called Dartmouth Crossing and more recently, businesses have been relocating to areas away from the downtown core because of the cheaper cost of office/retail space outside of the city centre (23).

2.9 Challenges to Halifax Regional Municipality

Reducing business's carbon footprint in HRM can provide a number of competitive advantages in the form of valuable promotional or sales opportunities, or anticipating industry wide GHG reduction programmes. Should such initiatives be implemented, businesses in Halifax will be challenged because their electricity is not generated from "green power". The customer, telecommunications and financial services will be impacted due to the volume of electricity, the type of heating used for their buildings, and the amount of paper that they consume. Other industries, such as Nova Scotia Power, Imperial Oil Refinery, Oland's Brewery, and the Halifax Ship Yards will be at a disadvantage because they produce large amounts of GHG whether it is from burning fossil fuels to create electricity (NSP), burning oil to produce a better refined oil (Imperial Oil), producing beer (Oland's) or in the creation of steel products and the shipping industry (Halifax Ship Yards).

Halifax relies on shipping its products by rail, trucks, ships, and airplanes which are all dependant on fossil fuels. Halifax is particularly vulnerable in this respect because it is so isolated from other major markets. Carbon emissions associated with the transportation burden of exporting their products is likely to be an area of significant vulnerability for many Halifax businesses in the event of GHG regulation. The following sections will discuss the possible format of such regulation in more detail, and describe the implications for Halifax in each case.

3.0 Overview of Carbon Pricing

GHG emissions may be regulated by each or a combination of several possible systems. These methods include GHG intensity reductions, cap and trade systems, and carbon taxes. The following sections will provide an overview of these tools in more detail, including their strengths and weaknesses for achieving GHG emission reductions and their economic repercussions.

3.1 GHG Intensity Reduction Defined

Carbon intensity reduction is defined as a reduction of GHG per unit production or on a larger scale, a reduction of GHG as compared to the GDP of a country. This method of reduction is generally popular with governments and businesses because it does not limit production with an absolute GHG emission limit but instead the reduction is relative to other considerations. For example, the Alberta government has implemented this system in order to expand the oil sands production while still reducing overall GHG emission intensity (1).

This method allows businesses to grow. An absolute cap on GHG emissions may limit businesses' future growth, or even possibly require they shrink their production if GHG emission reductions cannot be made adequately.

A further benefit of the intensity reduction method is its versatility. There are several means by which to accomplish this goal. The primary method is to develop technologies that reduce the carbon used in the means of production and spark the research sector. This goal can be accomplished throughout the business chain, as energy companies develop renewable or less polluting methods of generating power, such as wind or the development of CO2 sequestration, respectively. CO2 sequestration is a sufficient option because the amount of GHGs released into the atmosphere is reduced even though the amount of carbon utilized is the same.

Businesses outside of energy production have several options at their disposal to reduce their carbon footprint. First, they can switch to greener energy providers who have lessened their carbon footprint. Another option is to choose to purchase raw material from providers who have used a less GHG intensive method of creating their products. Finally, businesses can meet energy intensity targets by reducing the carbon footprint of their business itself. This task may be accomplished in a variety of ways, such as upgrading aging equipment to newer GHG reducing equipment or reducing GHG through greener distribution methods.

The biggest issue with GHG intensity reductions is that they don't necessarily produce an absolute GHG reduction. In fact, often they have produced an absolute increase in GHG because the GHG is only reduced on the basis of percentage of units produced. Thus, if a company/country grows its production at a rate that exceeds its intensity reduction of GHG, then absolute GHG levels increase. For example, in 2004 the United States reduced GHG intensity by 2.6%, however the economy grew 4.4% that year. Therefore, absolute carbon emissions actually grew 1.7% in the U.S. in 2004 because of increased economic activity (2).

Consequently, as a carbon reduction method, intensity based targets are only effective if the economy is in a static or shrinking position, arguably where some companies currently find themselves in the midst of the economic crisis. As the goal of most businesses is to expand, GHG intensity cuts do not seem to be a practical method to meet any type of actual reduction in emissions.

3.2 Cap and Trade Defined

The purpose of the Cap and Trade system is to reduce emissions while allowing companies options in how they choose to comply with the regulations. A sanctioning body establishes the total allowable emissions in a given region over a specific period of time – the 'cap'. This limit "is enforced by the issuance of permits, or 'allowances,' which must be surrendered by each source in an amount equal to its emissions" (1). Companies must decrease their emissions to be commensurate with

the amount of allowances they have been awarded, either by decreasing their production, increasing the GHG efficiency of production, or purchasing allowances this raising the company's individual cap. In some systems, companies may also be allowed to purchase carbon credits from certified programs which offset the GHG emissions.

Collectively, the participants in the program must remain under the emissions limit set by the governing body. Firms failing to comply with the system are faced with sanctions or fines.

The Cap and Trade System grew out of the policies of the Environmental Protection Agency of the United States and its enforcement of the Clean Air Act (2). However, the ideas can be traced back to economic theories of the late 1960s and early 1970s, when several researchers began to conceptualize "tradable permits as an alternative to command-and-control and taxes" (2). The first practical implementation of these theories came as an "offset mechanism [which] was accommodated into the legal framework of the [Clean Air Act] in 1977" (2). In 1979, 'emission reduction credits' were introduced as a currency for emissions amounts below standards (2). Later, in 1988, "emissions trading left its protected space and stepped out into the wider world of environmental politics" (2), when the US Government instituted Project 88, which sought to implement a cap-and-trade system to reduce the emissions causing acid rain. "Final rules for emissions trading were adopted in January 1993. By 1994, a market had developed" (2). Denmark and the UK were the first states to start developing national emissions trading schemes for greenhouse gases. The EU, Canada, and other Western nations then began exploring Cap-and-Trade options.

Globally, the market for carbon emissions allowances is expected to surpass $100 billion later this year. From January to September of 2008 the market has grown roughly 36 percent. Analysts attribute this "robust growth largely to consistently high prices for carbon allowances and credits in European Union countries that are bound by the Kyoto Protocol cap on heat-trapping gases, which expires in 2012" (3). Currently, 37 industrialized nations as well as the European Union have signed on to the Kyoto Protocol, which intends to reduce greenhouse gas emissions "an average of five per cent against 1990 levels over the five-year period 2008-2012" (3). The Middle East has been a late entrant into the carbon emissions market, but interest within the region is growing. The UAE recently announced plans to spearhead a 7 billion dollar GHG emissions reduction program, as well as becoming a member of the Kyoto protocol in 2005 (3). These acts commit the region to a reduction of carbon emissions .

The United States did not choose to become a part of the Kyoto Protocol, but does currently administer several Cap and Trade programs. The Regional Greenhouse Gas Initiative (RGGI) seeks to limit emissions from power plants in the Northeastern United States, and the Clean Air Act provisions continue to be enforced. In Canada, British Columbia recently unveiled the Greenhouse Gas Reduction Act, which creates a Cap and Trade System for companies operating provincially (4).

Additionally, the premiers of Ontario and Quebec, Dalton McGuinty and Jean Charest, respectively, have publicly "announced their desire to form an interprovincial carbon trading system" (5).

Criticisms

Current criticisms of the Cap and Trade System include worries about proper regulation, of corruption, of the cost of implementation and maintenance of the system, and of concerns surrounding the failure to produce any tangible changes. Other GHG reduction methodologies share many of these criticisms. Because the majority of these programs are fairly new, it is difficult to say whether these critiques have merit. However, the implementation of the Clean Air Act's SO2 trading program was very successful, assuaging some of the worries about the efficacy of the program.

Concerns also exist about carbon credit schemes which have ambiguous environmental benefits. For example, eucalyptus plantations have been set up for the purpose of carbon credits but at the expense of native forests. In such a system, bartering for carbon credits has had unforeseen impacts on other environmental issues, such as deforestation or biodiversity loss.

Finally, a cap and trade system imposes a firm cap on emissions, which some businesses feel would put excessive pressure on them to change their business practices quickly. The result could be a significant negative impact on the economy, at least in the short-term, while industry adjusts to the new operating environment.

Benefits

Cap and Trade is sometimes preferred to other regulatory approaches to climate change as the "cap" ensures a firm limit to emissions. Intensity targets and carbon taxes offer no such guarantee. The "trade" also, in theory, ensures that GHG reductions are made where it is most economically efficient to do so. A carbon tax or intensity target gives no such option for flexibility.

3.3 Carbon Tax Defined

Simply speaking, a carbon tax, "is a tax on the carbon content of fuels, effectively a tax on the carbon dioxide emissions of burning fossil fuels." The carbon tax takes advantage of the fact that the carbon content from every form of fossil fuel…is known (1), and consequently a price can be placed on each form of fuel that is representative of the levels of emissions the fuel emits.

The basic principle of the carbon tax is straightforward, however opinions differ on what should be done with the tax revenue that is collected. Most proponents of the

carbon tax agree that the implementation of such a system should be revenue neutral, by returning the monies collected to the taxpayers. Some proponents, such as the Liberal Party of Canada in the last federal election, argue that all carbon tax revenue should be returned to tax payers in the form of income tax cuts. Others, such as the David Suzuki Foundation argue,

> "A portion of the carbon tax revenues [should] be allocated to sustain the substantial emission reduction measures that are needed to immediately begin addressing climate change (measures include a massive investment in renewable energy, energy efficiency and green infrastructure) versus adopting a strictly revenue neutral policy." (2)

In theory, the implementation of the carbon tax should cause people to use less fuel by driving less, using less electricity, and subscribing to more environmentally conscious behaviour. While the taxation of carbon will certainly affect individual consumer decisions in the short run, the major effects of the carbon tax will be felt in the long run, as consumers and corporations shape their decisions to reflect the additional cost of carbon use.

As with any flat rate tax system, taxes are applied universally, meaning that irrespective of income, individuals and corporations pay the same tax rate for carbon use. However, many proponents of the carbon tax system support protective measures for lower income individuals.

There are conflicting views on the equitability of the carbon tax. Because higher income families generally consume more energy through flying and driving more and owning larger homes, wealthier families will inevitably pay a larger percentage of the overall carbon tax revenues collected. However, if you were to evaluate the proportion of total income that is spent on a carbon tax, it is probable that poorer families would spend a greater proportion of their monthly income on the carbon tax than wealthier families.

To mitigate this concern, many proponents of the carbon tax support measures to shield lower income families from the costs of a carbon tax, such as targeted decreases in income tax rates. Targeting income tax cuts to low and middle-income earners offsets the upfront costs of the carbon tax. However, this can make the carbon tax arguably less attractive to high-income earners and businesses.

It is important to note much of the criticism from ordinary consumers is that businesses will merely pass on the additional costs of using carbon to consumers. Most, if not all, consumer goods will be affected in some way by the additional costs of using carbon whether through production, transportation, or operating costs.

There are also advantages to business with respect to the carbon tax. In the event that corporate tax rates are cut, businesses will have more money to invest as capital to produce and operate more efficiently, leading to lower operating costs.

As more and more businesses move to more sustainable operating procedures, businesses that opt not to invest in more efficient behaviour are increasingly at a disadvantage.

4.0 Case Studies

Each of the GHG regulation tools that have been discussed (GHG intensity reduction, cap and trade, and carbon tax) have been applied in various contexts and in some cases, combined in an effort to curb GHG emissions. The following sections will review cases of the application of each tool and discuss the strengths and weaknesses of each, particularly in light of the tool's possible application within the context of HRM.

4.1 GHG Intensity Reductions

4.1.1 Introduction

This section analyzes the possibility of a simple GHG intensity reduction system as the main tool by which to reduce Halifax's GHG emissions. As discussed earlier in the report, GHG intensity reduction is the reduction of GHG outflow per unit of product produced, or service rendered. Unfortunately, it is often highly reliant on expensive technology to help create this reduction. Furthermore, it has been shown to be highly ineffective in reducing the absolute volume of GHG emissions an economy. Due to these issues, GHG intensity reduction implementation has been relatively limited in relevant economies.

4.1.2 Comparison Method

Within the United States, where GHG Intensity Reductions was voluntarily implemented on a federal scale in 2007, individual states often chose a much more stringent method of reducing GHG. Within the Canadian context, GHG management occurs at the provincial level, rather than federal. Only the province of Alberta has adopted these regulations as a part of their GHG reduction plan. The similarities between Alberta, a prairie province and Nova Scotia, in particular Halifax, a port city, are limited. Despite these differences, with Alberta being the only place where GHG intensity reductions are the only form of greenhouse gas management, there is little choice other than to choose it as a comparison.

Within this report, a number of Albertan cities have been chosen as points of comparison. Despite attempts to find similarities between these cities and the HRM, no single city that was a close match to Halifax Thus, this report uses a multi-city approach. Obviously, this method can lend itself to gaps within the comparison. Any relevant differences that may appear between the chosen Albertan cities and Halifax will be identified to ease the difficulty of comparison.

Further confounding the comparison was finding cities that compared and had released their economic records for 2007-2008 (Alberta implemented their GHG intensity reduction plan in 2007). It was also beneficial to find cities that had released their GHG levels for those years as well. These indicators of economic and environmental progress further limited the search for comparable cities. For these reasons, two Albertan cities have been chosen as a comparison model for HRM: Calgary and Edmonton.

4.1.3 Edmonton

Edmonton is the capital and economic hub of Alberta similar to Halifax being the capital of Nova Scotia as well as the economic hub of Atlantic Canada. As can be seen in Figure 4.1, With the exception of Manufacturing and Trade, Edmonton has the same percentage of workers within each industry as Halifax.

Figure 4.1. Comparison of Industry Sectors of Edmonton and Halifax, as a percent of workers employed

	Edmonton	Halifax
Agriculture & other resource	3%	2%
Manufacturing and Construction	16%	11%
Wholesale and retail trade	17%	16%
Finance and real estate	5%	6%
Health Services & Education	18%	20%
Business Services	19%	20%
Other Services	22%	25%

(1)

Further reasons for comparison with Edmonton include that it is known both for its clean environmental reputation and renowned in the business world as strong economically. Even during the current economic downturn Edmonton is expected to survive relatively well.

4.1.4 Effect of GHG Intensity Reduction

Environmentally:

No statistics have been released concerning the businesses within Edmonton for years since the provincial mandatory reduction. However, we can gain a slight understanding of Edmonton's progress by comparing Edmonton's current goals and Alberta's. According to the City of Edmonton's environmental strategy webpage (2), they are attempting to reduce their GHG levels to 6 percent below 1990 levels by

2010. The goal that Alberta set for the province was 30% below 1990 levels by 2010 (3). With Edmonton being the economic stronghold within Alberta, it makes sense to assume that they would be attempting to reduce their GHG levels to a level similar to the Alberta standard. Due to the disparity between the goals it seems likely that Edmonton will fall short of the reductions mandated by Alberta's legislation.

Economically:

According to the Third Quarter Economy Review for Edmonton, economic growth in 2007 remained stable at 5.5%, the same as the year before, and an increase of 2% from two years prior. However, the economic downturn in the United States as well as a lack of residential area which restricts the number of available workers have caused a slump in the Edmonton economy. It is difficult to make any connection between the slumping economy and the environmental initiatives that have been legislated.

4.1.5 Calgary

Calgary was chosen as a comparison to Halifax for a number of reasons. Primarily, Calgary is the largest city in Alberta just as Halifax is the largest city within Atlantic Canada. Both economies are comprised of similar employment demographics, as seen in Figure 4.2.

Figure 4.2: Comparison of Calgary and Halifax Industry Sectors as a percentage of workers employed

	Calgary	Halifax
Agriculture & other resource	6%	2%
Manufacturing and Construction	16%	11%
Wholesale and retail trade	16%	16%
Finance and real estate	6.50%	6.4%
Health Services & Education	14%	20%
Business Services	25%	20%
Other Services	17%	25%

(1)

There are some distinct differences between the cities, namely the population size and density. Calgary is a city of over a million citizens, while Halifax only has a population of approximately 400,000, making Calgary about 2½ times the size of Halifax. Calgary is also much more densely populated than Halifax. These issues complicate the comparison. It is difficult to say whether an increased population

and density would make it more difficult to govern because of the increased number of businesses or whether the low density Halifax area would provide more challenges in enforcement and achieving effectiveness.

4.1.6 Effect of GHG Intensity Reduction

Environmentally:

As of this writing, the numbers concerning the GHG production of Calgary for the year 2008 are unavailable. However, it is possible to evaluate what has occurred in 2007, the first year in Alberta's GHG intensity reduction plan. According to a report released by the City of Calgary (2007), the City has reduced its absolute GHG by about 1/3, from 170Kt of CO_2 to only 125Kt (4). However, this report is misleading. At closer inspection the report examines not all the operations within Calgary, but only the municipally owned buildings, fleets and infrastructure. A report on the total amount of CO_2 or other greenhouse gases for the year 2007 or 2008 has not been published and thus it is difficult, short of surveying each individual business, to know if there has been any considerable reduction of greenhouse gases.

Economically:

As with Edmonton, similar problems exist in producing economic information about Calgary, due to the recent imposition of reducing GHG intensity. Only one yearly economic report has been released since then summing up the industries within the city. A further hindrance to the interpretation of data is that the latest numbers reported (5) come from the beginning of the current recession due to the sub-prime mortgage crisis in the United States. This important set of circumstances means that the growth this section attempts to analyze cannot be accurately compared. The economy towards the end of 2007 was already beginning to slow down due to high fuel costs. These factors are explicitly discussed within the Calgary Economic 3rd Quarter Report of 2007 (6).

Due to this economic slowdown caused by the sub-prime crisis and spiking energy costs, it is difficult to understand how the GHG intensity reduction truly affected Calgary. These circumstances create an ambiguity about the cause of GHG reductions. Were the reductions created by the regulations, or were they a repercussion of the economic slowdown? This remains to be seen, and further economic and environmental reports will need to be examined in the future to determine the effectiveness of this strategy in Alberta.

4.1.7 Conclusion

This report examined the effects of a GHG intensity reduction strategy on both the environment and the economy. Unfortunately, due to the limited number of regions that have utilized this method, the short time-span in which these initiatives have

been in place, and the recession which has negatively impacted most economies worldwide, it is difficult to estimate the success of the intensity reduction plan. However, by examining the goals set by the province and the goals set with at least one of the cities and seeing a vast difference, it may be safe to assume that the predictions of the Alberta government have not occurred. This discrepancy can possibly be attributed to a lack of effectiveness in regards to lowering greenhouse gases. It can be assumed that with a slowed economy production would fall, and thus absolute greenhouse gas levels should fall as well, yet despite the strong economic downturn the goals have yet to be met.

A number of factors are necessary to be able to give an accurate analysis of the effectiveness of greenhouse intensity reductions. First and foremost, the economy would need to be functioning at a normal level. It would not make much sense to take measurements of absolute greenhouse gases in a hindered economy. Second, more long term data needs to be examined. There would need to be several economic reports showing an increase (or at least no decrease) in economic functioning at a normal level to be able to assume these initiatives did not hinder a city's economics. Finally, and possibly most importantly, there needs to be accurate measurements of greenhouse gases produced and these need to be reported. Despite the difficultly in producing this information, without base records for each company there can be no indication of progression or regression.

4.2 Cap-and-Trade

4.2.1 Regional GHG Cap-and-Trade System & Applicability to HRM

Halifax is committed to finding green solutions to its environmental problems, to reducing emissions, and to work towards combating global warming. Currently, it has demonstrated its commitment to these goals through the use of environmentally friendly initiatives such as the use of tidal, hydro, and wind power. However, much of Nova Scotia's energy infrastructure is still reliant on fossil fuels. 53% of the power plants of the province continue to burn coal, another 29% using either natural gas or oil, for a total of 82% of Nova Scotia's energy needs. Due to this dependence on fossil fuels, Nova Scotia could take additional steps to further reduce greenhouse gas emissions throughout the province. One such step would be through the implementation of a cap and trade system of emissions control.

4.2.2 The Regional GHG Initiative (RGGI)

RGGI is a cap-and-trade system housed in the Northeastern United States which focuses exclusively on power plants and their carbon emissions. The ultimate goal of this program is to reduce the current 188 million tons of carbon emissions to 169 million tons after 10 years. Ten states have pledged their commitment to this 10% reduction: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire,

New Jersey, New York, Rhode Island, and Vermont. As is consistent with cap-and-trade plans, the participants:

> "Will be able to use a CO_2 allowance issued by any of the ten participating states to demonstrate compliance with an individual state program. In this manner, the ten individual state programs, in aggregate, will function as a single regional compliance market for CO_2 emissions." (1)

This program is still in its infant stages. The first auction for emissions vouchers was held on September 25th, providing the industry with some 12.565 million units. A second auction was held shortly thereafter, providing the industry with the opportunity to attain at least 30 million more vouchers, with the third auction to be held in the spring. These offerings provided the opportunity for companies to begin planning their strategies in order to comply with the regulations surrounding carbon emissions (2).

The funds raised by these offerings are put toward five distinct areas of emissions planning, each with direct and measurable benefits for the environment. These include:

1. The promotion of energy efficiency measures,
2. Direct mitigation of electricity ratepayer effects attributable to the implementation of RGGI,
3. Promotion of renewable or noncarbon-emitting energy technologies,
4. Stimulation or reward of investment in the development of innovative carbon emissions abatement technologies with significant carbon reduction potential or
5. A state's administration of RGGI. (3)

4.2.3 The Impact of Cap-and-Trade

The stated goal of the cap and trade system is to enable the reduction of carbon emissions while at the same time allowing the participants to retain their individual autonomy. Companies are free to buy, trade, or sell emissions vouchers to each other, thus allowing each firm to develop an individual strategy for lowering its emissions and complying with the emissions regulations. However, there will be a financial impact for the owners of these companies for complying with the RGGI regulations. This impact can be mitigated through dispensing the vouchers through means other than auction. Alternatives include 'grandfathering' emissions vouchers to companies who have historically operated in the region, or allocating vouchers in proportion to the energy the power companies produce (4). Use of these alternatives, however, would prevent the intake of funds necessary to maintain the cap and trade system, and to create and upkeep other environmentally friendly projects.

The short-term impact of RGGI is widely projected to be negligible on the earnings of the power companies, and as a result, the costs will not be immediately passed on

to the consumer. To accomplish this goal, the regulating states have issued an abundance of emissions vouchers. JPMorgan predicts that as a result, vouchers will have "little scarcity value" and "therefore expect prices not to be far above the floor price established by the auction." As a result, "the initial impact on the retail cost of electric power in the RGGI region would then be slight, in line with the pledges of various state officials that greenhouse-gas regulation could be undertaken without hurting power consumers." The space between the implementation of the program and the first reductions in emissions not only protects the consumer, but it also grants the energy firms the time to adapt and implement new policies (5).

The required emission reductions follow the trajectory shown in Figure 4.3.

Figure 4.3: RGGI Emissions Trajectory for Fossil-Fuel Power Plants

Year	Maximum CO_2 Emissions by Generators in Region (short tons)	Change from Base Year
2009	188,076,976	0%
2010	188,076,976	0%
2011	188,076,976	0%
2012	188,076,976	0%
2013	188,076,976	0%
2014	188,076,976	0%
2015	183,375,052	-2.5%
2016	178,673,127	-5.0%
2017	173,971,203	-7.5%
2018	169,269,278	-10.0%

(6)

4.2.4 Can Halifax Benefit from a Cap-and-Trade System?

These large scale cap and trade systems of carbon emissions are relatively new, and thorough evaluation of their results is not yet possible. The first emissions reduction for RGGI will not take place for another 6 years. Similarly, another cap and trade system, the European Union Emissions Trading System (EU ETS), has only been operational since 2005. It is important to note that RGGI functions as an interstate entity, while the EU ETS functions internationally. The complex and expansive nature of organizing, maintaining and administrating a cap and trade system may prohibit smaller regions from participating. While some of these costs are allayed by the auctioning of emissions vouchers, the auction is only one of several methods of dispensing allowances, and not necessarily ideal for all cap and trade systems. Additionally, much of the jurisdiction within RGGI rests at the state level. For example, the number of vouchers to be issued for RGGI is decided on a state by state basis, not city by city. While implementing a cap and trade system on a municipal level may be possible, lacking the scope of these larger interstate and international programs may confound a similar system in Halifax. Should Nova Scotia wish to become part of a larger network of provinces or states, however, a cap and trade system would be a plausible method of emissions control.

4.3 Carbon Tax

As global warming has gained increasing momentum, experts have debated the most effective and appropriate means to address the growing crisis. Carbon pricing has been widely accepted as an attractive tool to combat the looming disaster. In its most basic form, carbon pricing is meant to modify certain consumer behaviours by making traditional actions more costly and less attractive.

The carbon tax, first contemplated in the Netherlands in the early 1990s, exists today in a number of structural capacities. While the detailed implementation of a carbon tax differs, simply put, the carbon tax places a tax on the consumption of carbon. Over the past decade and a half, several countries, particularly Scandinavian countries, have implemented a carbon tax in varying forms in an effort to combat the negative effects of global warming.

4.3.1 The Prominent Plans

Finland

Finland was the first country to implement a nation-wide carbon tax almost two decades ago (7). Originally developed to tax carbon use only, it was eventually extended to include taxation on carbon use through electricity. The design of the Finnish system incorporates all users of carbon emitting energy, and taxes each entity equally at $89.39/tonne of carbon (7).

Sweden

Sweden introduced a nation-wide carbon tax shortly after Finland in the early 1990s. However, the design of the Swedish system differs considerably from the system that was implemented in Finland. Many of the differences can be attributed to Sweden's desire to cater to industry and business. Currently set at $150/tonne (7) of carbon, in an effort to support industry Sweden made specific exceptions for industry by taxing it at 50% of the total rate (7).

While the front-end of Sweden's carbon tax system focuses on penalizing unsustainable behaviour, it also acts progressively to reward industrial advancement. Consequently, all energy stemming from renewable sources such as ethanol is tax-exempt (7), leading to enormous growth in the renewable energy sector.

The strength of Sweden's plan stems not only from the foundation and flexibility, but equally as importantly from its perpetual growth and modification. In 2007, Sweden announced that it would be increasing carbon tax rates (7), unpopular no doubt with the electorate, but propelling the environmental movement forward. However, Sweden did not follow Finland's example and does not extend their taxation policy to electricity use.

Municipal Implementation: Boulder, Colorado

The sheer magnitude of implementing a carbon tax means that they are rarely implemented at a municipal level. Moreover, because of the relative ease with which businesses and people can move, implementing a carbon tax municipally is not without considerable risk.

That said, Boulder, Colorado became the first municipality in the world to implement a form of carbon tax in 2006 (1). With a population about a third the size of Halifax, Boulder has a considerably young population with almost 50% of residents between the ages of 21 and 44 (1). Some may argue that the younger demographic is more inclined to not only support, but encourage forms of carbon pricing. Raised with an environmental awareness, many young people are not only cognizant of the global environmental challenges, but actively pursue measures that combat the growing crisis.

In contrast to Sweden, Boulder instituted a carbon tax solely on electricity at a rate of $7/tonne of carbon (1), costing the average household about $1.33 (1) per month, an arguably negligible amount for most.

Canada

In Canada, progress has been considerably slower than its Scandinavian counterparts. Recently the British Columbia and Quebec governments each introduced separate provincial policies aimed at taxing carbon content. In Quebec, the plan was implemented in 2007 and was designed to tax the carbon content in hydrocarbons such as petroleum, coal, and natural gas (7). However, the effectiveness of this plan with respect to reductions in carbon emissions is questionable at best, due to Quebec's reliance on hydro for power output which minimizes the use of carbon for provincial electricity.

The British Columbia government has struggled with their policy since its implementation last winter. A revenue neutral carbon tax was introduced in the province in February 2008 (2), and has remained unpopular with the electorate since its introduction. The revenue neutral carbon tax plan is considerably more advanced than many of the plans described above in that it not only collects tax on carbon output, but it also redistributes the income generated from its collection to taxpayers.

Of course, as evidenced by the federal election last fall, there is some question as to whether a carbon tax is ever truly revenue neutral. Many environmentalists, including David Suzuki, suggest that portions of carbon tax revenues be retained for investment in green infrastructure, pulling into question the neutrality of the

system. Indeed, Mr. Dion had a difficult time defending his argument that every dollar collected would be returned to the taxpayers' pockets.

However, nationally Canada has made little progress. Last fall, carbon taxes received a tremendous level of national attention when the Leader of the Liberal Party, Stephane Dion, introduced a carbon tax policy (3) as the nucleus of the Liberal Party platform. The policy proposed taxing all carbon emitting fuels in a revenue neutral manner, leading low and middle income families with tax cuts and upper class families with minimal compensation for the additional monies spent. The policy, married with an unpopular leader, led to the eventual defeat for the Liberal Party (9). The Party's new leader, Michael Ignatieff has all but abandoned the policy.

4.3.2 Carbon Tax and Halifax

Due to the magnitude and scope of carbon taxes, they are rarely, with the exception of Boulder, Colorado, implemented municipally. While provinces such as Quebec and British Columbia have implemented carbon taxes provincially, there are considerably more examples of nationally implemented carbon taxes. As such, the following discussion will evaluate the different hybrid systems introduced in the preceding section within the context of Halifax, Nova Scotia.

Electricity

A carbon tax system, similar to that implemented in Boulder, Colorado that taxes only carbon content involved in the production and use of electricity would be a difficult and unpopular approach in Nova Scotia.

Approximately 53% of power generation in Nova Scotia continues to be coal generated (10), and while efforts have been made to lessen the dependence on coal, the government has been slow to act on these initiatives due to the political ramifications of closing coalmines, which provide employment and create revenues for Nova Scotia. While transitioning to natural gas or even oil would be a more favourable design, both energy sources still create emissions. The success of electricity carbon taxes is most highly observed in provinces such as Quebec that turn to hydro and other alternative energy sources for electricity, almost mitigating the relevance of a carbon tax.

Interestingly, electricity was the largest source of GHG emissions in Boulder, Colorado (1), and the implementation of the tax was anticipated to cost the average householder only $1.33 per month (1). However, Boulder has also made a series of other ambitious goals with respect to the environment, including meeting its own Kyoto target of reducing emissions to 1990 levels by 2012. This optimistic planning, of course, not only takes financial investment and governmental commitment, but also a significant demonstration of support from the electorate.

Carbon Content Exclusive of Electricity

This approach, similar to that of Mr. Dion in the last federal election, would see a flat rate tax applied to any carbon emitting activity or substance. Much of the criticism of this tax was that its costs could be easily applied to consumers and avoided by businesses. Halifax's economic dependence on shipping and transportation makes this approach even less appealing as the taxation on fuel alone would severely damage this sector.

Moreover, Nova Scotia's population is almost evenly divided between urban and rural living. This is in sharp contrast to Canadian numbers with almost 80% of the population living in urban areas (8). Of course, while the Chamber focuses predominantly on businesses within Halifax Regional Municipality, many people who work within city limits commute from more rural communities.

Lastly, the fisheries continue to play an integral role in the Nova Scotia economy. While the resulting increase in shipping and transportation costs would inevitably affect fishers, their daily operations would also be considerably affected due to potentially debilitating fuel costs. Similar to the experiences of manufacturing towns in southern Ontario, the effects of struggling sectors are felt throughout the economy in the form of diminishing spending and participation in the economy. Halifax's considerable dependence on small businesses make it more sensitive to economic fluctuations as small businesses are more susceptible to changes in consumer preferences.

Hybrid System

A hybrid system, consisting of a carbon tax on both electricity and broad carbon content would have considerable ramifications for Nova Scotians. Of course, this concern alone is not a reason to object to the approach in principle. The argument of countries that have implemented carbon pricing systems, is that the long-run benefits far outweigh the initial costs and adjustments with respect to carbon taxes.

A hybrid system would carry the advantages and disadvantages of each system evenly. There are matters of concern with respect to the effect a carbon tax would have on Halifax businesses, and more broadly on the Halifax economy. However, as time progresses, it can be suggested that in order to expand and compete on the world stage, Halifax may have to seriously commit and invest in greener infrastructure and more environmental business practices.

The pathway to environmental sustainability is by no means cheap or easy, and the initial stages would no doubt create enormous challenges. However, Halifax is also in the middle of an expansion phase, and it is becoming increasingly evident that companies seeking to expand to other cities have begun and will continue to

evaluate individual cities' capacity for sustainability, attractiveness for potential employees, and investment in cutting edge infrastructure and innovation.

4.4 Multiple Tools

Regulators may choose to implement GHG regulation singly, or by using a combination of tools, leading to both positive and negative policy interactions. Alternately, GHG regulation at different government levels (federal, provincial, municipal) may lead to more than one tool applying to a particular business via overlapping schemes. The various instruments may interact directly (several instruments applying to one stakeholder), indirectly (an instrument having an indirect effect on a stakeholder who is directly regulated through another mechanism), or through trading (where permits or emission targets are transferred among systems by stakeholders) (1). Interactions may increase the effectiveness of the various policies in terms of efficiency and the achievement of environmental goals, but it is at least as likely that they may hamper efficiency and undermine environmental progress. Sorrell (2) described these interactions and their impacts in four categories: double regulation, double counting, equivalence of effort, and linking and fungibility.

Stakeholders may complain of double regulation when they perceive that they are "paying twice" for their carbon emissions through direct regulation under two or more systems. Such regulation however may be justified if it addresses more than one market failure, such as carbon externalities and asymmetric information.

Double counting may occur when a single unit of carbon emissions or reductions is counted under two separate systems. The result may be either double coverage- where a single unit of emissions results in the surrender of two permit units, or double crediting, where a single unit of reduction results in two credits. Usually these two cases will cancel one another out. However, where double crediting occurs without the compensating effect of double counting, the environmental goals of the policy instrument will be undermined.

Equivalence of effort becomes an issue where different industries or emission sources are regulated by different mechanisms. Conflict can arise as to the relative cost of emissions abatement under the different mechanisms, and the damage to competitive fairness if inequalities exist. Furthermore, emissions may be "displaced" to the least cost mechanism, thus undermining the environmental goals of the instruments.

Finally, interactions may occur as permits or credits are traded among the various systems in play. Linking emissions control regimes is recommended as a way to increase coverage of emitters and find the most efficient opportunities for emission reduction. However, linking may also result in a "lowest common denominator" approach to regulation, where the least strict regime undermines the goals of the other policy tools by flooding the collective market with emission permits.

Sorrell and Sijm (1) identified each of these interactions as potential risks for the implementation of the European Union Emissions Trading Scheme, given the numerous existing regulations in the UK with which this new policy instrument could interact. These existing policy tools included: a carbon tax (Climate Change Levy), national carbon emission and credit schemes (UK ETS), industrial pollution control mechanisms (IPPC directive), and energy efficiency and renewable energy programs (Energy Efficiency Commitment and Renewables Obligation).

Sorrell and Sijm (1) agreed with other papers on the subject (3, 4, 5, 6, 7), that multiple policy instruments can co-exist provided they target different market failures or different target groups (or both). Indeed, a variety of policy instrument may be required for just this reason, to ensure complete coverage of sources and meaningful reductions to emissions.

From the perspective of Nova Scotian business owners, it is important that in the case of a combination of carbon control instruments, that the burden is equal across industries and business to ensure a fair playing field for competition. Trading among tools can ensure that emission reductions are made at least cost, and clear targets both at the business and regional level will ensure real environmental improvements are achieved.

Conclusion

This report defined and analyzed three distinct GHG emission reduction strategies: Intensity Reduction, Cap and Trade, and Carbon Taxation. Intensity Reduction seeks to reduce GHG emissions per unit production or a reduction of GHG as compared to GDP; Cap and Trade seeks to reduce emissions through the issuance of vouchers to be traded or sold between businesses; and Carbon Taxation seeks to increase the cost of greenhouse gas producing goods or services through government tax thereby discouraging their use.

Ultimately, each strategy presents obstacles to implementation. Intensity Reduction may fail to reduce the absolute GHG emissions in a region. Cap and Trade may be effective at reducing the emissions, but the administration of such a scheme may be cost-prohibitive and complicated. Carbon Taxation could lead to costs being directly passed on to consumers, increasing both the cost of living as well as damaging local business.

Despite its challenges, GHG regulation has been implemented all over the world, and is increasingly being enacted in North American jurisdictions (including California, British Columbia and Alberta). The current economic crisis may have shifted the focus away from environmental issues, however the new global economy is likely to retain a focus on more sustainable development including lower GHG emissions.

Regions that anticipate this business environment and move early to adapt are likely to be at an advantage.

Halifax businesses find themselves in a unique position with regards to the possible regulation of GHG emissions. A large portion of the Halifax economy is founded on the import/export industry and tourism, both of which are closely associated with fuel consumption and GHG emissions. The Halifax electricity market is also fuelled mainly by coal, which is associated with high GHG emissions. As such, Halifax and its businesses find themselves uniquely vulnerable in many respects to the possible regulation of GHGs. GHG emissions are projected to increase through 2015 and then to decline due to conversion of oil and coal fuelled facilities to natural gas. Even with conversion to natural gas, Nova Scotia's (and Canada's) per capita emissions are among the highest in the world and about twice the West European average. (1)

The requirements to reduce GHGs will eventually be enforced in Halifax at either the federal, provincial or municipal level. HRM council has already committed to reducing GHG emissions 20% below 1997 levels by 2012 as part of the Partners in Climate Protection program. The Environmental Goals and Sustainable Prosperity Act requires that Nova Scotia reduce its GHG emissions to a point at least 10% below 1990 levels by 2020. As regulation will continue to increase, it is advisable to begin investing now in the infrastructure that will be required to meet these and more stringent future targets. Changes in infrastructure and/or adapting processes to abide by regulations can be costly and requires a considerable time commitment. However slowly phasing these changes in prior to deadlines and costly penalties is advantageous for business.

In conclusion each of the GHG reduction methodologies would be difficult to implement, perhaps particularly in Halifax given the economy's dependence on fossil fuels. However, GHG regulation seems inevitable, and in this case anticipating regulation could provide a competitive advantage to the Halifax region. The reduction of GHG emissions will differentiate the HRM from other comparable cities and attract employees and businesses looking for more sustainable living and working environments. Investments in "green" energy and infrastructure, public education programs regarding energy efficiency, and diversification of industries in the HRM are all steps that will help address possible future GHG regulation.

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