UNIVERSITY OF CAPE TOWN

'A Critical Comparative Analysis of Seven Existing Carbon Tax Systems with a view to deriving a Related Best Practice within a South African Context.'

SUBMITTED TO THE UNIVERSITY OF CAPE TOWN
in partial fulfilment of the requirements for the degree MCom (Taxation)
Faculty of Commerce
UNIVERSITY OF CAPE TOWN

Ross Robertson (RBRROS006)

7/31/2010

Supervisor: Jennifer Roeleveld, Department of Accounting, University of Cape Town

DECLARATION

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Chapter 1: The Purpose and Value of the Research

Introduction

In an ever changing global environment it becomes a challenge of vital importance to maintain equilibrium between the various forces at play within this setting. As first announced by Sir Isaac Newton in his published work *Philosophiæ Naturalis Principia Mathematica* on July 5, 1687, "for every action there is an equal but opposite reaction" (Wikipedia, 2009). This derivation of Newton's Third Law of Motion succinctly and accurately encapsulates the situation we find ourselves in today. Industry in nearly every single form consumes fossil fuels and hence omits some form of greenhouse gas (GHG) into the atmosphere. Considering the growth in industry, the relative increase in the population and consumption of natural resources, there is little wonder as to why the threat of climate change caused by global warming is a topic of burning importance.

Fossil fuels are defined as fuels formed by natural resources such as the anaerobic decomposition of buried dead organisms (Wikipedia, 2009). The age of the organisms and their resulting fossil fuels is typically millions of years, and sometimes even exceeds 650 million years. These fuels contain a high percentage of carbon and hydrocarbons. Anaerobic decomposition in turn is defined as a series of processes in which microorganisms break down biodegradable material in the absence of oxygen. Examples of such fossil fuels are coal, natural gas and petroleum (Wikipedia, 2009).

For centuries fossil fuels have been consumed without consideration being given to their potentially harmful effects on the atmosphere and the environment. Industries, driven by the need to satisfy consumer demand and the call for increased profits, have continually used up non-renewable natural resources so as to achieve these goals. A by-product of this process has been the significant rise in the emissions of GHGs into the atmosphere. The bare essence of the problem faced by every single person is that the process of climate change is being sped up to the extent that extreme natural phenomenon, such as tsunamis, hurricanes and droughts, are becoming a more regular occurrence. The cause of this rapid change is the amplification of the greenhouse effect caused by the omission of greenhouses into the atmosphere (Ministry of Finance British Columbia, 2008).

There is little doubt, and indeed objective evidence, to show that the climate is changing, that it is being caused by human activities, and its effects will worsen if no action is taken. Indeed, there is almost unanimous agreement by all of the world's top scientific experts in

the subject area for these conclusions, drawn from the most recent report (Forth Assessment Report: Climate Change 2007) by the Intergovernmental Panel on Climate Change (IPCC). As an illustration of the changes being experienced by our planet, the IPCC concluded that 11 of the last 12 years (1995–2006) ranked among the warmest since 1850. It has also concluded that atmospheric carbon dioxide equivalent (CO_2-equivalent) concentrations increased from a relatively stable 280 parts per million (ppm) to 380 ppm over the past 150 years, and that current concentrations are the highest on record for 650,000 years according to analysis of ice cores. Evidence of rising sea temperatures has been recorded along with the resulting melting impact on the ice caps. This cycle of the ocean temperatures rising and the ice caps melting will, over time, cause the level of the ocean to increase with catastrophic implications for island and other low lying countries (Ministry of Finance British Columbia, 2008).

These increases are mainly attributable to the release of increased amounts of carbon dioxide, methane, and nitrous oxide into the atmosphere caused directly by fossil fuel combustion and land use changes. These gases act to trap more solar heat within the earth's atmosphere than was the case in pre-industrial times, much like a greenhouse, hence the term "greenhouse gases." (Intergovernmental Panel on Climate Change, 2007)

The Intergovernmental Panel on Climate Change

The IPCC was established by the World Meteorological Organization (WMO) and United Nations Environment Programme (UNEP) in 1988 with a mandate to evaluate climate change science, impacts and options for adaptation and mitigation. The IPCC has coordinated four major assessments of climate change, published in 1990, 1995, 2001 and 2007 that have provided objective and factual evidence as to the ever increasing effects of, amongst other things, carbon emissions on climate change.

To illustrate the extent of such publications, the drafting and review process for the most recent assessment involved 450 lead authors working with 800 contributors and 2,500 expert reviewers from 130 countries. Hundreds of scientists all over the world contribute to the work of the IPCC as authors, contributors and reviewers (Ministry of Finance British Columbia, 2008). Thus the content of the reports so published are not to be taken lightly and contain arguably the most accurate assessment of the climate changes affecting our environment today.

However damning the evidence may be, there remain sceptics in the world today who believe that the effects of global warming are exaggerated and unsubstantiated. However, regardless of such views, there is one fact that no one can deny: changes in climate affect everything from food production, the abundance of water resources, the frequency of catastrophic weather events, forest health, and recreational activities; in other words, almost every aspect of our daily lives. For example, in North America, the IPCC concludes that there will be:

- lower snowpacks in the western mountainous areas, with more winter flooding and competition for already scarce water resources
- challenges for crops that are already susceptible to warm weather events or depend on highly-utilized water resources; and
- more extreme heat waves, causing increased health problems in cities.

On a world-wide basis, the IPCC also concludes that there are increased risks of:

- extinction for approximately 20 to 30 per cent of plant and animal species; and
- decreases in global food production if local average annual warming exceeds the 1 to 3 degrees Celsius range.

(Forth Assessment Report: Climate Change 2007)

Global average temperature increases greater than 2 degrees Celsius (relative to preindustrial temperatures) are generally viewed by scientists as leading to impacts in many regions that may be beyond society's capacity to adapt (IPCC Working Group 2, 2007). The 2007 IPCC report concludes that based on the current understanding of the sensitivity of the global climate system to greenhouse gas emissions, avoiding a global increase greater than 2.0-2.4 degrees Celsius above pre-industrial levels requires that emissions by 2050 be reduced by between 50 and 85 per cent relative to 2000 levels. This implies stabilization of atmospheric concentrations of greenhouse gases at 445-490 ppm CO_2-equivalent. (Intergovernmental Panel on Climate Change, 2007)

However, it is not only scientists and governments that are concerned about the inevitably harmful effects that global warming is having. A recent report by Lloyd's of London, the world's leading insurer, states that "The frequency and magnitude of catastrophes –

especially weather related catastrophes – has increased significantly in recent years. Climate change is expected to exacerbate this further, and by 2050 mega-catastrophes like Hurricane Katrina, which used to occur every 100 years, are predicted to happen every 25 years. Businesses need to prepare for the prospect of growing natural hazard risks now" (Lloyd's 360 Risk Project). This statement further emphasises the inclusive effect that global warming is having both on the environment and consequently on industry, and will have on almost every aspect of our daily lives, unless mitigating steps are taken to reverse the process.

Solutions to the proven threat of climate change have attracted a vast amount of attention as evidenced by the convention on Climate Change hosted by the United Nations in Copenhagen very recently. But this was only the most recent in a series of conventions, treaties and other forms of agreements entered into in an attempt to stop the climate change effect from spiralling out of control. However, in the wake of such conferences a harsh question remains, how many of the proposed action plans are just those: plans? A plan is no more than a formalized thought until it is implemented and the effects thereof are tangibly observable to the general populace. Most importantly though is the factor of time. The planet cannot afford a drawn out and lengthy debate on the merits of the threats posed by global warming and then only contemplate possible resolutions to the threats so agreed to. Action needs to be taken immediately, and the action plans designed and implemented need to be effective without delay.

Two of these tangible solutions that have been proposed are those of setting carbon emission caps and subsequently granting credits so as to facilitate a trading of these credits, namely the 'cap and trade' approach, and the other is that of legislating and implementing a carbon tax. Variations of both of these systems have been implemented by individual countries the world over with varying levels of success However, as one looks to the future; there is no consensus on a global solution to what is very much a global problem.

The Context:

In the vast majority it is the first world countries that are responsible for the world's total GHG emissions. Owning to their developed industries and quickly expanding economies, resources, including fossil fuels, are consumed at an alarming rate causing a relatively higher level of greenhouse gas emissions than poorer, third world countries. As such, it

follows that one may justifiably look to them to lead the way in implementing mitigation strategies that will pave the way for others to follow in the global quest for a reduction in carbon emissions.

South Africa may be viewed as an exception to the general view that African countries do not necessarily have to implement measures to mitigate carbon emissions owing to their relatively low contribution to global greenhouse gas emissions of approximately 4%. South Africa however contributes 65% of this amount and approximately 1.5% of the world's total carbon dioxide emissions[1]. (Devarajan, Go, Robinson, & Thierfelder, 2009)

CO_2 emissions are caused predominantly by energy use and the CO_2 coefficient or intensity of each energy input into such process, in other words the carbon content of the fossil fuel utilised in the production of such energy. Because of our heavy energy usage and reliance on coal, South Africa's energy-related CO_2 emissions are relatively high among developing countries, estimated to be 443.6 million metric tons in 2006 by the Energy Information Administration (EIA), ranking it 11th globally, placing it among developing countries behind China (6018) and India (1293), South Korea (515) and Iran (477), but just ahead of Mexico (436) and Brazil (377). Within Sub-Saharan Africa, Nigeria (101) is a distant second to South Africa. In terms of per capita intensity; South Africa is comparable to United Kingdom and France, nations that are classified as being first world, developed nations (Devarajan, Go, Robinson, & Thierfelder, 2009)

The question must therefore be asked, what is South Africa doing to reduce its carbon emissions?

Currently in South Africa, there is a partial carbon tax on electricity generated from coal which is levied at two cents per kWh. In addition the governing authorities have imposed fuel levies and a new vehicle tax which is aimed at mitigating carbon emissions (The South African Revenue Service, 2010).

These environmental statutes and regulations require the private sector to eliminate inefficiencies in the use of energy, water and raw materials. Incentives for energy-efficient

[1] World Development Indicators (WDI), 2008. The primary sources of information are the International Energy Agency (IEA)'s annual publications, *Energy Statistics and Balances of Non-OECD Countries* on energy use*;* and the U.S. Department of Energy's Carbon Dioxide Information Analysis Center (CDIAC) on CO2 emissions. (IEA)'s annual publications, *Energy Statistics and Balances of Non-OECD Countries* on energy use*;* and the U.S. Department of Energy's Carbon Dioxide Information Analysis Center (CDIAC) on CO_2 emissions

investments have been explored and proposed in order to encourage the private sector to promote ‘greener technology. No pure carbon tax has as yet been implemented in South Africa

The extent of the above mentioned taxes and levies currently enacted in South Africa will be explored in Chapter 6.

Interestingly though, it was recently concluded by Devarajan, S *et al* in their paper “*Tax Policy to Reduce Carbon Emissions in South Africa*,” that the best possible way to mitigate carbon emissions effectively, or at the very least, that the most desirable method to achieve this from a welfare point of view would be via a “pure” carbon tax as opposed to various proxy taxes such as those on energy or energy-intensive sectors like transport and basic metals. They found that by holding the level of carbon reduction constant, and comparing the two types of taxes mentioned the pure carbon tax resulted in better welfare results. As a consequence, it was proposed that if a carbon tax were feasible, it will have the least marginal cost of abatement by a substantial amount when compared to alternative tax instruments. Interestingly, they also suggest that if a carbon tax were not feasible, a sales tax on energy inputs is the next best option (Devarajan, Go, Robinson, & Thierfelder, 2009).

Very importantly for the current research, the authors in the above mentioned paper concluded that labour market distortions such as labour market segmentation or unemployment will likely dominate the welfare and equity implications of a carbon tax for South Africa. This being the case, if South Africa were able to remove some of the distortions in the labour market, the cost of carbon taxation would be negligible. In short, the discussion of carbon taxation in South Africa can focus on considerations other than the economic welfare costs, which are considered, in light of the above mentioned research, to be quite low. This conclusion is supportive of the direction of the current research, which will only consider issues relating to the actual characteristics of the carbon tax system.

The Methodology:

The structure of the current research paper will be as follows:

Firstly, the two proposed solutions to the problem of carbon emissions, being the implementation of a cap and trade system or the introduction of carbon tax legislation, are

explored and critically analysed so as to provide the motivation behind holding one alternative as superior or preferable to the other. This critical comparison is followed by a theoretical discussion on how the chosen solution should be designed and implemented on a purely theoretical level, so as to achieve the objectives of reducing carbon emissions while not imposing an additional financial burden on individuals and resulting in inequitable socio-economic consequences.

A review of selected carbon tax systems either implemented or proposed around the world follows so as to provide a basis of comparison between such systems. The countries to be reviewed are

- Australia
- New Zealand
- Finland
- Sweden
- British Columbia
- Ireland
- France

This sample of countries was selected so as to obtain a complete spread across the types of carbon tax systems in existence (i.e. enacted, proposed or rejected). In addition, the sample contains the oldest two systems known, being Finland and Sweden, as well as two of the youngest regimes being those of British Columbia and Ireland respectively. The proposed system pertaining to Australia was selected because of the commonalities between that country and South Africa, which, it was envisaged, may cast some light into the provisions of carbon tax legislation needed to ensure a best practice in a country possessing such characteristics. New Zealand was reviewed owing to the thoroughness of the proposal and the guidance that might be derived there from, as well as certain of the interesting motivations provided for in proposing certain elements of the tax. Finally, it was considered to be of interest to explore the rationale behind the French system of carbon tax that was proposed and rejected on the grounds of being unconstitutional. It is envisaged that each of these countries have lessons and ideas to share when it comes to formulating a best practice around a carbon tax to be proposed for South Africa.

When the respective country reviewed had a system of carbon tax that was implemented and hence legislated, the associated budgetary reports introducing the tax were scrutinized along with any Annexes and subsequent amendments to the tax originally announced and implemented.

As noted, certain of the systems were either abandoned or rejected while still in proposal form. Such systems were analysed by reviewing working papers of individuals or project teams tasked with the objective of exploring a carbon tax for that respective country. Certain academic papers were reviewed as a part of this process in an attempt to fully understand the background behind the proposals as they stood in theoretical form.

All of the information relating to the countries reviewed represent factual statements derived from the sources mentioned above and contain no opinion of the author. Owing to the review nature of the systems, the respective budget or governmental document from which the information was derived will be cited in the introduction to that particular review and only if alternate sources were explored will they be noted, in all other cases the full extent of the information presented comes from the primary source noted.

This narrative review will be supported by a critical comparative analysis targeting certain key variables within each respective system that will corroborate and elaborate on the narrative review performed in the previous chapter. This comparative analysis will be presented in tabular format so as to facilitate a succinct review of the respective variables of the systems reviewed. The variables to be analysed per country are:

- Date of Enactment
- Initial Rate at time of Enactment
- Amendments to the tax
- The Tax Base
- Exemptions from the Tax (incl Rebates and Refunds)
- The Collector/Administrator of the Tax
- The Revenue Neutrality of the Tax
- Consequences of the Tax

The findings as derived from the analysis performed, coupled with the theoretical framework outlined as defining an ideal carbon tax and the current status of South African legislation aimed at reducing carbon emissions will be used to propose a best practice for South Africa in terms of designing and implementing a system of carbon tax. This proposal will attempt to take into account the uniqueness of the South African environment, availability of natural resources, climate and other factors that may play a role in differentiating South Africa from other countries that have in place, or proposed, carbon tax systems.

The Ultimate Direction:

It is hoped that the current study will provide guidance on how to approach the carbon emission problem in South Africa based on the approaches adopted in other countries around the world. Ultimately, it is essential that South Africa take some form of action to curb GHG emissions in order to mitigate the harmful effects of climate change and in doing so should attempt to avoid the failings of other countries who have gone before.

A discussion paper, to be released by the South African Government, exploring the feasibility of the implementation of a carbon tax in South Africa is tabled for release in June 2010. If this paper is made public at the stipulated time, it will be interesting and useful to compare the thoughts of the ruling Government to those which have emerged as representing a potential best practice for South Africa in bringing into existence a carbon tax system.

If this discussion paper reveals a "cut and paste" type approach in that the responsible authorities have seen fit to "borrow" existing carbon tax legislation from another country, it is hoped that this current study will be able to assist in identifying the potential pitfalls of such an approach and indeed acknowledging its advantages, all the while appreciating the uniqueness of the South African context within which such a system will be undertaken. One of the biggest dangers of "borrowing" legislation is that the context and ultimate goals of the country from which the system is borrowed, may vary significantly from those which exist in South Africa. This further stresses the importance of being made fully aware of the unique characteristics of current carbon tax systems and attempting to understand the motivation behind their formulation so as to be able to determine if they would obtain a similar result in a South African context.

Limitations of the Study:

The current study is not intended to propose draft legislation for South Africa defining the express provisions that would be required to be included so as to achieve the desired result. It does not, in any sufficient depth, consider the economic and social implications of designing a tax and administering that tax. Such enquiries present themselves as areas of future research, which together with the fundamentals outlined in the current paper, can be used to comprehensively draft carbon tax legislation for South Africa with the benefit of having fully explored and considered all implications of the proposed tax.

There are additional cross border issues that relate to the implementation of a carbon tax that are beyond the scope of this study. Border Adjustments, also known as Border Tax Adjustments or Border Tax Assessments, are import fees levied by carbon-taxing countries on goods manufactured in non-carbon-taxing countries. The need for such adjustments is to ensure that an even playing field and competitive environment is maintained and facilitated in international trade, while at the same time internalizing the costs of carbon emissions into prices of goods and services.

As Columbia University Economics Professor Joseph Stiglitz has noted, "Not paying the cost of damage to the environment is a subsidy, just as not paying the full costs of workers would be." (The Carbon Tax Center) Stiglitz was formerly chair of President Clinton's Council of Economic Advisers (1995-97) and Chief Economist and Senior Vice President of the World Bank (1997-2000). He and others have urged the adoption of carbon border adjustments to eliminate the artificial advantage gained by transacting with firms that manufacture goods or provide services for world markets, from countries that fail to tax or otherwise price carbon emissions at prevailing world levels.

In considering the uniqueness of a South African context, a high level approach is taken, without exploring the exact socio-economic profile of the country and relating this to the countries analysed. Reference will however be made to research papers that have explored the impact on the economic and welfare components of the South African environment.

Chapter 2: Exploring the Alternatives

The complexities opposing the obtaining of a common view on the best, and indeed, most effective and efficient way to combat global warming manifest themselves in the vigorous debate that surrounds the above two proposals. It is common cause that each of these alternatives possesses both positive features and certain negative characteristics. A comparison of these two methods of curtailing carbon emissions is necessary in order to fully understand their respective pros and cons.

Cap and Trade

It can be said that the cap and trade model provides a little bit for all parties involved and is potentially less restrictive than an outright tax. As a general rule, most people are strongly opposed to the introduction of a new tax in any form (Cooper), regardless of the motivation behind its introduction. Owing to these reservations, politicians and those in governance have sought ways to address the problem of reducing carbon emissions without the imposition of a new and additional direct tax, separate from those already in effect. Indeed, those in power are faced with a dilemma in that any proposed solution will have implications on social, political, economic and environmental levels, rendering it an almost impossible task to find a solution that will satisfy all stakeholders.

Environmentalists will be pleased by the fact that within the context of a cap and trade system, emissions levels are set at a predefined level and thus no more than the allowed amounts of carbon dioxide will be allowed to be emitted (Rosenblum, 2009). If correctly administered, these 'allowable' levels can be constantly reduced and thus slowly but surely reduce the amount of CO being pumped into the atmosphere. But what of the practicalities relating to this option? For instance, whilst such an idea might seem attractive at first, one needs to pose the practical question of how such a system will be implemented, administered and ultimately function. This implies questioning the design of such a system, deciding on how and by whom the emissions levels are to be set and most importantly defining how such a system is to be governed and administered. If the levels of allowable emissions are set by political bodies, then there emerges the irresistible opportunity for manipulation by lobbying bodies supporting certain political parties (Rosenblum, 2009). If one were to hypothesise, one could quite conceivably imagine a scenario where a significant consumer of fossil fuels contributes on a large and consistent scale to the

political campaigns of a particular politician. If the benefactor politician comes into power, there may very well exist the opportunity for the politician to return the generosity of their financial backers by granting them more carbon credits than would otherwise have been the case. It may even happen that the financial supporters of political parties are not large emitters of carbon dioxide in their own rights, but that they seek carbon credits so as to trade with them or utilise them as bargaining chips in the course of their business. While the above hypothetical examples may seem critical or as portraying the integrity of political leaders in a negative light, it would be naive to suggest that such a system would not, even if only possibly, be subject to manipulation and abuse.

A further weakness in a cap and trade system is the uncertainty surrounding the price at which emission credits will be traded (Rosenblum, 2009). It is trite that unless saving and protecting the environment remain the sole focus of the eventual solution to the problem of climate change, greed will take over and the environment will suffer. At no point can the direction of an emissions reduction system become one of profit making at the expense of the environment. Demand for carbon credits, a necessity of a cap and trade styled system, could cause the price of such credits to sore and thus create instability in the eventual cost borne by consumers. Another important issue to be decided on is how the credits are to be allocated across industry sectors, companies and geographical areas. Certain entities are para-statals (being an entity that is owned in part by the governing authorities) and thus are more likely to have the ear of the government when the emission caps are set. This would bring about an inequitable reality that would impact on the ability of private firms to compete with these para-statals.

Potentially the single most crippling weakness of a proposed Cap and trade system is the length of time that it would take to put such a system in place, ensure its operational integrity and eventually see the results it was designed to achieve (Rosenblum, 2009). Assuming that the emissions levels are perfectly set and that the distribution of carbon credits is done in an equitable manner, this system will take anywhere from three to five years to be effectively implemented with consequential results. It is this aspect that renders such a proposal most unattractive.

Carbon Tax

On the other hand, a carbon tax has the advantage of being administratively efficient and is significantly easier to implement. The ease with which a tax can be implemented means

that a solution to the burning problem of climate change can be achieved in far less time than it would take should an alternative, more complex approach be followed. (Rosenblum, 2009)

In addition, carbon taxes will ensure that there is a certain level of predictability in energy prices and guard against the possibility of price volatility being experienced due to market supply and demand dynamics involving carbon credits in a system such as that of a cap and trade approach. (Hsu, 2009)

A characteristic of any proposed solution that is often overlooked but that is of vital importance is that of transparency and ease of interpretation. Owing to the fact that any proposed solution will ultimately impact on the public, it is essential that they are able to understand the purpose behind the approach taken, the way in which the chosen solution will be implemented and administered, and finally how such a system will impact on them. A carbon tax has the advantage of being defined in terms of a legislated Act, thus ensuring transparency and will be levied in terms of the provisions of that Act providing for an increased level of understanding amongst the public who will ultimately bear the burden of any system implemented. (Hsu, 2009)

Linked to the issue of ensuring that the chosen approach is implemented in a transparent manner, is the advantage that a carbon tax can be adopted with a significantly smaller opportunity for manipulation by stakeholders who have a tangible interest in the solution adopted. Any belief by the general public at large that the system chosen for implementation as response to climate change puts parties with special interests on a different, more favourable footing to the rest of those involved, will lead to a loss of confidence in the system and hence an undermining of its intended purpose. (Rosenblum, 2009)

Carbon tax legislation can be drafted so as to target the emissions of carbon from every sector. According to the Carbon Tax Center, some of the cap and trade systems discussed to date are only aimed at the electricity industry, which, it is reported, accounts for less than 40% of total carbon emissions. Such systems are as a result ineffective in achieving the overriding goal of emissions reduction. (Rosenblum, 2009)

As with any proposal which has as its overall effect the implementation of an additional tax, the general public will, with a reasonable amount of certainty, respond with animosity

and contempt as they see their hard earned income being diminished even further. This thought process requires some qualification. Whilst it is true that the implementation of a carbon tax will have the immediate effect of increasing the price of products produced by manufacturers that are affected by the implementation of the carbon tax, there are possible ways to mitigate the impact of this additional burden.

The implementation of a carbon tax allows for the returning of revenues generated by such a tax to the public via a dividend type pay out based on a progressive tax shifting structure (Rosenblum, 2009). In the alternative, it may be found that the revenues generated in a cap and trade system flow to the market participants and thus leave the end consumer bearing the burden of the cost of the fight against global warming without receiving any form of assistance or compensation for their efforts.

The overall effect of implementing a revenue neural tax is that, after providing for the administrative costs of the tax, none of the revenues derived from the tax should be retained by the governing authorities.

It is with the above mentioned advantages in mind that this paper seeks to critically analyse and compare carbon tax systems currently implemented in countries across the world, as well as certain proposed legislation with a view to determining a best practice, in terms of carbon tax legislation for implementation in a South African context.

Chapter 3: A Theoretical Carbon Tax

An appropriate point of departure is to consider what exactly is meant by the term "carbon tax" and indeed to explore associated concepts that will, in theory, allow for and facilitate the effective implementation of such a carbon tax. A carbon tax is defined as a tax on the carbon content of fuels, thus effectively taxes the level of carbon dioxide emissions from burning fossil fuels (Wikipedia, 2009). From this definition it can be seen that the system is limited to taxing carbon dioxide emissions. For an explanation on how carbon atoms are converted into CO_2 gas and its then negative impact on the atmosphere, see *APPENDIX A.*

It is important to note that the carbon content of every form of fossil fuel is precisely measurable and exactly known (Rosenblum, 2009). Thus when the fuels are burned or consumed in the production of an end product, one is able to determine the exact amount of CO_2 gas that is released into the atmosphere. Based on this knowledge, it would appear as if the tax on carbon emissions presents few, if any, measurement and documentary problems and would be a relatively easy tax to administer.

Initially however, there would need to be some thorough research and documentation done of the manufacturing and production processes undertaken by those entities affected by the tax. Such a process would create a level of expectation relating to the recovery of carbon tax revenue from the affected entity (Hodgson & Cullen, 2005). There may very well be a legitimate argument for legislating that stakeholders need to have their carbon emissions audited, either by their existing audit firms or by a specialized carbon tax compliance unit, so as to ensure that the tax is correctly implemented and complied with. This process would ensure that standards are set before the tax is levied so as to prepare businesses and enterprises for the associated impact of the tax. Unless the exact utilization of fossil fuels within a production process and the consequential carbon emissions for a specific period are known, there will be no basis upon which to levy the tax.

Within a South African context one can find support for such a submission within the realm of triple bottom line reporting as described by the King Report[2]. Triple bottom line reporting, reduced to its bare essentials, suggests that companies report to their stakeholders along three lines, namely: economic, social and environmental. While carbon

[2] The King Report was the result of a committee charged with formulating guidelines for the establishment of good corporate governance and was headed up by Judge Edwin King. King I was published in 1994, with King II following in 2002. King III is the most recent Report, published in 2010

emissions impact on all three of these areas, it is suggested that within the environmental line, an economic impact of the company's carbon emissions is documented and the associated carbon tax liability calculated for review.

It is further submitted that existing tax structures are used to collect the tax, as evidenced by the system implemented in British Columbia, but it is essential that such structures are equipped with additional resources in order to deal with the taxes so collected. The entire value of a carbon tax system will be eroded unless the revenues derived therefrom, are either returned to the public or are put to use in a manner that directly addresses the problem that greenhouse gases are causing in relation to climate change.

The Design of the Tax System

In its simplest form, the system will need to be structured in such a way so as to levy tax on the carbon content of fossil fuels produced. Such production processes may include, but are not limited to mining coal, pumping petroleum, or extracting natural gas. Deforestation and the production of powder cement also cause significant amounts of carbon dioxide to be emitted into the atmosphere and as such should also be targeted by the tax (Hodgson & Cullen, 2005). The administrative and logistical realities of implementing the tax in relation to the latter two processes are extremely complex and may very well render the taxation thereof as being inefficient, especially in the early stages of implementation.

It has been suggested, and indeed commonly agreed to, that the implementation of the carbon tax needs to take place as far upstream as is possible (Rosenblum, 2009). This implies taxing the entity that extracts the fossil fuel from the ground and initiates the start of the supply chain that will ultimately see the product derived from that fossil fuel consumed by the end user. As such, the point where the fossil fuel is transferred to the next participant in the supply chain would provide the logical place for the implementation of the tax.

Rosenbaum, 2009 suggests that one of the most significant advantages of implementing the tax in this manner is that it will minimise the number of stages in the economy at which the provisions of the taxing legislation will need to be implemented and administered. In addition it is envisaged that such an approach will simplify the tax treatment of potential downstream carbon control technologies such as those involving coal capture and sequestration processes.

In theory, the tax rates will be stated in currency units per million Btu (or per unit of energy) of heat content for each fuel. This approach is seen as being the most equitable; as it takes into account the wide variations, occurring naturally, in the carbon content within each fuel type. Rosenbaum (2009) gives an example stating that such variations are most noticeable for coal, in that a ton of lignite coal contains approximately 40% less carbon than an equivalent ton of bituminous coal and accordingly releases 40% less CO_2 into the atmosphere upon combustion. As a matter of logistical relevance, there are three varieties of coal, namely; bituminous, subbituminous and lignite. Each variety would require its own unique standard rate of tax. As a matter of thoroughness, Rosenbaum(2009) contemplates including the option for coal producers to apply for a lower tax rate than those specified in the legislation provided that they can prove, via documented evidence provided by a suitably qualified professional, that the variety of coal so purchased contains less carbon than provided for in the standard legislation.

Similarly with the other types of fossil fuels, rates of taxation will need to be set in accordance with the Btu of heat content per fossil fuel. This manner of levying the tax keeps in mind the overall objective behind the tax, and thus focuses on the carbon content of each fossil fuel and taxes the release of CO_2 into the atmosphere accordingly. To levy the tax at a blanket or standard rate would be to lose sight of the objective of reducing carbon emissions in an equitable and transparent manner.

The most desirable and effective rate at which to introduce a carbon tax is a complicated issue. A carbon tax should in theory be set at a level equal or near the marginal social cost of the emissions of a ton of carbon or carbon dioxide (Hsu, 2009). Hsu, 2009 goes on to explain that a tax on carbon dioxide and a tax on carbon achieve the same means, but they are imputed, respectively, to the entire carbon dioxide molecule and to only the carbon atom, the weight ratio being 44/12.

Others would argue that the tax should be set at a level that is sufficiently high to ensure that the emission targets are met with reasonable certainty, thereby achieving the ultimate objective of the tax being the reduction of carbon emissions. (den Elzen, 2007). Yet several others, have argue d that the carbon tax should not exceed the level that is acceptable to the voting public, in other words, those directly affected by the implementation of the tax. (Li et al., 2004).

A theoretically sound system of carbon tax will include certain provisions allowing for rebates to accrue to effected stakeholders in relation to carbon dioxide control measures implemented and carried out by them (Rosenblum, 2009). That is to say that if the entity charged with the carbon tax can prove that the carbon dioxide emissions will be prevented from entering the atmosphere, then they should be granted partial or complete relief from the liability so imposed. Such systems have also been referred to as carbon recapture programs. The complexity attached to the drafting of the provisions allowing for such credits to or reductions in the amount of carbon tax required to be paid is that the entity will have to show, beyond all possible doubt, that the carbon has been permanently removed from the atmosphere. This burden of proof may negate the incentives of such a credit granting system. It is however important to incentivise enterprises that have invested capital and effort into ensuring that their emissions are effectively reduced. Levying them with a carbon tax at an extraction or primary level would be tantamount to double taxation (Rosenblum, 2009).

According to Rosenbaum, 2009, it is considered imperative that carbon tax legislation includes a credit styled exemption for the following reasons:

- It provides fair and workable treatment of "partial combustion" which will vary by user and use (e.g., unburned coal in ash that is returned to the mine for underground disposal; possibly also cement manufacturing, and plastics manufacture).
- It creates positive incentives to minimize emissions.
- It puts the burden on the fuel producer to demonstrate emissions avoidance (as opposed to a partial tax which allows the producer to reduce taxes unilaterally and burdens the government with substantiating a rebuttal case).

As alluded to earlier, revenue neutrality is an essential characteristic of a carbon tax system. If the governing authorities see the implementation of a carbon tax system as a vehicle for imposing an additional tax whose revenues will be used to supplement their coffers, and not used to assist in eradicating the negative impacts of global warming, it is submitted that the tax will have inflationary consequences that will fuel poverty and inequality.

Studies by Metcalf et al. (2008) and Metcalf (2009) have considered the possible distributional impacts of carbon taxes in the United States of America (US). The 2008

study considers three recent tax bills introduced to the US Congress. The taxes themselves, it is observed, are highly regressive, but when revenues from the tax are returned through the mechanism of a lump-sum payout, the taxes become progressive. The 2009 study contemplated a carbon tax combined with a reduction in payroll taxes. Such a collaboration envisages the revenues derived from the carbon tax being used to lower the relative thresholds applicable to the respective payroll taxes. It was found that this combination can be distributionally neutral. Furthermore, it was proposed that with an adjustment in Social Security payments for the lowest-income households in the US, the carbon tax policy could even be made progressive. (Rosenblum, 2009)

A study by Ekins and Dresner (2004) considered the distributional impact in the United Kingdom (UK) of introducing a carbon tax and increasing fuel duty. They found that a carbon tax can be made progressive, but that the tax would make those currently worst affected by fuel poverty more badly off. Of the policy options looked at for transport, the most effective in compensating low-income motorists is found to be an increase in fuel duties and the abolishment of vehicle excise duty. (Rosenblum, 2009)

Almost without fail, corporations transfer the burden of a carbon price onto consumers further down the supply chain. Studies have typically found that poor consumers spend a greater proportion of their income on energy-intensive goods and fuel. (Rosenblum, 2009) Therefore cost increases in energy tend to impact the poor in a more significant manner than the rich. This implies that any form of carbon tax system introduced would need to compensate for the inequitable distributive effects that the tax, on its own standing, may have. This corrective process is the envisaged result of rendering the tax a revenue neutral one. (Rosenblum, 2009)

To reiterate, there are currently two main schools of thought on the machinery best suited to returning the revenues derived from the tax to those affected thereby. One of the approaches would refund the revenues directly through regular periodic equal “dividends” to all residents who are registered taxpayers. In effect, every resident would receive equal, identical portions of the total amounts of revenue collected. Thus if one were to imagine the distributional effect of the tax, one would quickly see that the return of such revenues in the form of ‘green cheques’, all made out in the same amount, could actually leave the poorer populace better off owning to their relatively smaller consumption of products effected by the tax. (Rosenblum, 2009)

The other approach would result in each currency unit of carbon tax revenue collected triggering an equivalent currency unit's worth of reduction in existing taxes. As carbon-tax revenues are phased in, with the tax rates rising gradually but steadily, to allow a smooth transition giving consumers time to adapt to the new tax, existing tax levels will be reduced (Rosenblum, 2009). This "tax-shift" approach, while less direct than the dividend or green cheque method, would also ensure that the carbon tax is revenue-neutral and could offer other additional benefits. For example, reducing employee taxes could stimulate employment and provide taxpayers with more disposable income to compensate for the increased expenditure that they are incurring due to the increases in product prices resulting from the implementation of the carbon tax.

The individual's receipt of the green cheques of tax shift would be determined independently of the taxes that they pay and without considering the effects of the carbon tax on them personally. Thus the revenues returned in the form of tax benefits experienced would be completely unrelated to their energy consumption and otherwise determined carbon tax liability. By separating these benefits from the underlying payments made under the tax ensures the preservation of the incentives created by such a carbon tax to cut back on the use of fossil fuels and reduce CO_2 emissions into the atmosphere (Rosenblum, 2009).

As noted, such an administrative structure will serve to protect the poor against the negative distributive impacts that the tax would have if such compensation were not made.

A carbon tax, like most taxes, is regressive when implemented by itself. However, the regressive nature of a carbon tax can be minimized, and perhaps eliminated altogether; by keeping the tax revenue-neutral in the ways described that protect the less affluent.

It is trite that more affluent households use more energy on a relative scale than lower income households. They generally drive and fly more, have bigger and occasionally more than one house, and purchase more products that require energy to manufacture and use (Rosenblum, 2009). As a direct consequence of their relatively larger consumption of energy and related products and services, most carbon tax revenues will come from families of above-average means, along with corporations and government.

That is why the two "return" approaches described above, can turn the carbon tax into a progressive tax. Because income and energy consumption are strongly correlated, most

poor households will get more back in carbon dividends than they will pay in the carbon tax. The overall effect of a carbon tax-shift could be equitable and perhaps even "progressive", benefiting the lower income households.

However, it would be naive to suggest that such a tax would be welcomed by all and sundry. Even if a perfectly revenue neutral tax can be implemented, there would still be timing delays in the cashflow considerations associated with the implementation of the tax and the execution of the refund policy. Considering only the less affluent for the moment, they will be required to pay more for the products they consume by the manufacturers of those products who have passed on the cost of the carbon tax. This will occur as and when they purchase these products. The relieving affects of the return policy will only be felt once the revenues have been collected from the tax, possibly a month of two after the individuals' tax year. In some extreme cases, this timing delay may be enough to push certain households below the bread line; an eventuality that no government would ever hope for.

A variation to the above mentioned return structure of reducing personal and business income tax rates could be to reduce VAT (Value Added Tax) rates when implementing the tax on carbon emissions (Waggoner, 2008). This idea, put forward by Michael Waggoner in his paper "How and Why to tax Carbon" (2009), makes sound economic sense and may very well be an effective method of alleviating the negative cashflow considerations described above in that it would negate the increase in consumer prices due to the carbon tax with a simultaneous decrease in price of those same goods due to the reduction in the VAT rate.

Chapter 4: Carbon Tax Systems

The enactment of carbon tax legislation is still in the development stages in terms of acceptance across the globe. Certain countries have however, had a form of carbon tax in place since 1990. Finland became the first country in the world to enact legislation in 1990 embodying a tax on carbon. Sweden followed closely behind implementing a system of carbon tax in 1991. Other countries have been significantly slower in adopting a climate change policy that incorporated some form of a carbon tax.

It was not until 2005 that New Zealand formalised a plan to implement such a tax, but the coming into office of a new government brought to an end such thoughts and the proposed carbon tax never saw the light of day. Across the Tasmin Sea, Australia is currently undergoing a ferocious debate concerning the approach to be adopted in combating the harmful effects of greenhouse gas emissions. Although still in proposal form, a review of the thought process surrounding the implementation of the carbon tax in Australia will assist in developing a best practice for South Africa owing to several similarities between the two countries that will be explored later in this paper.

France is also in the advanced stages of enacting a version of a carbon tax. Indeed, the proposed Bill was set for adoption on the 1st of January 2010, however, a mere two days before the passing of the tax into law; it was ruled unconstitutional by France's Constitutional Council. (BBC News, 2009) According to the Council, too many polluters were exempt from the tax and that as a result the tax burden was not fairly distributed. Since this ruling, the French Government, still determined to combat global warming through the implementation of a carbon tax has suggested certain amendments to the original Bill. The original Bill, the reasons for it being deemed unconstitutional and the revised proposal will be analysed in a later section.

More recently, Ireland introduced a carbon tax. A mere two days after the latest United Nations (UN) climate change conference in Copenhagen, the tax was announced in the Minister for Finance's budget speech for the 2010 fiscal year. This implementation was not free of controversy in that the rural dwellers of Ireland, under the united voice of the Irish Rural Link, opposed the tax on the grounds that it would bear more heavily on the rural population of Ireland. Statistics from that organisation, who, according to the Central

Statistics Office of Ireland, constitute one third of the total population (Irish Rural Link, 2009)

However, it must be said that the revenue neutral carbon tax system introduced by British Columbia in 2008 is possibly the most comprehensive and well directed version of a carbon tax available to date. Currently, the carbon tax revenues are being returned to taxpayers through personal income and business income tax reductions. This system is a shining example of how effective a carbon tax system can be whilst at the same time mitigating the potentially harmful distributive effects of the tax.

All of the systems either proposed, or enacted by the countries mentioned will be critically analysed and compared so as to be able to accurately identify the characteristics that make for the implementation of a successful and equitable carbon tax. It is noted that the development of carbon tax legislation embodies the coming together of fiscal, social, political and economic considerations, and that no part played by each of these factors is any more important than the other. However, the focus of this research is into the legislative provisions governing the implementation of a carbon tax.

In drawing on the provisions of the systems analysed in order to determine a best practice for a South African context, reference will be made to the unique considerations necessary under those other factors as they pertain to the Republic of South Africa. This will be done so as to justify the inclusion and indeed exclusion of particular provisions that are embodied in other proposals when looking specifically at the South African environment and attempting to derive the most appropriate system of carbon tax for it based on those systems and proposals already in existence.

The following countries have either implemented a form of a carbon tax system, have proposed such a system, or have considered implementing the tax and then decided against it:

Australia

From the outset it is important to note that the system of tax described for Australia is a theoretical one and not one that has been implemented. The thoughts presented come from a Policy Monograph by John Humphreys, being the fourteenth in the Perspectives on Tax Reform series from the Centre for Independent Studies in Australia (Humphreys, 2007).

Australia, much like South Africa, is rich in natural resources, boasting significant amounts of coal exports and relying almost entirely on coal fuelled power stations for their supply of electricity. In addition, Australia currently has several fuel levies that are imposed on end consumers, in a very similar vein to those found in South Africa.

The Australian Government currently uses an approach that combines regulation and subsidy to curb carbon emissions, while at the same time has been contemplating the possibility of implementing a carbon trading scheme. John Humphreys believes that the country would be better served if the government replaced all of these options with a single revenue-neutral carbon tax. He cites similar reasons to those put forward in this paper for holding a carbon tax as being a more favourable solution to the problem of carbon emissions than for example a cap and trade system. He notes that a carbon tax system is more efficient, effective, simple, flexible, and transparent than its cap and trade counterpart. In line with other schools of thought he points to the added benefit that a carbon tax has to offer of providing revenue which can be used to cut other taxes. Indeed, a revenue-neutral carbon tax, administered in an efficient and honest way, could very well have little or no economic cost.

He proposes that in an Australian context, a carbon tax of $15 per tonne of CO_2e (carbon dioxide equivalent) emissions would generate enough revenue to increase the income-tax-free threshold to $10,000 or to drop the top marginal tax rate to 30%. A $30 per tonne CO_2e carbon tax would facilitate both of the above or allow for an increase in the income tax free threshold to $15,000.

Alternatively, a $30 per tonne CO_2 carbon tax could be used to fully offset all current fuel taxes. In such a reform, higher electricity prices would be offset by petrol prices falling by about 30 cents per litre. This approach could be seen as transferring Australia's current environment tax, which is on fuel, to a lower rate on a broader base. It would be revenue-neutral, efficiency-neutral, and equity-neutral, and would encourage Australia to start shifting away from its reliance on carbon intensive 'dirty' coal. This approach is easily likened to one that would be attractive in a South African context given the exceptionally high quantities of fossil fuels consumed in the country.

Unfortunately, owing to the infancy of the debate in Australia surrounding the implementation of such a tax, or any means for combating carbon emissions for that

matter, no further details are currently available with respect to the specific provisions that such a tax might seek to include.

New Zealand

The proposal of the New Zealand Government was to introduce carbon tax legislation setting the initial rate of the tax at NZ$15(equivalent to US$10.67 based on a conversion rate of USD 1.00 = NZD 0.71)) a ton CO_2-equivalent emissions, commencing on 1 April 2007 and continuing until the end of the first Kyoto Protocol commitment period, on 31 December 2012.

However, owing to a change in government, the idea of a carbon tax and the associated proposal were abandoned in favour of alternate measures. The observations and thoughts presented here are taken from a (New Zealand) Government Consultation Paper entitled *Implementing the Carbon Tax* and authored by the Hon Dr Michael Cullen ((then)Minister of Finance and Minister of Revenue) and the Hon Pete Hodgson ((then)Convenor of the Ministerial Group on Climate Change). (Hodgson & Cullen, 2005).

It was thought that the rate would only be amended if it diverges significantly and on a sustained basis from the long-term trends in the international price of carbon emissions, but that it would not exceed $25 a tonne of CO_2 during the afore mentioned period.

It was anticipated that the following types of firms would be required to file regular returns with the New Zealand Inland Revenue service:

- firms that mine petroleum products[3] except for crude oil that is sold in its raw state;
- firms that mine coal;
- oil refineries, in regard to production of emissions in the course of their activities;
- firms that supply jet fuel to a domestic flight of a domestic airline;
- firms that use geothermal energy for process heat or electricity generation;
- firms that carry out certain industrial processes (such as calcination of limestone for cement) that result in emissions; and
- firms that seek rebates of the tax, except for the export of most petroleum products.

It was thought that a differentiation would have to be made between those firms listed above and other firms that, rather than filing regular returns, would be required to pay the tax to the Customs Service. Such firms would include:

[3] Generally petroleum mining permit holders.

- importers of coal, coal products, gas, and refined petroleum products (except crude oil imported through a refinery and jet fuel);
- oil refineries, with regard to their refined products (other than jet fuel and non-emitting products); and
- importers of carbon anodes, carbon pitch and carbon black.

The proposed system was expected to cover all major greenhouse gas emissions, excluding methane and nitrous oxide from the agricultural sector, provided that doing so would be feasible and cost effective. Most importantly, the tax was going to be aimed at New Zealand's emissions from fossil-fuel based energy supply and use, industrial process emissions, and fugitive energy emissions of carbon dioxide, methane and nitrous oxide. Fugitive energy emissions cover those emissions that leak or are vented during production and use of sources of energy, such as flaring at oil and gas production sites, leaks from gas distribution lines and methane emissions from coal mines. Interestingly, the tax was also envisaged as including perfluorocarbons (PFCs) that result from industrial processes.

Initially, the Government was not going to apply the tax to sources of emissions already covered by other policies. Such an approach has been seen before and results from the need to avoid effective double taxation on these sources of emissions. In New Zealand, these sources include emissions of synthetic gases, other than PFCs, from process emissions and methane from the waste sector.

In terms of the revenues generated from the implementation of the proposed tax, it was put forward that such revenues not be used to enhance the Government's net fiscal position, an important characteristic of any carbon tax system, but rather that they be recycled through the tax system. In New Zealand, the majority of the renewable electricity generators are State owned and it was anticipated that such projects would benefit immensely from the introduction of the carbon tax.

As with any system of carbon tax, it is important not to levy the tax blindly, but to offer exemptions, refunds and rebates in the appropriate situations. In the current scenario, it was envisaged that relief from the tax would be provided

- under the terms of Negotiated Greenhouse Agreements (i.e. other measures in place);
- on export of fossil fuels; and

- when carbon is permanently embedded or sequestered, other than in biomass.

In addition, under certain circumstances the administrative and compliance costs of measuring emissions from certain sources would result in it not being cost effective to apply the tax to certain producers, and as a result such producers would also be exempt from the tax. Such circumstances may arise, for example, where there are many individual emitters each procusing a relatively small amount of GHG emissions.

It was proposed that a minimum threshold of $2,000 worth of emissions a year, calculated as if the charge was being applied, be set for the application of the carbon tax to any taxpayer. As a result, an entity would only be required to register to pay tax if its carbon tax liability for the past year, had the carbon tax applied, or its expected carbon tax for the coming year, had the carbon tax applied, exceeded this amount.

Similarly, it was put forward that coal miners would not be required to pay the carbon tax on coal if the value of the coal they supplied or used in the past 12 months, and the expected value of the coal in the next 12 months, were less than $2,000. The purpose of setting such a minimum threshold was to provide a simple way of excluding from the carbon tax a number of landowners for whom coal production is a minor incidental activity, and avoiding the need to calculate their potential carbon tax liability thereby lightening the administrative burden of the tax.

It was settled that the administration of the carbon tax, exemptions, rebates and refunds would largely be modelled on existing systems for tariffs, excise duties and General Sales Tax (GST).

The Inland Revenue Service of New Zealand would have been the lead administrative agency for the carbon tax, in that it would have administered all points of obligation to pay the tax other than imports and removals from oil refineries, and all rebates except those administered by the Customs Service. Thus by using the standard Inland Revenue rules for handling other taxes and applying them to the carbon tax mechanisms, the carbon tax would have been fully integrated into the existing systems of tax, allowing for an efficient and effective adoption process.

To ensure that the tax was collected on the entire range of products targeted, the New Zealand Customs Service would have collected the tax on products that were subject to the tax at the point of importation or when removed from a refinery, except for jet fuel. It was

planned that Customs would also pay the rebates due to exporters of liquid petroleum products, except for those derived from compressing gas, which would still be subject to the tax.

However, a new government determined that the carbon tax would not cut emissions enough to justify the costs, and the tax was abandoned (Myer 2005). [CTC addendum: In Sept. 2007 the government unveiled a proposed emission cap-and-trade scheme intended to cover all carbon emissions]

Finland

Finland was the first country to adopt a carbon tax. Launched in 1990, Finland's carbon tax is a separate component of Finland's excise tax on fossil fuels used for transportation or heating (Rosenblum, 2009).

The scope of the carbon tax is broad in that it applies to gasoline, diesel, light fuel and heavy fuel oil, jet fuel, aviation gasoline, coal, and natural gas (Ministry of the Environment, Finland 2008a). Coal is subject to a tax of $73.97 (€49.32) per metric ton, natural gas is subject to a reduced tax rate of $3.02 (€2.016) per MWh, and liquid fuels are taxed between $0.07 (€0.05) and $0.09 (€0.06) per litre. (European Environment Agency., 2009) Commercial vessels and commercial air traffic as well as fuels used for electricity are exempt. Electricity is taxed, but the rate per kWh does not vary according to carbon content; however, a refund is available for renewable electricity.(Ministry of the Environment, Finland)

Initially, Finland based its carbon tax purely on carbon content but later modified it to include a 60% carbon component and a 40% energy component. The environmental tax component (i.e. carbon surtax), based on the carbon content of fuels used for heating and transportation is, since January 2008, €20 per tonne of CO_2 (€75 per tonne of carbon).

The energy component was a tax based on energy use in MWh rather than on carbon content of the fuel. In January 1997, however, Finland returned to a pure carbon tax (Sumner, Bird, & Smith, 2009). The carbon tax was most recently increased by 13% to $30 (€20) per metric ton CO_2 on January 1, 2008 (Ministry of Environment Finland 2008b). Carbon tax revenues, as reported by the Finnish Revenue authority, have been approximately $750 million (€500 million) annually. (Ministry of the Environment, Finland)

A point worth noting is that all revenue from the carbon tax in Finland goes directly into the general central government budget without any earmarking (Sumner, Bird, & Smith, 2009). It therefore appears as if this system is without any mechanisms in place for returning the revenues, via green cheques of tax shifting benefits, to those parties who are actually bearing the burden of the tax.

In 2000, the Finnish government determined that because of the carbon tax, CO_2 emissions were reduced by roughly 4 million metric tons of CO_2 between 1990 and 1998. Four million metric tons of CO_2 represented approximately 7% of the 57 million metric tons of emissions recorded in 1998 (Ministry of the Environment, Finland).

Most recent changes (as of 1 January 2008) to the system of carbon tax include:

- tax rates were raised by 9.8% on average
- increase in carbon surtax was 13%;
- biofuel oil used in working machines or heating is exempted
- exemptions for hobby aviation, pleasure yachting and waste oil were repealed.

(Ministry of the Environment, Finland)

A summary of the environmental taxes as applicable are summarised in the following table (Ministry of the Environment, Finland):

Fuel	**Basic tax**	**Surtax** (*=carbon comp., €20/tonne CO_2)	**Strategic stockpile fee**
Unleaded petrol, euro cents/litre			
- reformulated sulphur free	57.24	* 4.78	0.68
- other grades	59.89	* 4.78	0.68
Diesel oil, euro cents/litre			
- sulphur free	30.67	* 5.38	0.35
- other grades	33.32	* 5.38	0.35
Light fuel oil, euro cents/litre	2.94	* 5.41	0.35
Heavy fuel oil, euro cents/kg	-	* 6.42	0.28
Jet fuel (kerosene), euro cents/litre	33.32	* 5.38	0.35

Aviation gasoline, euro cents/litre	37.54	* 4.78	0.68
Coal, euros/tonne	-	* 49.32	1.18
Peat	-	-	-
Natural gas, euros/MWh	-	* 2.016 (reduced rate)	0.084
Electricity, euro cents/kWh - rate I (households,services, agric.) - rate II (mining, manufacturing)	- -	0.87 0.25	0.013 0.013
Pine oil (heating), euro cents/kg	6.70	-	-

Sweden

First implemented in 1991 a carbon tax was introduced in Sweden to supplement the existing energy taxes. When this was done, those existing energy taxes were reduced by 50% (Energidata Göteborg et al., 1995). Industrial consumers pay a 50% lower carbon tax than the standard. Currently there is no tax levied under this regime on electricity producers. At present the general carbon tax level is 36.5 öre/kg CO_2 which equates to approximately $ 150/tonne CO_2. (Sumner, Bird, & Smith, 2009)

In assessing the effectiveness of this system, one notices that it has not been overwhelming successful in reducing carbon emissions for the following reasons:

1) the carbon tax on industry is only 50% of the general level,
2) only a relatively small fraction (30%) of the energy supply to industry was fossil fuel-based when the tax was introduced and
3) for most industrial companies the energy cost is a relatively small fraction of the total cost and has therefore low priority.

However, what one will notice is that there is a close interplay between the carbon and other energy taxes in Sweden. The reasons for such interplay may be found in the characteristics of the Swedish energy system that differ from most other industrialised countries:

1) Swedish electricity production is almost entirely fossil fuel free and is based almost entirely on nuclear and hydro power. There is also some electricity production in cogeneration plants in industry and district heating.

2) Renewable energy contributes approximately 27% to the Swedish energy supply. Biomass is, together with hydro power, the dominating source and provides approximately 15% of the energy supply. The significant importance of renewable energy has been brought about by favourable geographical conditions, industrial structure and governmental policies. Noticeably, the Swedish population density is low with large forests from which large amounts of bio-energy can be extracted. Energy use in industry is heavily dominated by the forestry industry which has excellent opportunities to utilise by-products for the internal energy demand and finally governmental policies have historically supported the development of hydro power and bio-energy by placing a higher cost on other, 'dirtier' fuels.

3) The per-capita electricity utilization rate in Sweden is comparatively high partly because of the rapid expansion of electric space heating during the 1980s and partly because of the existence of a large electricity intensive industry. Currently about 35 TWh/yr electricity is used for space heating (Swedish National Energy Administration, 1999) This is equal to approximately 25 % of the total electricity demand. The necessity of such heating is a direct consequence of the country's climatic conditions.

Initially, when the new taxation system was introduced, industry was exempted from energy tax and had to pay only 50% of the general carbon tax level. In 1993 this fraction was reduced to 25%. In 1997 the fraction was once again raised to 50%. For energy intensive industries there are special rules that allow for further reductions of the carbon tax. The total effect of the 1991 tax reform on industry was to reduce tax levels, for some fuels by more than 50% (Johansson)

The differentiation of the carbon tax among sectors has had some effect on the behaviour of companies. Between 1993 and 1997 when the tax difference between fuels used in district heating systems and fuels used in industry was larger than today, some industries sold their by-products to the district heating companies while they themselves burned fossil

fuels. This was not an efficient solution but an effect of the construction of the tax system (Johansson).

Revenue from Sweden's carbon tax was relatively steady from 1993 to 2000 then gradually increased from 2000 to 2004. It generated approximately $3.65 billion (25 billion SEK) annually in 2005, 2006, and 2007 (Sumner, Bird, & Smith, 2009)

Sweden directs the tax revenues to the general government budget and has as such also chosen not to incorporate into the carbon tax system mechanisms by which the revenues of the tax so levied can be return to those affected by it (Sumner, Bird, & Smith, 2009).

British Columbia

In British Columbia (BC), 65.9 million tonnes of CO_2-equivalent were released in 2005. Various scenario planning activities have revealed that under a "business as usual" scenario, emissions are expected to continue to rise as they have in the past. In order to design effective strategies to reduce emissions, it is important to know which types of human activities generate greenhouse gases. Because fossil fuels play such an important role in providing energy for most industries and have become integrated into our daily activities. For example, emissions have been shown to originate from a variety of sectors; such as transportation, agriculture, electricity, fossil fuel production, industry, waste and Residential and commercial use. (Ministry of Finance British Columbia, 2008)

The carbon tax system as designed and implemented by BC was announced in their 2008 Finance Budget. This announcement, it has been said, supported and added momentum to their Government's plan to reduce greenhouse gas emissions by providing the fiscal framework to implement government's climate action initiatives. The machinery required in order to achieve the means that have been on the lips of all concerned parties is provided for in the system of carbon tax as communicated in the Budget. All information expressed in the review of this system of carbon tax comes from the Budget and Fiscal Plan 2008/09 – 2010/11 of British Columbia, as announced and published on February 19, 2008. (Ministry of Finance British Columbia, 2008)

As with the implementation of any tax, one always has to bear in mind the burden it places on enterprises and potential drawbacks it may have on facilitating competitive behaviour. BC has maintained its commitment to a strong, vibrant and competitive economy that

promotes investment, innovation and job creation by ensuring that mechanisms are put in place to mitigate the regressive effects of the tax so introduced. Consistent with these two objectives, the Government introduced legislation to implement a new carbon tax effective July 1, 2008. Under a three year revenue neutral carbon tax plan, 100 per cent of revenues from the tax, it was envisaged, would be returned to British Columbians through offsetting tax reductions. It was through the working of this plan that the Government sought to turn the regressive implications of the tax into progressive ones.

The carbon tax applies to the purchase or use of fossil fuel within BC. The amount of GHGs emitted when a unit of fossil fuel is burned depends fundamentally on the chemical makeup of the fuel, as identified and explained earlier, and in particularly on the amount of carbon in the fuel. That fact allows for a relatively simple administrative principle for applying the carbon tax. Administratively, the carbon tax is applied and collected at the wholesale level in essentially the same way that motor fuel taxes are currently applied and collected in BC. This minimizes the cost of administration to government and the compliance cost to those collecting the tax on government's behalf. Even though the carbon tax applies to a broader range of fuels and fuel uses than existing motor fuel taxes, with few exceptions, the same mechanism and administrative infrastructure can be used for both purposes. The ease with which this tax was able to be integrated into the current taxing framework allowed for the timeous and efficient implementation of the tax, thereby proving that such a system is favourable to for example a cap and trade system that may take several years to establish before any active implementation is evidenced. Some environmentalists and economists initially suggested starting with a higher level of tax, arguing that a low initial tax rate will have little immediate effect. However, by allowing this relatively long phase-in period up to the $30 per tonne level it was intended by the government to give people and business time to adjust their habits and purchasing patterns, and in addition, to respect decisions taken before the tax was announced, such as vehicle purchases.

The carbon tax was initially based on a rate of $10 per tonne of greenhouse gas (GHG) emissions, and is set to increase to $30 per tonne by 2012. It is set to rise by $5/tonne annually to reach $30 per tonne of CO_2 in 2012. The first increase took effect on July 1, 2009, bringing the tax rate to $15/tonne. The tax will have the broadest possible base. All

emissions from fossil fuel combustion in BC will be taxed, with no exemptions except those required for integration with other climate action policies in the future and for efficient administration. This differentiates the BC system from some of the other systems which are characterized by extensive exemption provisions which have, in an extreme case, had the effect of rendering a proposed carbon tax regime as being unconstitutional on the grounds of unfairly discriminating between the emitters of carbon emissions when implementing the tax.

The tax base includes fossil fuels used for transportation by individuals and in all industries, including the combustion of natural gas to operate pipelines, as well as road, rail, marine and air transportation. In addition, the tax base includes fuel used to create heat for households and industrial processes, such as producing cement and drying coal.
The only fuel types not included in the tax base are those that are not "fossil fuels." These are generally referred to as biomass fuels or biofuels, which include firewood, woodwaste, ethanol, bio-diesel and bio-heating oil. The CO_2 produced from the combustion of biomass is not included in the inventory because the carbon released by combustion was first drawn from the atmosphere by the plants through photosynthesis. Fuels that include both fossil fuel and biomass fuel, such as blended gasoline and ethanol, will only be subject to tax on the fossil fuel content of the fuel.

Certain fuel uses are not subject to the tax. These exemptions, such as for inter-jurisdictional commercial marine and aviation purposes and fuel to be exported, are needed to ensure that the tax applies only to combustion and thus emissions produced in BC. Thus, neither the emissions released elsewhere to produce fuel imported to BC nor the emissions released elsewhere from burning fuel exported from BC are included in the tax base. The intention is to effectively tax the emissions from burning fossil fuels within the province.

The fossil fuels included in the tax base account for about 70 per cent of British Columbia's total current GHG emissions. Other emissions, including those resulting from industrial processes such as production of oil, gas, aluminium and cement, as well as emissions from landfills and other sources, have not yet been made subject to the tax. It will be interesting to observe whether emissions from other sources are eventually subjected to the carbon tax. There are technical measurement issues with these other GHG

emissions, many of which are created during the production process and vary considerably from facility to facility. Also, many of these emissions will be subject to the cap and trade system or other GHG reduction measures under development.

Since different fuels generate different amounts of GHG when burned, the initial rate of $10 per tonne of CO_2-equivalent had to be translated into tax rates for each specific type of fuel. This has been done based on the carbon content of the respective fuel.

The carbon tax revenues are being returned to taxpayers through personal income and business income tax cuts, as promised by the then-BC finance minister Carole Taylor, who spearheaded the push for the tax. More specifically, the Government's action plan for returning the revenues from the carbon tax back into the economy includes:

- introducing a new low income refundable Climate Action Tax Credit of $100 per adult and $30 per child for low income families, which will be paid quarterly;
- reducing personal income taxes by 5 per cent on the first $70,000 of income by 2009;
- lowering the general corporate income tax rate to 11 per cent from 12 per cent and the small business rate to 3.5 per cent from 4.5 per cent; and
- introducing additional increases to the Climate Action Tax Credit and reductions to personal and corporate income taxes. The goal is to lower the general corporate income tax rate to 10 per cent and the small business rate to 2.5 per cent by 2011.

In total, carbon tax revenues of $1.85 billion over three years will be returned to taxpayers through offsetting tax cuts and tax credits.

Thus it is a key principle, reinforced in the legislation, that all the revenue generated by the carbon tax will be recycled through tax reductions. Most importantly, none of the carbon tax revenue will be used to increase spending, or be used to reduce a tax deficit should thatarise.

On an administrative level, accountability for full revenue recycling is achieved primarily through a legislated requirement that each year the budget necessarily include a three-year

plan for carbon tax revenue recycling. For example, the first plan was included in the Revenue Neutral Carbon Tax Plan topic box and shows that for 2008, the revenue was to be recycled through a refundable tax credit, the Climate Action Tax Credit, as well as reductions in personal and corporation income tax rates. Failure to table a revenue neutral plan would have meant that the Minister of Finance is ineligible to receive the 10 per cent salary holdback.

There is also annual reporting on the actual amount of carbon tax collected and revised estimates of revenue reductions due to the revenue recycling measures.
Owing to the forward looking nature of the revenue recycling plan as announced in the budget, it must be based on estimates and the actual carbon tax revenue and revenue recycling costs may vary from those estimates for a number of reasons. If, for example, the actual amount of revenue recycled is less than the amount of carbon tax revenue collected for a given year, the plan will also show how the government intends to return the excess to taxpayers through additional tax reductions. This ensures that there will be full, transparent, ongoing revenue recycling, two key principles of turning an otherwise regressive taxation system into a progressive one.

As noted, the tax was initially set at a relatively low rate so as to allow individuals and businesses to adjust to its implications, with increases following over the subsequent five years.

To assist British Columbians in making lifestyle changes to reduce their use of fossil fuels, each resident received a Climate Action Dividend payment of C$100 in June 2008, paid out of the 2007/08 surplus. The total value of these benefits was $440 million. Such actions add to the overall commitment of the Government to keep as its focus the reduction of carbon emissions, while ensuring that the tax has the least regressive effect as is possible under the circumstances.

In addition to the carbon tax and offsetting tax reductions, the 2008 Budget also included a further $64 million of tax measures and $986 million of spending commitments for climate action initiatives. Further tax measures included to promote climate action for a total three year revenue commitment of $64 million comprised:

- Small Business Venture Capital Act tax credit budget increased by $5 million annually and allocating $7.5 million to clean technology businesses;
- tax relief for fuel efficient conventional vehicles qualifying for the federal ecoAuto rebate, equal to the federal rebate. This is in addition to the existing tax relief for hybrid and alternative fuel vehicles; and
- provincial sales tax exemptions for a variety of energy efficient goods, including washing machines, refrigerators and freezers as well as electric power-assisted bicycles and tricycles and electric motorcycles.

What the above signifies is the need to constantly bear in mind the objective of the tax, being the need to reduce carbon and other greenhouse gas emissions in the face of global warming. This implies the need to dedicate the revenues so derived from the taxes to this cause, and in addition to supplement the benefits of the tax with other actions aimed at reducing carbon emissions. The tax should not be seen as a means of purely broadening the tax base, nor should it be seen as a standalone solution to the problem of global warming.

It is envisaged that the tax as defined above will impact on individuals in various ways. The main impacts of the carbon tax on individuals are related to their transportation and heating costs. For those who use private vehicles for transportation, the impact of the tax depends on four factors – distance driven, fuel efficiency of the vehicle, the type of fuel used, and driving habits. All of these can be adjusted over time to reduce the impact of the tax. The amount of carbon tax associated with heating and cooling of residential buildings and domestic hot water depend on the type of energy used, the energy efficiency of the equipment, the outside temperature, the level at which the thermostat is set and the energy efficiency of the building.

The impact of the carbon tax on businesses and other non-natural persons is slightly different. Every business or other organization that purchases or uses fossil fuel for combustion in British Columbia is subject to the carbon tax. The main uses of the fuel are for transportation, heating of buildings and providing heat for industrial processes. The relative amount of tax paid and the impact on the business will depend on many things, including the industry, the particular configuration of each facility, the ability to use alternative fuel sources, and to make new investments to reduce the use of fossil fuels. The low initial tax rate was not expected to significantly affect the business community and the five year phase-in will allow time for businesses to adjust.

As indicated, most of the carbon tax revenue is recycled to business, initially through significant corporation income tax reductions, mitigating the net impact on the business community. In addition, the reduction to school property tax rates for the major industrial class announced in the *Budget 2008*, while not a revenue recycling measure, provided important tax relief to industrial facilities across the province and will help improve their competitiveness.
(Ministry of Finance British Columbia, 2008)

Ireland

On the 9th of December 2009, The Irish Minister of Finance, Mr Brian Lenihan, announced the introduction of a carbon tax system in Ireland. This announcement was made in his Financial Statement for 2010. All information concerning Ireland's system of carbon tax was derived from Mr Lenihan's speech as well as from the supporting Annexures to that speech which expand on and explain the taxes so introduced, (Lenihan, December 2009) (Irish Ministry of Finance, 2009)

Citing the economic and social implications of climate change as being significant, and noting the responsibility of Governments everywhere to change behaviour to reduce our greenhouse gas emissions, he announced the introduction of a carbon tax equivalent to €15 per tonne (of CO_2 emitted).

In his budgetary speech, Mr Lenihan conceded that changing behavioural patterns takes time, but insisted that a start had to be made at some point. The most effective way, he suggested, to make such a start was to put a price on carbon. A carbon tax, he said, "would encourage innovation by incentivising companies to bring low carbon products and services to the market."

In terms of possible relief incorporated into the provisions of the taxing statute, the Minister announced that a vouched fuel allowance scheme will be developed to offset the increases for low income families' dependant on such fuels.

According to the Finance Minister, the yield from the carbon tax will be used to boost energy efficiency, to support rural transport and to alleviate fuel poverty. The carbon tax will provide a means by which Ireland will be able to maintain or reduce their payroll taxes. €50 million of the carbon tax yield will be used to fund measures such as help for

households at risk of fuel poverty to make their homes warmer. The local authorities will receive additional funding to retrofit the social housing stock. This represents a significant boost to the plan to retrofit over one million homes by 2025. It does however seem that this system of carbon taxation potentially lacks sufficient mechanisms through which to return the revenues from the tax to those affected by it so as to render it a fully revenue neutral tax. This observation is further supported by a statement of the Minister suggesting that the carbon tax is a means of broadening the tax base and that the revenues so derived from the implementation of the tax will assist, to some degree, in alleviating the deficit currently in existence in Ireland. This tax is expected to yield €330m per annum.

The tax applied to petrol and auto-diesel with effect from midnight, 9 December 2009; and from 1 May 2010 to Kerosene, Marked Gas Oil, Liquid Petroleum Gas (LPG), Fuel Oil and Natural Gas. The application of the tax to coal and commercial peat is subject to a Commencement Order.

Exemption from the tax will apply only to participants in the EU Emissions Trading Scheme (ETS) in respect of fuels so covered by that Scheme. On that basis, electricity is not currently subject to the carbon tax.

It is estimated that the overall direct impact on households will be between €2 and €3 per week.

Measures are being put in place aimed at improving energy efficiency in low-income households, particularly those dependent on solid fuels.

Accounting and payment of the carbon tax in respect of transport fuels will be required to be made by the 15th day of the following month.

The impact on individual fuels in terms of nominal and percentage price changes is illustrated below:

Fuel Type	**Unit**	**Current Price €**	**CarbonTax at €15 (VAT incl)**	**% change in Price**	**Revenue Yield in a Full year (VAT incl) €m**
Petrol	Litre	1.19	4.2 cents	3.50%	75
Auto-diesel	Litre	1.1	4.9 cents	4.40%	92
Kerosene	1,000	516	€ 43.14	8.40%	47

	Litres				
Marked Gas Oil	1,000 Litres	539	€ 46.87	8.70%	43
LPG	1,000 Litres	720	€ 27.97	3.90%	4
Fuel Oil	1,000 Litres	600	€ 52.15	8.70%	1
Natural Gas	13,750 kWh	800	€ 47.86	6.00%	47
Peat Briquettes	Bale	3.85	39 cents	10.10%	6
Coal	40kg	16.2	€ 1.79	11.10%	15

France

In September 2009, French President Nicholas Sarkozy proposed the implementation of a carbon tax of $24.74 (€17) per metric ton of CO_2 on fossil fuels such as gasoline, gas, and coal (Sarkozy, 2009)

It was envisaged that the tax would add (to the price) $0.07 (€0.045) for each litre of diesel, $0.06 (€0.04) for each litre of gasoline, and $0.006 (€0.004) for each kWh of natural gas consumed (Keller, 2009). Sarkozy expected the tax to raise $4.499 billion (€3 billion). (Sarkozy, 2009) (Sumner, Bird, & Smith, 2009)

The proposed French carbon tax was scheduled to be signed into law on 1 January 2010. However, in a last minute Constitutional Coucil ruling, the tax was found to be unconstitutional and thrown out. The Council found that the enabling provisions as embodied in the 2010 National Budget of France were unconstitutional on two grounds: Firstly that the exemptions contained within the provisions for a carbon levy violated the primary declared purpose of the levy, being to combat carbon emissions and hence "global warming"; and secondly that the exemptions would cause the levy to fall disproportionately on gasoline and heating oils and not on other carbon emissions, thereby breaching the principle that taxation should be evenly and fairly borne.

The information contained in the review of the French proposal for a system of carbon tax was derived from the 2010 National Budget of France. And the associated Bill embodying the proposed carbon tax.

Article 7 of the law instituting a carbon levy explicitly stated that the objective of the levy was to significantly reduce carbon emissions in the fight against global warming. In order to achieve this end, the option to impose an additional tax on the consumption of fossil (energy) fuels was taken so as to encourage enterprises, households and governments to reduce such emissions.

However, Articles 7 and 10 of the Act instituted exemptions, reductions, reimbursements, partial redemptions and specific rates which had the effect of exempting carbon emissions resulting from:

- thermal energy generating activities,
- the production of electricity, as France's electricity is primarily carbon free (approximately 80% nuclear and approximately 10% hydroelectric). In addition, the electric sector is covered by the European Union's Emissions Trading System.
- eighteen thousand of the country's most polluting industrial sites such as refineries, coke , cement and glass factories,
- products manufactured for dual use,
- energy used in electricity consumption,
- products used by aircraft, excluding private pleasure craft
- energy consumed in the public transportation of air and road passengers,
- Products intended for use by facilities subject to the quota of emissions of greenhouse gases under Directive 2003/87/EC of the European Parliament,
- A method used in manufacturing non-metallic mineral products,
- Products used for international shipping, other than on board vessels or private yachts. However, for any form of shipping made exclusively in French territorial waters, the rate of contribution is reduced by 35% compared to the rates normally applicable to energy products used, and
- Products used in overseas departments until 30 June 2010

In addition, emissions resulting from agricultural activities, maritime transport, fishing industries, as well as road freight and shipping enterprises, were to be taxed at a reduced rate.

The result of the above mentioned exemptions and reductions in the rates of levying the tax would have been that 93% of industrial emissions, excluding those related to the production of petroleum and related fuels were exempt from the carbon contribution.

The overall impact of such exemptions would have been to subject only half of the total amount of greenhouse gases emitted to the carbon tax. This would have led to the focus of the carbon tax falling solely on the carbon dioxide emissions caused by fuel and heating products. As stated directly in the proposed carbon tax provisions: "Any product, including certain hydrocarbons, used or to be used or sold as motor fuel or an additive to increase the final volume of motor fuel is subject to the contribution to carbon tariff equivalent to the carbon content of the fuel where it is incorporated."

Undoubtedly, it was the blatant discrimination between the different classes of carbon dioxide emitters that prompted effected parties to approach the Council and demand the withdrawal of the proposed tax. For industrial activities, it was found that such exemptions were not justified by the quota system of greenhouse gas emissions as determined by the European Union, as such quotas are allocated free of charge. In other words, the exempted entities were not already being subjected to a carbon contribution that warranted their exemption from the proposed carbon tax.

The Council therefore found that, by their importance and effect on the equitable distribution of the carbon tax so proposed, the exemption provisions embodied in the proposed law were contrary to the initially stated objective of reducing greenhouse gas emissions in the fight against global warming and thus created a divide characterized by the unequal sharing of the public burden of the newly proposed carbon tax.

This finding resulted in the withdrawal of the proposed carbon tax on the grounds of it being unconstitutional for the reasons outlined.

The carbon tax was to be made payable by the same people who owe taxes levied on conventional domestic consumption, in other words, the event of paying tax and chargeability of that tax would be tantamount to those applicable to taxes such as domestic

consumption taxes.The Bill also stated that within three months following the entry into force of this Act, a committee monitoring the carbon contribution is to be established. It would have a mandate to assess the effectiveness of this contribution and give an opinion on the determination of its base and changing its rate. The composition and tasks of the Committee are specified by Order in Council of State.

In order to achieve revenue neutrality, the proposed system included a provision providing for a lump sum tax credit of €46 to be receivable by individual taxpayers who are tax resident in France. This amount was to be raised to €61 if the taxpayer was domiciled at 31 December of the tax year in a town that is not integrated with a perimeter of urban transport. This tax credit relief was to be doubled for couples who were subject to joint taxation, and increased by €10 per dependent, but the increase of €10 was to be divided in half for children who were deemed to have a carbon footprint equal to one another and their parents.

The tax credit was to be offset against the income tax after the deduction of tax cuts mentioned in other parts of the 2010 Budget, after the deduction of other tax credits available to the taxpayer and deductions or withholdings not yet discharged. If the credit under the carbon tax system exceeded the tax due, the excess would have been returned to the taxpayer.

The date of determination of the carbon tax payable and credits receivable was to be the 31st of December each year.

For non natural taxpayers, a refund system was proposed that would have seen the parties subject to the carbon tax receive a refund equal to 75% of the contribution rate applicable to each ton of carbon dioxide produced. The percentage of this refund was to be reassessed each year depending on the effectiveness of the implementation of the system so proposed.

Following the rejection of the first carbon tax regime proposed by the French Government, a communication from the Government was presented to the Cabinet (January 20, 2010) concerning a remodelled carbon tax.

The communication announced that the State will consider the (re)creation of a carbon contribution the objective of which "will be to integrate the effects of emissions of

greenhouse gases into the systems price [and] will be strictly matched by lower tax burden in order to preserve the purchasing power of households and business competitiveness. "

It was stated that the principle of such a contribution will not be affected by the decision of the Constitutional Council of 29 December 2009 on the Finance Bill announced for 2010. The Government also said that it believed that the quota system of CO_2 emissions (as determined and administrated by the EU), and free allocation until 1 January 2013, did not justify the complete exemption of carbon contribution payable by such entities.

The Government conceded to the decision of the Constitutional Council and, while being careful to preserve the competitiveness of enterprises and the essential public interest recognized by the Constitutional Council, announced that a new device for implementing a system of carbon taxes will be submitted to Parliament for entry into force on 1 July 2010. The announcement suggested that the new proposal will include the main aspects and characteristics of the system previously passed by Parliament.

For instance:

- The price of carbon contribution will remain at 17 euros per tonne of CO_2;
- For households, the device will remain unchanged, based on the principle of bonus-malus;
- For firms in sectors not subject to the system of allowances, the implementation of the carbon contribution, combined with reform of business tax, will incentivise investment into pollution reduction technologies, thus enhancing their competitiveness. For certain sensitive sectors and energy intensive ones, specific transitional measures will be maintained. For example, agriculture and fisheries (taxed at 25% of price) or road transport, maritime and inland waterway freight (taxed at 65% of tariff).

A carbon contribution will be applied, in terms of the new proposal, until 1 January 2013 to companies subject to the system of emission allowances. Special mechanisms for certain sensitive sectors will be established to preserve the competitiveness of enterprises.

In conjunction with the above mentioned activities, the Government will put forward, to the Community authorities, the establishment of a European contribution to carbon and a carbon tax on cross border commercial activities within the European Union so as to

internalize the price of products imported with their own carbon cost, which would establish a fair and competitive environment for businesses operating in Europe.

Chapter 5: A Comparative Analysis

As described in the introduction section of this paper, there are several key variables on which one can compare various systems of carbon taxation and evaluate the merits thereof whilst always bearing in mind the unique characteristics of the country in which the specific carbon tax is being levied.

A summary of the variations in those key variables between the various systems is presented below.

	Australia	New Zealand	Finland	Sweden	British Columbia	Ireland	France
Date of Enactment	This system is still in proposal form.	Not Enacted	1990	1991	July 1, 2008	December 9, 2009	Proposed, rejected on the basis of being unconstitutional. An amended draft Bill is currently in proposal form.
Initial rate of tax	AUS$15 per tonne of CO2e (carbon dioxide equivalent), Alternatively, a $30 per tonne CO2 carbon tax could be used to fully offset all currently enacted fuel taxes	NZ$15(equivalent to $10.67 (of U.S.) per ton of carbon (based on conversion rate of USD 1.00 = NZD 0.71)) a tonne CO_2-equivalent emissions	Mk 6.66 ($1.45) per metric ton of CO2	$44.37 (250 SEK) per metric ton CO2.	$10 (Canadian) per metric ton of carbon dioxide (US$9.55 equivalent)	€15 per tonne (of CO2 emitted)(US$21.50 equivalent)	$24.74 (€17) per metric ton of CO2
Amendments	n/a	Not enacted as a change in government determined that the carbon tax would not cut emissions enough to justify the costs, and the tax was abandoned	Originally based only on carbon content, it was subsequently changed to a combination carbon/energy tax, based on a 60/40 carbon/energy content, the energy content portion being 3.5 Mk per MwH ($0.21 per gigajoule). In January 1997, however, Finland returned to a pure carbon tax. The tax was raised to Mk 13.59 ($2.96) in 1993 and to Mk 38.3 ($8.34) in 1995	Sweden modified rates such that industry paid only $11.28 (80 SEK) per metric ton while other consumers paid $45.15 (320 SEK) per metric ton in 1993. The standard rate was $55.57 (370 SEK) per metric ton in 1996, and between 1999 and 2003, the standard rate rose to $104.83 (910 SEK) per metric ton while the rate for industry levelled off at approximately $23.04 (200 SEK) per metric ton	n/a	n/a	n/a

Scope of the Legislation	n/a	Recent developments see the country moving towards a cap and trade system	The carbon tax applies to gasoline, diesel, light fuel and heavy fuel oil, jet fuel, aviation gasoline, coal, and natural gas		The carbon tax applies to the purchase or use of fossil fuel within the province. Therefore, the tax is applied primarily to transportation fuels, natural gas, and fuels used in industrial processes. The tax base includes fuel used to generate heat for households and industrial processes such as producing cement and drying coal. In addition, the carbon tax applies to road, rail marine, and air transportation within British Columbia	Applies to petrol and auto-diesel with effect from midnight, 9 December 2009; and from 1 May 2010 to Kerosene, Marked Gas Oil, Liquid Petroleum Gas (LPG), Fuel Oil and Natural Gas. The application of the tax to coal and commercial peat is subject to a commencement order.	Fossil fuels such as gasoline, gas, and coal
Rate of Tax	n/a	The tax applies to all major greenhouse gas emissions, , provided that doing so would be feasible and cost effective. Most importantly, the tax was going to be aimed at New Zealand's emissions from fossil-fuel based energy supply and use, industrial process emissions, and fugitive energy emissions of carbon dioxide, methane and nitrous oxide, including	€18.05 per tonne of CO2 (€66.2 per tonne of carbon) or $24.39 per tonne of CO2 ($89.39 per tonne of carbon) in U.S. Dollars, an alternate source puts the tax at $30 (€20) per metric ton CO2	$150 per ton of carbon	July 1, 2009, $15/tonne	€15 per tonne (of CO2 emitted)(US$21.50 equivalent)	n/a

		perfluorocarbons (PFCs) that result from industrial processes. The tax would only be applied if emissions exceeded NZ$2000 pa					
Exemptions	n/a	Methane and nitrous oxide from the agricultural sector, owing to the administrative and logistical considerations involved in applying the tax to such emissions Relief from the tax would have been provided under the terms of Negotiated Greenhouse Agreements (i.e. other measures in place); on export of fossil fuels; and when carbon is permanently embedded or sequestered, (other than in biomass).	Industry raw materials and fuel for aeroplanes and certain vessels is exempt. Energy produced from peat is also exempt	No tax is applied to fuels used for electricity generation. Industries, including manufacturing, agriculture, co-generation plants, forestry and aquaculture, pay a lower proportion of the general level in that they are required to pay only 50% of the tax. Fuels from renewable sources such as ethanol, methane, biofuels, peat, and waste are exempted	Inter-jurisdictional transportation is exempt from the carbon tax. Non fossil fuels such as biomass fuels or biofuels, which include firewood, woodwaste, ethanol, bio-diesel and bio-heating oil	Exemption from the tax will apply only to participants in the EU Emissions Trading Scheme (ETS) in respect of fuels so covered by that Scheme. Therefore electricity is not subject to the carbon tax.	Carbon emissions resulting from: · thermal energy generating activities, · the production of electricity, as France's electricity is primarily carbon free (approximately 80% nuclear and approximately 10% hydroelectric). In addition, the electric sector is covered by the European Union's Emissions Trading System. · eighteen thousand of the country's most polluting industrial sites such as refineries, coke , cement and glass factories, · products manufactured for dual use, · energy used

							in electricity consumption, · products used by aircraft, excluding private pleasure craft · energy consumed in the public transportation of air and road passengers, · Products intended for use by facilities subject to the quota of emissions of greenhouse gases under Directive 2003/87/EC of the European Parliament, · A method used in manufacturing non-metallic mineral products, · Products used for international shipping and intra, other than on board vessels or private yachts. However, for shipping made exclusively in French territorial waters, the rate of contribution is

							reduced by 35% compared to the rates normally applicable to energy products used, and · Products used in overseas departments until 30 June 2010 were exempt under the first proposed Bill In addition, emissions resulting from agricultural activities, maritime transport, fishing industries, as well as road freight and shipping enterprises, were to be taxed at a reduced rate.
Administrator	n/a	Inland Revenue Service of New Zealand and the New Zealand Customs Service	Finish Tax authority	Swedish Revenue Authority	BC Revenue Authority	Irish Revenue Authority	French Revenue Authority
Credits	n/a					A vouched fuel allowance scheme will be developed to offset the increases for low income families' dependant on such fuels.	
Returns of Revenue	The revenue so collected could be used to increase the income-tax-free threshold to	Revenue neutral with the revenues derived from the tax being used to lower other taxes,	None, all revenue from the carbon tax in Finland goes directly into the	None, all revenue from the carbon tax in Sweden goes directly into the	Revenue Neutral: Carbon tax revenues are being returned to taxpayers through	Through the maintenance or reduction of payroll taxes	The proposal indicated that the tax would be accompanied by a

	$10,000 or to drop the top marginal tax rate to 30%; or used to fully offset all current fuel taxes	resulting in a tax shift benefit for taxpayers.	general central government budget	general central government budget	personal income and business income tax cuts brought about by 'tax shifts'	€50 million of the carbon tax yield will be used to fund measures such as help for households at risk of fuel poverty to make their homes warmer	reduction in taxes for households and businesses or repaid through a "green cheque"
Annual Revenue Produced	n/a	n/a	$750 million (€500 million) annually	$3.65 billion (25 billion SEK) annually in 2005, 2006, and 2007	Carbon tax revenues for the 2008-2009 fiscal year were $292 million (C$306 million). The tax is expected to raise $531 million (C$557 million) in the 2009-2010 fiscal year, $714 million (C$748 million) in the 2010-2011 fiscal year and $911 million ($955 million) in the 2011-2012 fiscal year	Expected to yield €330m per annum.	Expected that the tax to raise $4.499 billion (€3 billion)
Consequences of the Tax	n/a	n/a	According to Finnish government studies, CO2 emissions are five percent lower than they would be without the tax. The government says that the tax has stimulated investment in renewable energy technology such as biomass gasification. However, industry representatives claim "that this tax is just another way to increase budget revenues." IER,	The Swedish Ministry of the Environment estimated that CO2 emissions fell about 15% between 1995 and 1990 because of the tax (Johansson 2000). In terms of overall emissions, Sweden saw GHG emissions fall by almost 9% between 1990 and 2006. In December 2008, Sweden reported that GHG emissions have fallen by more	In 2008, the carbon tax was estimated to be an additional $0.0223 (C$0.0234) per litre of gasoline. The tax will increase to approximately $0.0637 (C$0.0667) per litre in 2012. Natural gas is taxed at $0.47 (C$0.50) per GJ, and coke is taxed at $23.74 (C$24.87) per metric ton. It was estimated that the tax would reduce emissions by 3	It is estimated that the overall direct impact on households will be between €2 and €3 per week. The yield from the carbon tax will be used to boost energy efficiency, to support rural transport and to alleviate fuel poverty	The tax would add $0.07 (€0.045) for each litre of diesel, $0.06 (€0.04) for each litre of gasoline, and $0.006 (€0.004) for each kWh of natural gas consumed

			February 8, 1995	than 40% since the mid-1970s. (Ministry of the Environment, Sweden 2008)	million metric tons annually by 2020 (Ministry of Finance, British Columbia 2008).		

Chapter 6: A Proposed Best Practice for a South African Context

Important considerations in attempting to establish a best practice for South Africa pertain to the current levels of carbon emissions and the steps currently taken by those in power to address and potentially mitigate the threat of climate change.

Emissions and Currently Enacted Emissions Related Legislation

Emissions in South Africa

The significant cause of CO_2 emissions in South Africa is the burning of coal as the main natural resource for energy. Of the total energy consumption of about 5.0 quadrillion Btus, 75.4 percent is coal, 20.1 percent oil and the rest is accounted for by natural gas, nuclear, hydroelectricity and other renewable energy sources. (Devarajan, Go, Robinson, & Thierfelder, 2009) Although crude oil is mainly imported, 40 percent of total oil consumption is currently accounted for by synthetic liquids processed from coal and gas. As a result of this pattern of energy use, 85 percent of the energy-related CO_2 emissions were attributed to coal in 2003 and only about 12 percent is due to oil and a very small amount (1 percent) is due to natural gas

Expanding this analysis further, one can show that the sectors of the economy that produce the highest amounts of carbon emissions in South Africa are the manufacturing activities that use the most coal or electricity. Transportation, both public and private, follows in second position due to the utilization of petroleum. There is an important distinction to be made between the using of electricity in general activities and the actual production of such electricity. The latter, owing to its overwhelming dependence on coal as an input, is the largest emitter of CO_2 in South Africa, accounting for 48 percent of the total CO_2 emissions. (Devarajan, Go, Robinson, & Thierfelder, 2009) Devarajan *et al* goes on to state that *a*ctivities undertaken to produce and manufacture metallic products are also to blame due to their use of coal to fire up furnaces, emitting about 22 percent of the CO_2 emissions as a group. In addition the transportation sector combined with household use of petroleum accounts for 10.5 percent of total CO_2 emission. They noted that households by themselves contribute about 9 percent and that other sectors producing observable levels of CO_2 emissions include the chemical sectors, rubber, water supply, other mining, and food manufactures. A point worth noting is that even though using petroleum as an energy input

is fairly pollutant, second only to coal in terms of its CO_2 coefficient, the sector producing crude oil in South Africa hardly emits any carbon emissions because all crude oil is imported, its pollution being generated outside the country (Devarajan, Go, Robinson, & Thierfelder, 2009)

Legislation aimed at Environmental Reform in South Africa

All Information regarding the existing taxes and levies imposed in South Africa and classified as 'environmental taxes was obtained from the Tax Proposals 2009/10 guide as developed by the South African Revenue Service (SARS). (The South African Revenue Service, 2010)

Current legislation provides for a three year 50:30:20 per cent accelerated depreciation allowance for investments in renewable energy and bio fuels production. It was proposed in the 2009 Budget that investments by companies in energy-efficient equipment should qualify for an additional allowance of up to 15 per cent on condition that there is documentary proof of the resulting energy efficiencies (after a two- or three-year period), certified by the Energy Efficiency Agency.

A levy on plastic shopping bags was introduced at 3 cents per bag in 2004/05.The 2009 Budget again brought about an increase in the levy to 4 cents per bag from 1 April 2009.

The introduction of an environmental levy on incandescent light bulbs to promote energy efficiency and reduce electricity demand was proposed in 2009. It is suggested by the government that energy-saving light bulbs last longer, require five times less electricity and result in lower greenhouse gas emissions. It was recommended in 2009 that an environmental levy of about R3 per bulb (between 1 cent and 3 cents per watt) be levied on incandescent light bulbs at the manufacturing level and on imports from 1 October 2009.

South Africa has responded to the concept of clean development mechanisms (CDMs) established in terms of the Kyoto Protocol which allow for certified emission reductions (CERs) to be issued to recognise progress in reducing the release of greenhouse gases into the atmosphere. There is, however, uncertainty with regard to the income tax treatment of CERs, which may be one reason for the slow take-up of clean development mechanism projects in South Africa. In an attempt to alleviate such confusion, s 12K was introduced into the South African Income Tax Act, which had the effect of exempting income derived from the disposal of primary CERs. However, where CERs are to be classified as trading

stock, they are classified as secondary CERs and do not enjoy the s 12K exemption, but are rather taxed as ordinary trading stock. However, this seemingly simple section has far reaching consequences that have further slowed the uptake of investment in CDMs. One of the most striking implications of exempting the incomes derived from the sale of CERs, is that the costs incurred in establishing the means by which such CERs are produced will not be deductible for tax purposes. The reason for the non-deductibility of these costs being that they are incurred in the production of exempt income, in other words not incurred in the production of income as defined and hence not deductible under the general deduction formula of the Income Tax Act, 1962. S 23(f) also places a specific prohibition on the deductibility of expenditure incurred in respect of any amounts received or accrued which do not constitute income as defined. Such a reality represents a major drawback for potential investors in CDM projects, as it takes between two and five years for CDM projects to become revenue producing which would be the first time that an incentive would accrue in the form of tax benefits exempting the income so derived.

Policy measures to address the environmental and social costs associated with the transport sector, such as reforms to vehicle and fuel taxation, seek to promote fuel efficiency, limit the rapid growth of the number of vehicles on the roads and encourage the use of public transport. Improved fuel efficiency is important in curbing the growth in greenhouse gas emissions.

After the increases announced in the budget, the total levy on 93 octane petrol amounted to R2.44 (or 32%) of the R7.85c per litre pump price, and R2.29 (or 33%) of the R7.01 per litre pump price for diesel.

It was recommended in the budget that the existing ad valorem excise duties on motor vehicles be adjusted to incorporate CO_2 emissions as an environmental criterion from 1 March 2010.

The current "luxury" ad valorem excise duties on new motor vehicle sales (passenger cars and light commercial vehicles) are based solely on price.

The 2009 Budget introduced a CO_2 emissions tax on new passenger motor vehicles purchased. The 2010 Budget recommended that the original basis of tax be transformed into a flat rate of CO_2 emissions tax effective from 1 September 2010. The overriding motivation behind this tax is to influence the composition of the country's vehicle fleet to

become more energy efficient and environmentally friendly. This emissions tax will initially only apply to passenger motor vehicles, but will become applicable to commercial vehicles once the appropriate rates are agreed to.

From the above, it can be seen that only certain items are subject to environmentally motivated levies and taxes. Furthermore, such levies and taxes are aimed at the end consumer level

The taxes identified and outlined above raise some important questions; firstly, is enough being done to mitigate emissions of greenhouse gases into the atmosphere, and secondly, what are the revenues derived therefrom being used for?

The answer to the first question seems to be no. Based on the statistics for 2003, one can see that energy derived from coal consumption and resulting carbon emission are by far the most significant contributors to our total carbon footprint, yet no taxes are levied on such processes at the phase of initiation. One does not have to look far to see that the country is not focused on replacing its coal fuelled power stations with those fuelled by renewable energy sources.

Recently, the obtaining of a loan from the World Bank to build a coal fuelled power station suggests that the country is sticking to methods of energy production that utilize fossil fuels. The World Bank granted a US $3.75 billion project loan to Eskom, South Africa's power utility. The rate is at 6 month LIBOR + 0.5% fixed margin and a variable spread of 0.24%, to be reset semi-annually. The maturity is 28.5 years with a grace period of 7 years. It is envisaged by the authorities that the loan will be used to co-finance the Medupi power station and the country's first large wind and concentrated solar power (CSP) projects. Medupi's cleaner coal supercritical technology together with the country's first renewable energy projects, are a critical part of South Africa's responsible approach to mitigating the issues caused by carbon emissions (National Treasury, 2010) It is however, difficult to accept that current investments in projects utilizing 'dirty fuels' for the production of energy can at all be in line with a country's commitment to reducing carbon emissions. Surely the message must be read as implying that the consequences of current (investment) actions will be dealt with in the future, when, it is submitted, it might be too late to undo the harm already done.

Secondly, there is no apparent mechanism in place for returning the revenues derived from the levies and taxes currently labelled as those targeting environmental reform (The South African Revenue Service, 2010). Such revenues are not flagged for specific uses and as a consequence it must be assumed that they are aggregated with other revenue sources in the general government budget.

It must be noted that certain proceeds from the loan obtained from the World Bank, as described earlier, will be used to fund the country's first large wind and concentrated solar power (CSP) projects. It is startling that no internal revenues, as derived from the levies implemented to reduce carbon emissions, have been designated for this or other projects of a similar nature. These measures, as misguided as they might be, will need to be considered when designing and implementing a carbon tax, as failure to do so will result in consumers bearing the brunt of such environmental levies as well as the system of carbon taxes so implemented

The Proposed Best Practice

In describing a proposed best practice for South Africa in terms of implementing a carbon tax, an objective factual reflection of the characteristics of carbon tax systems, both in theory and practically speaking, has been used to generate the proposal.

Initial rate of tax

Without question, the primary objectives behind implementing a carbon tax are to reduce carbon emissions and motivate all parties to move towards cleaner, greener and renewable sources of energy. But if in addition to this main principle, one considers the socio-welfare implications of the tax as being of critical importance, then the characteristics of the tax will need to account for these factors. As a result there are two main and interdependent considerations that need to be dealt with in setting an initial rate of tax. Firstly, how strong a signal is deemed necessary to ensure that consumers begin to change their behavioural patterns, and secondly what will be done with the revenues so derived. It may seem that the considerations relating to the revenues collected from the tax occur at the other end of the scale in terms of implementing the tax, but in truth they are vital in setting the rate of tax at the correct level.

In Australia, the rate proposed expanded on the second consideration and contained two variations depending on the means intended to be achieved by the implementation of the tax. The proposed rate was determined by taking the revenue required to achieve an

increase in the income-tax-free threshold to $10,000 or to drop the top marginal tax rate to 30%, estimating the total emissions levels to be subject to the tax, and solving for the applicable rate that would ensure such revenue levels were generated. In a similar manner, but merely by altering the desired welfare consequence of the tax, it was suggested that a $30 per tonne CO_2e carbon tax could be used to fully offset all the current fuel taxes in existence in Australia.

Adopting a different approach, the officials in British Columbia sought to introduce their version of carbon tax at a relatively low rate (C$10) and gradually increasing this initial rate by C$5 per annum reaching a target rate of C$30 in 2012. This method of implementation allowed consumers and businesses firstly to adapt gradually to the idea of a carbon tax and secondly to take higher future energy costs into account when making decisions of a long term nature. Thus in this case the motivation was also to protect those affected by the tax, but the approach taken to set the rate used the rate as the starting point working towards the revenues, and not the revenues so derived to establish the rate.

It is submitted that, owing to the relatively high levels of fuel levies in place in South Africa, accounting for approximately 33% of the total fuel price, it would be desirable to adopt an approach such as the one suggested in Australia, where the rate is set at a level that will allow for a full reduction in fuel levies. Alternatively, it may be considered more equitable to phase in the tax gradually per the British Columbian (BC) approach and consequentially reduce the fuel levies over time as opposed to entirely upfront. As noted, the effectiveness of the rate decided upon, and the public's response thereto depend significantly on the interplay between that rate and the manner of relief provided for by the returning of revenues.

Scope of the Legislation, including Exemptions

As a general rule, the carbon tax should be applied to the purchase or use of fossil fuels within the country of question. This would include transportation fuels, natural gases, and fuels used in industrial processes (Sumner, Bird, & Smith, 2009). The tax base should include fuels used to generate heat for households and industrial processes such as producing cement and drying coal and all road, rail marine, and air transportation occurring within that country

It is submitted that the tax base be made as broad as possible, following the approach adopted in BC and therefore subjecting consumption of all fossil fuels to the tax.

Exemptions from the application of the tax should, as per the system in BC, be considered necessary only when required for integration with other climate action policies in the future and for efficient administration of the tax. That is to say that, the only fuel types not included in the tax base are those that do not qualify as "fossil fuels." Examples of such fuels types are referred to as biomass fuels or biofuels, firewood, woodwaste, ethanol, bio-diesel and bio-heating oil. The motivation behind exemption of the emission of CO 2 produced from the combustion of biomass is because the carbon released by combustion was first drawn from the atmosphere by the plants through the process of photosynthesis and have thus, in their own right, already served to reduce the extent of carbon emissions in the atmosphere.

Expanding on the point noted by BC concerning the efficient administration of the tax, in New Zealand the proposal allowed for the exemption from the tax of methane and nitrous oxide emitted by the agricultural sector owing to it not yet being feasible and cost effective to tax such emissions. Thus it is essential that the logistical and practical considerations of actually administering a carbon tax are taken into account when determining the scope of the emissions subject to the tax.

South Africa would therefore have to identify, by way of preliminary study, those emissions sources that are not cost efficient or indeed practical to administer.

South Africa should also focus on internalizing of the cost of combustion and resulting emissions by only taxing the emissions produced from burning fossil fuels within the country. Thus, by following the example of BC, South Africa should exempt certain fuel uses that do not result in emission of GHGs in this country. Such exemptions may apply to inter-jurisdictional commercial marine and international aviation transport services, as well as fuel and fossil fuels that are to be exported.

It is crucial to the effectiveness of the carbon tax system that decisions concerning the granting of exemptions are economically viable and socially acceptable. Failure to do so will facilitate anticompetitive behaviour, prejudice certain industries and erode the integrity and transparency of the system so implemented. As one might learn from the first proposal embodying a French carbon tax, inequitable and potentially abusive exemptions and rebate provisions will be considered to go against the objective of a system of carbon tax and may even result in the proposal being ruled unconstitutional. As discussed, this

system was deemed to be unconstitutional on two grounds: namely that the exemptions contained within the provisions for a carbon levy vitiated the primary declared purpose of the levy, to combat carbon emissions and hence "global warming"; and that the exemptions would cause the levy to fall disproportionately on gasoline and heating oils and not on other carbon emissions, thereby breaching the principle that taxation should be evenly and fairly borne.

The potential for discriminative exemption provisions finding their way into a South African carbon tax system is certainly a reality. Eskom, the sole supplier of electricity is a para-statal entity as noted previously and as such therein lies the motivation for the government to reduce the burden that would otherwise be imposed by the tax. Owing to the statistics presented above, an exemption pertaining to the production of electricity would almost single handedly undermine the effectiveness of the tax. In addition Sasol, the largest petrochemical manufacturer and refinery in South Africa is also an entity in which the government has an ownership interest. In 2009, the emissions resulting from its activities, as measured in carbon dioxide equivalent, amounted to 71.3 million tonnes (News24, 2009)

A consideration that South African authorities would need to engage with is whether to enforce the tax on upstream or downstream sources of targeted emissions. It has been noted that arguments exist for the implementation of the tax at either of these stages. Taxing upstream sources is believed to facilitate an administratively efficient method of tax collection, while taxing downstream sources such as electricity and fuel consumption has the effect of providing a more direct signal to consumers (Metcalf & Weisbach, 2009). BC imposes and collects the tax at a wholesale level preferring this method as it reduces the cost of the administration of the tax to the government as well as the compliance cost to those collecting the tax on government's behalf. This method of collection is almost identical to that applied to motor fuel taxes in BC, and as such may be the most desirable path for South Africa to follow owing to our experience with motor fuel levies and taxes.

If this approach is found to be undesirable, then it is suggested that the tax be implemented as far upstream as is practical. This would be at the point where possession of the carbon-bearing fuel passes from the "producer" (e.g., coal mine; oil wellhead or tanker; gas wellhead) to the immediate next entity in the supply chain (e.g., coal shipper or utility; oil refiner or importer; natural gas pipeline) (Komanoff & Rosenblum, 2007).

A final refinement to the design of the tax base would be to provide the opportunity for partial or total rebate of the tax payments if the paying entity can prove that some or all of the carbon emissions will be prevented from entering Earth's atmosphere permanently (Komanoff & Rosenblum, 2007). The motivation for including such rebate considerations is that they have the advantages of:

- Providing for a fair and workable treatment of "partial combustion" which will vary by user and use (for example: unburned coal in ash that is returned to the mine for underground disposal; possibly also cement manufacturing, and plastics manufacture).
- Creating positive incentives to minimize emissions.
- Placing the burden on the fuel producer to demonstrate emissions avoidance thereby reducing the administrative complexities of the system. (Komanoff & Rosenblum, 2007)

Collector/Administrator

Virtually all of the carbon tax systems reviewed have been implemented as an extension of existing structures as administered by the respective countries revenue and customs authorities where appropriate. Thus in keeping with the example of those that have gone before, it is envisaged that the South African Revenue Service (SARS) will serve as the administrator of the carbon tax. SARS has a customs division that too could be used to facilitate the application of the tax on fossil fuels imported into the Republic for domestic use or consumption .

The motivation for using the standard rules as applied by the respective revenue authorities in handling other taxes and extending their application to the carbon tax mechanisms, as suggested in the New Zealand proposal, is to ensure that the carbon tax is fully integrated into the existing systems of tax, thereby facilitating an efficient and effective adoption process. A corroborative reason is that certain of the methods envisaged to return revenues to those effected, include tax shifting arrangements and certain 'green cheques' which by their very nature will apply to registered taxpayers. Common administration of the carbon tax with other taxes will facilitate the interplay between the levying of the carbon tax and the returns of revenues through the reduction of other taxes, without the need to involve other parties in a cross communication of information that may very well detract from the efficiency and integrity of the process.

As alluded to earlier, there may be a need for collaboration with audit firms to ensure that the emissions levels report by taxable entities are certified and that the tax is thus based on actual emissions levels. There may be a valid argument for requiring the entities affected by the tax at the level at which it is implemented to report in their annual financial statements so as to promote the transparency of the tax and ensure that those emitting GHGs are held to account.

Returns of Revenue

Revenues from carbon taxes are directed in different ways. Revenues can be (1) directed specifically to carbon mitigation programs, (2) directed to individuals through measures, such as reductions in income taxes, or (3) used to supplement government budgets (Sumner, Bird, & Smith, 2009)

The systems in Finland and Sweden make no provision for the returning of the revenues from the tax to those affected by it (it is believed however, that the Finnish carbon tax is accompanied by reductions independent cuts in income taxes (Sumner, Bird, & Smith, 2009)). This, it is considered, is a less than desirable outcome and one that should most certainly be avoided in a South African context. Although the temptation exists for the South African authorities to expand their tax base in light of a cumulative deficit for the year to date of R10,9bn as reported on 31 May 2010 (Businessday, 2010) and use the revenues collected from the carbon tax to reduce the deficit, it is proposed that such a result would be disastrous in a South African Context. Firstly an approach as described would imply that the main motivation behind implementing the tax is to increase government revenues without consideration for the effect of carbon emissions on climate change. Secondly, the welfare implications would be severe and lower income households would suffer at the hands of the tax. The inflationary implications of the tax would drive prices of affected goods higher and no supplementary income would be available to individuals and corporations. And finally, there would be no guarantees that the revenues so derived would be used for infrastructural development of cleaner technology and renewable energy sources.

It is submitted that the single most important characteristic of a carbon tax is the manner in which it provides for mechanisms to return the revenues so derived to those affected by the tax. This characteristic, as has been shown, has consequential implications for almost every

other aspect and component of the tax. It is essential to any South African carbon tax proposal that the tax is entirely revenue neutral.

For South Africa, it is proposed that the mechanism to be put in place to render the system of carbon tax as being revenue neutral be one that makes use of so-called "tax shifting" benefits. Examples of such tax shifts as proposed in Australia could result in the revenues from the carbon tax being used to increase the income-tax-free threshold above its current level or to drop the top marginal tax rate; or used to fully offset all current fuel taxes. As noted, owing to the high level of fuel levies in place in South Africa, it may be desirable to reduce such levies through the revenues derived from the carbon tax. Alternatively, and perhaps more equitable, the revenue neutrality of the tax could be achieved through a partial reduction in fuel levies accompanied by a reduction in payroll taxes as well. Thus, people who are not severely influenced by the fuel levies owing to their use of public and alternative means of transport might still benefit by paying less income tax.

While a valid argument exists for using the revenues from a carbon tax to develop cleaner technologies and invest in infrastructure that will stimulate the production of renewable sources of energy, it is submitted that such steps may take a significant amount of time to return the benefits to those affected by the tax, worsening the impact of the tax on all, especially the poor. In addition, the South African Government has shown limited interest in the development of such technologies an infrastructure and thus it is suggested that the mechanism adopted to transfer the benefits of the revenues of the tax back to those paying the tax, be that of a tax shifting arrangement.

Ensuring Emissions Reductions

It is proposed that South Africa compliment a system of carbon tax with intensive studies of the emissions levels as at the date of enactment of the tax and emissions target levels for the initial phases of the tax and into the short to medium term future. The reason for such studies is to ensure that the ultimate goal of reducing carbon emissions is not lost sight of, and that in setting the initial rate, as well as in contemplation of any future rate changes, the effect of the rate on the emissions levels is considered. Fundamentally, it is essential that there is some method of measuring carbon and other GHG emissions so as to ensure that tax is being effective and to note, if necessary, which areas need to be refined so as to achieve the original objectives behind the introduction of the tax.

Additional Factors:

Another very important consideration to bear in mind is the direction in which the international community is headed. If the current trends are sustained and it becomes an internationally accepted norm that countries have in place a mechanism for effectively combating the effects of climate change by reducing carbon emissions, South Africa may find itself in a situation where it has invested millions of Rands in technologies and infrastructures that are no longer considered acceptable by international standards. Trade barriers may also arise between South Africa and countries that have effectively internalised the cost of carbon emissions. Such countries would need to protect their domestic industries subject to the additional burden of a carbon tax and as such choose trading partners whose exports are similarly taxed. International pressure may go so far as to effectively ban the export of 'dirty' products, i.e. those derived from methods and practices that are not carbon efficient, and place a preference on products derived from 'clean' production processes so as to stimulate the demand for these products.

Questions will most certainly be raised by the general public as to the effect that such a tax would have on the cost of electricity to them. Such questions will be fuelled by the recent price increases experienced in South Africa as initiated by Eskom on all tariffs of 24.8% for the current financial year, with further increases of 25.8% and 25.9% following over the next two financial years respectively (Mail&Guardian, 2010). These prices increases come about as the para-statal finds itself struggling to cope with increasing demands for electricity amidst increasing input costs, ageing infrastructure and ever increasing maintenance requirements. From the government's point of view, the incremental impact on lower income households caused by higher electricity prices, resulting from the implementation of the tax and the need for additional working capital, will need to be assessed to ensure that the cash flow implications on such households are not dire. In light of the increases in electricity prices that are occurring independently of any carbon tax, the need for a completely revenue neutral carbon tax becomes essential. If this is not achieved, then the implementation of a carbon tax might just be the piece of straw that broke the back of the camel.

One might well question the steps that government will take in relation to those existing environmental taxes listed and described previously. If a carbon tax is implemented on top of such measures, consumers might bear the brunt of an effective economic double tax. Alternatively, and potentially more fairly, those in power may consider the taxes currently

in effect when setting the initial rate at which to introduce the carbon tax so as to allow them to effectively phase out those other taxes in the face of a single carbon tax. To maintain the other environmental taxes and levies while implementing a carbon tax would require careful drafting of the exemption, rebate and refund provisions of the governing legislation embodying the carbon tax so as to ensure that the same items are not taxed under various different statutes. As has been seen, extensive exemption provisions can be problematic and even err on the realm of becoming unconstitutional.

Conclusion

Amidst ever increasing global pressure in the face of climate change, South Africa must take an effective stand on the issue of carbon emissions and the consequential impact on the environment. For every day that passes, the problem worsens and a workable solution becomes more difficult to agree on and implement. A critical success factor of such a proposed solution will depend on the ability of the solution to change the mind sets of individuals and corporations in order to ensure an inclusive approach to combating the harmful effect of carbon emissions. In addition to the mindsets of individuals and corporations, it is essential that the governing powers understand from the very outset the purpose of the action plan adopted to mitigate GHG emissions, and do not attempt to utilise the vehicle proposed as a solution in order to achieve ulterior goals such as fiscal gain.

Various means of combating carbon emissions have been debated the world over and in certain countries, cap and trade systems have been determined as the most desirable means of achieving the stated objective of carbon emission reductions. However, it is felt that the complexities of such a system in terms of the design, implementation and administration thereof, coupled with the time lag that will prevail before a cap and trade system is implemented effectively, prejudice this alternative and render it inferior to the proposed course of action.

It is with the above in mind that the current paper proposes the adoption and implementation of a carbon tax as the means by which carbon emissions in South Africa can be controlled and at the same time preserve the attitudes of those affected towards this proposed solution. If those who are required to effectively carry the burden of the tax see it as nothing more than another tax aimed at filling a hole in the Government's coffers with no tangible benefit or respite being offered to them, the entire objective of the tax will be undermined and nothing more than dissatisfaction with the additional tax burden will prevail.

It is thus crucial to the successful implementation of the carbon tax that it be framed in such a way so as to allow for revenue neutrality with an effective and functional way of returning revenues derived from the implementation of the tax to those who bear the ultimate cost thereof.

A carbon tax that clearly defines the fossil fuels targeted, sets out the method of determination of the tax payable on each tonne of CO_2 released by the consumption of such fuels, clearly outlines the exemptions to the tax and explains how the revenues are to be returned to the taxpayers is suggested as the way forward in order to achieve a reduction in carbon emissions in the most efficient and effective way possible, while minimizing the welfare burdens of such a tax.

It is critical that lessons be learnt from the attempts of other countries to implement carbon taxes, and that such lessons, coupled with the uniqueness of the South African environment, be addressed and incorporated into the drafting of carbon tax legislation for South Africa.

South Africa is at a crossroads in terms of its response to global warming; and it is at this crossroads that the correct decisions need to be taken, and that decision, it is submitted, is to implement a carbon tax in the very near future.

Appendix A:

Carbon and hydrogen atoms are present in every fossil fuel — coal, oil and gas. The bond between carbon and hydrogen atoms is the primary source of energy from fossil fuels and of the heat released in fuel combustion. Essentially all carbon atoms are converted to CO_2 when the fuel is burned. Carbon dioxide, an otherwise non-lethal and innocuous gas, rises in the atmosphere and remains resident there, trapping heat re-radiated from Earth's surface and causing global warming and other harmful climate change. In contrast, non-combustion energy sources — wind, sunlight, falling water, atomic fission — do not convert carbon to carbon dioxide. Accordingly, a carbon tax (or CO_2 tax) is effectively a tax on the use of fossil fuels, and only fossil fuels. (The Carbon Tax Center)

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