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# Enhancing green tax measures in Hong Kong : a means of addressing the city's environmental problems

Yuzhu LU

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ENHANCING GREEN TAX MEASURES IN HONG KONG:  
A MEANS OF ADDRESSING THE CITY'S ENVIRONMENTAL PROBLEMS

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LINGNAN UNIVERSITY

2010

ENHANCING GREEN TAX MEASURES IN HONG KONG:  
A MEANS OF ADDRESSING THE CITY'S ENVIRONMENTAL PROBLEMS

by  
LU Yuzhu

A thesis  
Submitted in partial fulfilment  
of the requirements for the Degree of  
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Lingnan University

2010

## ABSTRACT

### Enhancing Green Tax Measures in Hong Kong: A Means of Addressing the City's Environmental Problems

by  
LU Yuzhu

Master of Philosophy

Nowadays, pressures on the environment are increasing around the world. In particular, Hong Kong, a compact city with a population of nearly seven million, one which has undergone remarkable economic growth over the past few decades, has developed severe environmental problems. It also has deficiencies in its taxation system: a small tax base, for example. In today's world, "green" taxes have been accepted and applied by more and more countries, especially those in the OECD. However, Hong Kong still has not adequately used the tax tool as an integral part of the government's anti-pollution strategy. Accordingly, the major objective of this study is to make proposals for improving the use of green tax measures in Hong Kong.

The study first systematically introduces background theories of green tax and discusses its advantages and disadvantages. Then, it elaborates on the primary environmental problems in Hong Kong, followed by describing the green tax measures currently existing in the city. The thesis then summarizes and analyzes green tax measures in selected countries which are at the cutting edge of utilizing the tax tool as an integral part in their environmental policy, especially the Scandinavian nations. The study also conducts interviews with Government officials, green groups and those potentially in opposition to green tax. Finally, by drawing on the experiences of green tax measures in selected countries, proposals are made on improving existing green tax measures, introducing new environmental taxes, using the revenue from these taxes and dealing with implementation issues.

The research findings of this project will help modernize as well as to green Hong Kong's taxation system and thus eventually to improve the environment of Hong Kong.

## DECLARATION

I declare that this is an original work based primarily on my own research, and I warrant that all citations of previous research, published or unpublished, have been duly acknowledged.

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(LU Yuzhu)

Date

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## **CHAPTER 1 INTRODUCTION**

There are six sections to this chapter. The first section sets out the reasons for the choice of this thesis topic. The second introduces various environmental policy instruments. Background information on the focus of this thesis – “green” taxation - is introduced in the third section (including the definition, the economic theory and its advantages and disadvantages). The research questions, objectives and methodologies of the study are presented in the fourth section, followed by a description of the scope of this study in the fifth section. The final section outlines the structure of the thesis.

### **1.1 Choice of Thesis Topic**

I have been in love with travelling since I was very young, and I have been to many places. Beautiful natural views made me feel glad and grateful from the bottom of my heart. However, as time goes by, more and more sad phenomena appear - many attractive scenic spots became severely polluted and lost their original beauty, depressing me greatly. Taking Taihu Lake – a very famous and pretty lake in China – for example, due to the global warming, the temperature around Taihu is continually rising in recent years, together with the abuse of fertilizer caused by agricultural production surrounding Taihu and the immoderate sewage discharging. As a result its water quality has been falling day by day. Finally, in May 2007 Blue Algae broke out extensively, and the former clear and beautiful water of Taihu Lake turned dark green and noisome, not only ruining the beautiful view but also causing the Wuxi city whose drinking water relies on Taihu Lake to descend into a water crisis.

At the same time, when referring to Hong Kong, the environmental situation is much

worse than before. Because of the increasing population and number of motor vehicles, the air quality has declined significantly and the temperature has gradually increased, and as will be discussed in Section 3.1.1, according to the Hong Kong Observatory, the average temperature in Hong Kong rose at a rate of 0.28°C per decade from 1980 to 2009. Poor air quality can result in an increase in ill health, for example respiratory diseases, amongst the population. According to a World Health Organization (WHO) assessment, more than 2 million premature deaths each year can be attributed to the effects of air pollution.<sup>1</sup> Additionally, Hong Kong has seen its waste loads rise as its economy has grown. As will be mentioned in Section 3.4.1, the per capita level of municipal solid waste disposal rose from 1.28 kg per person per day in 1991 to 1.36 kg in 2007. At this rate, it is expected that by 2015 Hong Kong's landfills will be exhausted.

Beside my concern over the environment, following my studies in Hong Kong taxation, I realized that, comparatively speaking, the taxation system in Hong Kong is a simple and old system. Our existing tax legislation has been in existence and has remained in its present form for decades. Hong Kong's taxation system has the following main characteristics: 1. mainly territorially driven; 2. low tax rates; 3. a scheduler system of taxes; 4. a small tax base (the Hong Kong Inland Revenue Department only collects the following taxes and fees: salaries tax, property tax, profits tax, stamp duty, business registration fee and betting duty. There is no tax on capital gains and dividend income and no sales tax). The total tax revenue in the sum of HK\$200,696.5 million was 12.15 percent of GDP for 2007-08 and had been maintained at around 10 percent for the last twenty years.<sup>2</sup> This ratio is definitely

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<sup>1</sup> World Health Report 2002, Reducing Risks, Promoting Healthy Life, Geneva, World Health Organization,.

<sup>2</sup> Census and Statistics Department (2009). *Statistical Table 030 and 193*. HKSAR: the HKSAR

very low when compared with that of other developed countries, many of which range from 28.3 percent (the United States) to 43.6 percent (France).<sup>3</sup> As a result, it may affect the role of government with respect to macroeconomic control. There is a need for more stable sources of revenue that will be less affected by the cycles in the economy and by any sudden jolts that it may encounter. In conclusion, at present, the tax base is far too narrow and needs to be broadened.

In today's world, green tax measures have been accepted and applied by more and more countries, especially those in the OECD, among which the Scandinavian nations are the forerunners. Therefore, I became aware that taxation starts to and is able to play a very important role in protecting the environment. However, Hong Kong, which has long been considered a developed economy, still has not adequately used the tax tool as an integral part of the government's anti-pollution strategy. Currently there are only a limited number of green tax measures existing in Hong Kong: firstly, for air pollution, there are First Registration Tax and Vehicle License Fee to restrict the amount of motor vehicles, excise duties on motor fuels to regulate the use of transportation fuels and some tax incentives to encourage the use of energy-efficient vehicles and the investment in environmentally-friendly facilities; secondly, the Sewage Charging Scheme was introduced to reduce the water pollution; finally, for the waste, a Construction Waste Disposal Charging Scheme and a plastic bag tax have been introduced.

After I realize that currently the application of green tax measures in Hong Kong is very limited, it becomes interesting to me to find out what research has been done in the area of green tax in Hong Kong. Until now, only a few studies involve studies of green tax

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government.

<sup>3</sup> OECD (2008). *Country Statistical Profiles 2008*. Available from OECD: StatExtracts Database.

in Hong Kong, and the major ones are addressed below:

VanderWolk (2010), after surveying the relevant legal and tax landscape, argues that the Hong Kong government should consider introducing well-designed tax measures related to the use of fossil fuels in the energy and transport sectors, and to the use of water. The policy proposal he gives includes a carbon duty levied on all the fossil fuels and payable by the importer, an enhancement of current excise duties on motor fuels and an enhancement of water and sewage charges.

Chan (2009) provides an overview of the HKSAR Government's actions to fix its environmental problems in recent decades. Especially, Chan discusses the income tax opportunity of a green tax incentive introduced in 2008 available to both local and international trades and industries in Hong Kong.

Cheung (2008) considers whether Hong Kong should introduce green taxes in the context of sustainable development and makes recommendations to the enforcement framework of green taxes from aspects of global warming, waste, vehicle tyres, vehicle fuels, Electric Road Pricing (ERP), etc. He states that "concentration on waste management is not enough if we wish to fully implement the goals of a sustainable development. The other green measures such as ERP, larger scale of tax incentives, etc. should be adopted in future."<sup>4</sup> He also highlights the importance of the cooperation with neighbouring provinces of the PRC – "We have to build greater environmental interactivity in the PRD region that will support a long-term conversion to a sustainable green economy."<sup>5</sup>

As can be seen from the above brief description of three major studies, green tax is

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<sup>4</sup> See Cheung's paper at p. 68

<sup>5</sup> See Cheung's paper at p. 69

still a relatively fresh research area in Hong Kong, and a gap in the literature exists. Hopefully this gap can be filled through this study.

In conclusion, this project provides a good opportunity to combine the issue of environment and taxation, conforming to the occasion and corresponding to my own wishes - making a contribution to the improvement of both the environment and taxation in Hong Kong. Thus, my thesis topic was made clear to me.

## **1.2 Various Environmental Policy Instruments**

Green tax is only one type of instrument available to the policymaker, and different instruments tackle environmental problems in different ways. Thus it is important to understand what other environmental policy instruments exist and how they work. Environmental Policy Instruments - tools used by governments to implement their environmental policies - are usually classified into three broad categories: command-and-control regulation, voluntary approaches, and economic instruments.

### **1.2.1 Command-and-control Instruments**

Command-and-control instruments, in other words regulations, means "institutional measures aimed at directly influencing the environmental performance of polluters by regulating processes or products used, by limiting the discharge of certain pollutants, and/or by restricting activities to certain times, areas, etc., through licensing, setting of standards, zoning, etc." (Opschoor and Vos, 1989, p. 12) Environmental policy was originally largely based on regulations (OECD, 2001). Regulations can take the form of "performance standards", consisting either of emission limits for each source, or of concentration limits which request emission-related measures if the concentration is too high. There are also

“technology-based standards”, that specify the technology to be used in the production or the treatment of emissions. For example, the obligations to recycle or incinerate waste, or the requirement to use the best available technology, are technology-based standards.

### **1.2.2 Voluntary Approaches**

Voluntary approaches (VAs) refer to “commitments from polluting firms or industrial sectors to improve their environmental performance” (Lévêque, 1997). VAs are seen as potentially being an instrument that could be finely-tuned and quick to set up. It also has been highlighted that there are advantages in terms of increased flexibility for polluters and regulators in facing specific problems, and that VAs potentially foster environmental innovation and the sharing of information on cleaner technologies. However, several weaknesses of voluntary approaches are also identified. Firstly, concerns about their real effectiveness have been repeatedly expressed. If the agreement does not contain monitoring and sanctions there is a risk that parties will not comply with it. Secondly, if the number of stakeholders is high, the cost of negotiation and of setting up the agreement may be high. Thirdly, compared to a tax alternative, voluntary approaches will cause revenue loss. As a result, the use of voluntary approaches in environmental policy should be carefully assessed.

### **1.2.3 Economic Instruments**

Economic instruments, which include the subject of this study – green tax, provide economic agents with financial incentives to reduce environmental damage and are created in order to guide the behaviour of polluters. Emission trading system (ETS) and green tax are two prime examples of economic instruments. Although ETS is not

the focus of this study, it is valuable to know some background information.

Emission trading system, also called “cap-and-trade”, is a market incentive system with tradable rights. In such systems, the regulator issues a finite number of use rights (cap) authorising the holder to use a particular resource or discharge a particular pollutant. The cap can be traded, so that those who want to use a resource or pollute more must acquire them from those willing to use or pollute less. There has been, for a relatively long time, a fierce debate among academics about which instrument – ETS or green tax – is a better way in tackling the climate change problem. Below is a brief presentation of discussions about advantages and disadvantages of ETS as compared to green tax.

With regard to its advantages, ETS can achieve the desired level of carbon dioxide emission reductions while offering the possibility of a new market in carbon allowances for industry groups and therefore the potential for significant income for companies who can inexpensively reduce their carbon dioxide emissions, thus the cap and trade is more politically acceptable than green taxes. ETS also has the advantage of benefit certainty. Because ETS imposes an overall cap on the level of emissions permitted in the economy, it provides certainty as to the environmental benefit that result from its implementation.

With regard to its disadvantages, firstly, from a theoretical perspective, precisely because it imposes a fixed cap without regard to the cost to the economy at large or to individual polluters of attaining that cap, ETS suffers from lack of certainty in regard to the cost it imposes, in other words, ETS is cost uncertain. Secondly, in practice, where a cap and trade system becomes more complicated and potentially unwieldy, is in the setting of baselines for the distribution of allowances and in the

monitoring and enforcement of a complex allowance system (Avi-Yonah and Uhlmann, 2009). ETS relies on a perfect market and price mechanism. In reality, however, markets are not perfect. As a result, ETS is less transparent than the green tax and is prone to gaming and cheating. Thirdly, while the revenue generated by carbon tax could flow to an accountable government which would be able to use the extra funds for a socially useful purpose such as investing in the use of clean energy, the ETS cannot generate such revenues. Finally, some scholars also argue that ETS sends a more ambiguous signal to polluters than a green tax does. ETS achieves the goal to reduce greenhouse gas emissions by either allowing polluters to purchase the right to pollute or to receive permits to pollute for free. The underlying message is that the government permits polluters to pollute as long as they are willing to pay. “Labels are important, and calling the cost a tax sends a different signal than calling it the purchase price for a right to pollute.” (Avi-Yonah and Uhlmann, 2009)

### **1.3 Background Information on Green Tax**

Green tax is the central subject of this study. Before investigating the practical use of green tax, it is essential to learn its background information and build the theoretical foundation for green tax. The definition and classification of green taxes, the rationale behind green tax, and then its advantages and disadvantages in comparison with other environmental policy instruments are explained below.

#### **1.3.1 Definition and Classification on Green Tax**

The rudiments of green tax – Pigouvian Tax - were first presented by economist Arthur Pigou in his book *The Economics of Welfare* (1920). In many economic transactions, there is an impact one economic agent imposes on another

that is not directly involved in the transaction, and in economics, this kind of impact is termed an “externality”. If the activity imposes an adverse impact on others, it is a negative externality, for example, pollution. Pigou advocated that a tax could be levied on the market activity to correct the market outcome, if there are negative externalities associated with the market activity, and the tax should be set at a level equals to the negative externality. As a result, this kind of tax – fully internalising the externalities - was termed “Pigouvian Tax” by later academics.

This study applies the definition of green tax provided by OECD: “Any compulsory, unrequited payment to general government levied on tax-bases deemed to be of particular environmental relevance” (OECD, 1989). The OECD also classified green taxes into three types according to different tax bases: emission tax, input tax and output tax. In addition, green taxes can also be classified into specific (that is, levied in relation to the weight or number of the taxed product) and *ad valorem* (as a percentage of the value of product) according to the different tax rate (Wallart, 1999). Emission tax prices emissions directly. As a result, a typical rational firm is likely to search for substitution options that reduce its tax payment. If emission abatement options are available, the least distortive option is to implement such technologies as long as they are cost-efficient.

Energy tax is a prime example of an input tax. With input taxation the firm can no longer reduce its tax payment directly by reducing emissions if this would require the same (or more) inputs. The input substitution mechanism is triggered depending on the choice of the input tax rate and the technological options (Vollebergh, 2008). For example, with an input tax that reflects differences in input characteristics, such as differences in carbon or acid components, substitution within an input composite will be triggered.

Output tax is an indirect instrument to reduce emissions. A rational firm facing an output tax has no incentive to abate emissions directly because this does not contribute to a lower tax burden, and the efficiency of the output tax depends on the link between output and emissions. According to Vollebergh (2008), with a specific output tax base, i.e., with a tax base linked to their goods characteristics, an output tax also induces firms to reconsider their product composition as long as it is mutable providing the firm emission reduction opportunities with potentially low cost.

When designing a tax, the government usually decides the type of tax through a comprehensive consideration of the following factors: the effectiveness of reducing pollution, the level of administrative difficulty, and technological issues. According to Fullerton, Hong, and Metcalf (2001), an emission tax is superior among the three types of tax because it provides the most direct incentive to companies to reduce their emissions during the production process. However, few taxes anywhere in the world are precisely targeted taxes on emissions. The primary reasons for this situation are threefold. First, there is a technical difficulty in measuring emissions. In these cases, the government always shifts to an alternative tax that applies to a measurable activity that is closely correlated with emissions. For example, to reduce vehicle emissions, the gasoline tax may be the best available instrument. Second, there are significant costs associated with measuring emissions. Third, there are difficulties with preventing tax evasion and illegal disposal activities.

Further, this study uses the term “green tax measures” to indicate not only the taxes/charges/fees levied on pollutants or polluting-related behaviour, but also to indicate the tax incentive/penalty measures (including rebates, funds, depreciation allowances, etc.) provided to encourage environmentally-friendly behaviour.

### **1.3.2 Economic Theory of Green Tax**

Economic theory is the rationale for green tax to be used in practice. Therefore, in order to understand how exactly the green tax works and with an additional purpose of estimating the level of green tax in practice, the economic theory of green tax is introduced below. Note that if the green tax is set at a “Pigouvian Tax” level, that is when the tax fully internalises external costs of a market activity, the pollution will reach the optimal level. As a result, three essential mechanisms, through which the “Pigouvian Tax” works, are explained.

As mentioned in Section 1.3.1, pollution is a negative externality associated with market activity. The presence of negative externalities drives producers and consumers to make decisions that do not lead to an optimal allocation of resources: the pollution level is greater than the optimal level.

As a rule, economic efficiency in the market of a good is attained if, for this good, supply – here referring to marginal private cost – equals to demand – here referring to marginal willingness to pay. With environmental externalities, this is no longer true, because the external costs to the environment are not taken into account. In order for economic efficiency to be attained in the presence of pollution, the total cost of the good - defined as the social cost - has to be considered, not only the private cost.

However, when making their decisions, producers and consumers consider only the private cost. They do not take external costs, such as environmental costs, into consideration. As a result, the production, hence the pollution, will be higher than the optimal level. The green tax can re-establish economic efficiency through the internalization of external costs. The tax forces consumers and producers to take into

account not only the private cost, but the total cost related to their activities, that is, the social cost.

A Pigouvian tax essentially works through three mechanisms: reduction of the quantity exchanged, incentives to implement abatement technologies and incentives to engage in R&D activities (Wallart, 1999).

Reduction of the Quantity Exchanged

Figure 1 shows the market of a good, the production or consumption of which is polluting. There is no abatement technology; therefore, the polluting emission is proportional to the quantity produced. For simplicity, it is assumed that the marginal

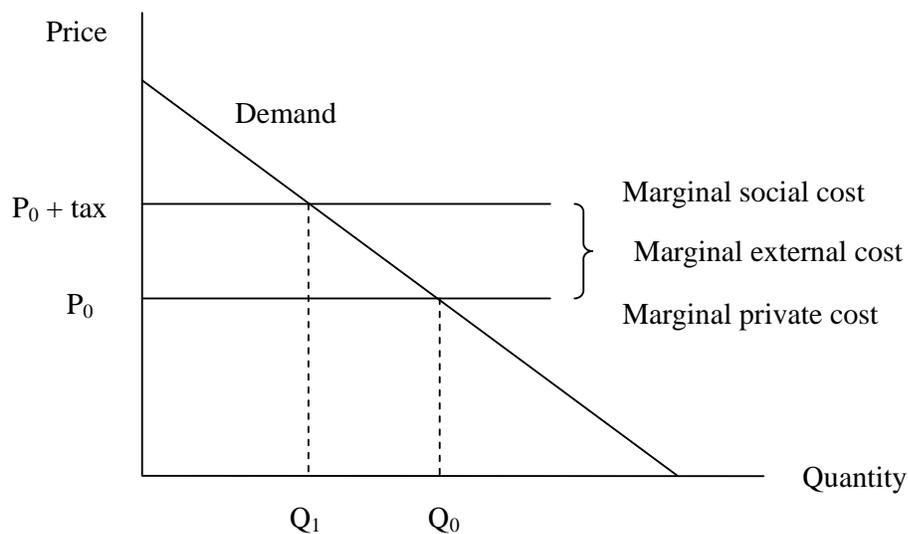


Figure 1: The Optimal Production of a Polluting Good

private cost, as well as the marginal external cost, is constant with respect to quantity. Without pollution, the optimal quantity is  $Q_0$ , which corresponds to the intersection of the demand curve and the marginal private cost curve. However, as soon as pollution is taken into account,  $Q_0$  is no longer optimal. With the external cost of pollution, the optimal quantity will be determined by the intersection of the demand

curve and the marginal social cost curve, i.e.,  $Q_I$ .

Suppose that the government knows the level of the marginal external cost (MEC) in Figure 1, and in the cases presented here, the MEC has been assumed to be constant. It imposes a tax equal to the MEC. As a result, for each unit produced, firms will have to pay a tax equal to the MEC. Therefore, when choosing the quantity to be produced, firms will not consider the marginal private cost, but will instead consider the marginal private cost plus the tax, that is, the marginal social cost. They will produce the optimal quantity  $Q_I$  instead of the initial quantity  $Q_0$ . In addition, they will have to pay the tax to the government, which is an amount equal to  $Q_I$  multiplied by the tax.

Incentive to Implement Abatement Technologies

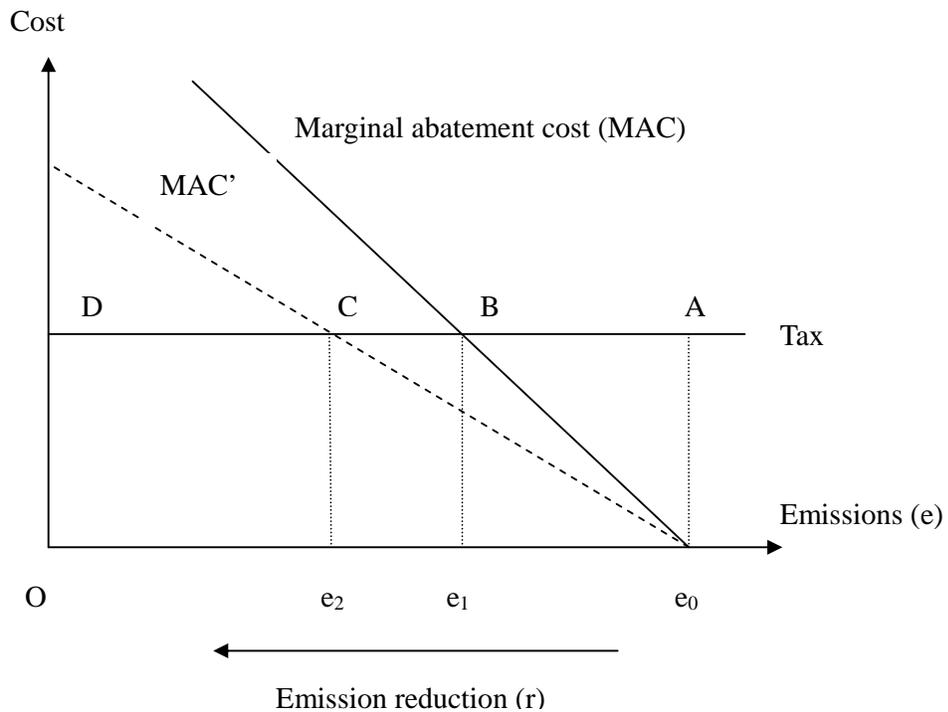


Figure 2: The Optimal Level of Pollution with an Abatement Technology

Suppose now that there exists an abatement technology, which allows firms to reduce

their polluting emissions and thus to avoid the payment of part of the tax. There will be an abatement cost function corresponding to this technology. This case is shown in Figure 2, where polluting emissions are measured from left to right, and emission reduction from right to left. The initial level of emissions is  $e_0$ , which reflects the situation without any abatement activity. In the absence of government intervention, firms will choose this level. However, from this level  $e_0$  emissions can be reduced significantly at a small cost.

Now suppose, as in the preceding case, that the government imposes a tax equal to the marginal external cost. For the initial level  $e_0$ , the marginal reduction cost is smaller than the level of the tax, and it will be cheaper for firms to purify their smoke than to pay the tax. Such is the case until the level of emission  $e_1$  is reached, where the marginal reduction cost is equal to the level of the tax. At this point, firms minimize their costs, paying an abatement cost of  $e_0B e_1$  and a tax of  $O e_1BD$ . It can be seen that the tax gives an incentive for firms to use an abatement technology, to the extent that the clean-up cost is smaller than the tax they would otherwise have to pay between  $e_0$  and  $e_1$ . As a general rule, taxes induce firms to modify the structure of their productive capital so that their production generates fewer emissions.

#### *Incentive to Engage in Research and Development (R&D) Activities*

Firms, at the emission level  $e_1$ , still pay a substantial tax amount to the government. However, they think that they are able, with technological innovation, to reduce the pollution abatement cost. Therefore, they engage in research and development activities, and find a means to move the marginal abatement cost curve downwards, from MAC to MAC'. This allows them to further reduce their emissions, and therefore to pay a smaller tax amount. The new equilibrium will be  $e_2$ . At this point,

firms pay  $O e_2CD$  to the government and bear an abatement cost of  $e_0 e_2C$ .

As a result of this technological innovation, firms save an amount equal to  $e_0BC$ , less the cost of the R&D. It is shown that the tax favours technological progress - it gives an incentive for firms to develop less polluting products and processes. If the tax did not exist, firms would not get any benefit from environmental R&D. Therefore, they would have no interest in undertaking this kind of research.

### **1.3.3 The Advantages and Disadvantages of Green Tax**

As mentioned in Section 1.2, there are various environmental policy instruments in tackling environmental problems, especially command-and-control regulations are the original primary base of environmental policy, in comparison green tax is a new type among these instruments. Thus, it is reasonable to wonder why green tax are applied by more and more countries as an important tool in dealing with their environmental problems, and also to wonder, what hinders a more widespread use of green taxes. As a result, it is essential to discover the positive and negative effects of environmental taxes compared with command-and-control.

#### **1.3.3.1 Advantages of Green Tax**

Green tax has several advantages over command-and-control instruments as a way of controlling environmental problems, primarily including five parts as follows:

##### **1.3.3.1.1 Static Cost Minimisation**

Static cost minimisation, in other words, cost effectiveness. Green taxes are more likely to achieve an efficient allocation of pollution abatement across polluters than is a policy based on regulation. This is due to the flexibility inherent in market-based approaches. By encouraging companies to exploit different opportunities to abate

their pollution activities and creating incentives for them to do so, green taxes ensure that control of pollution takes place where the marginal costs are lowest, thus ensuring substantial cost savings.

#### **1.3.3.1.2 Dynamic Efficiency**

Green tax could create incentives for dynamic efficiency, i.e. a continuing incentive to reduce pollution abatement costs. With conventional environmental regulations, there is generally little incentive for a firm to go beyond required performance standards. By contrast, as shown in Figure 2, the specificity of green tax requires polluters to pay for residual emissions on top of abatement costs. As a result, an ongoing incentive is created by green tax for firms to further reduce polluting emissions, through cost-effective abatement, innovation of cleaner production techniques and better abatement technologies. Consumers also have incentives to demand less polluting products and to reduce polluting activities.

#### **1.3.3.1.3. Lower Compliance and Administrative Costs**

Green taxes, in some cases, involve lower administrative costs for both governments and business than would be possible under the regulatory approach. For example, regarding the government, the use of green taxes eliminates the need for government certification of production processes and technologies. Regarding the business, green taxes do not prescribe specific technologies or solutions, but leave it to the target groups to decide whether they would prefer to control their output of emissions, change their input of raw materials and energy, or to do a mixture of both. Consequently, the compliance cost can be cut.

#### **1.3.3.1.4 Important Revenue Source**

Green taxes also generate revenues which can be used for a variety of purposes, some of which improve the environment or give further incentives to do so.

#### **1.3.3.1.5 Behavioural Effects**

Green tax can encourage people to change their consumption behaviour. A simple example will be if a tax is imposed on the energy used to generate electricity, then the electricity price may increase along with that, so this will encourage people to use less electricity.

#### **1.3.3.2 Disadvantages of Green Tax**

Besides the above advantages, there are several disadvantages that hinder a more widespread use of green taxes, as follows:

##### **1.3.3.2.1 Distributional Effects**

The distributional impact of a tax is related to the incidence of a tax. The final incidence of a tax depends on the relative demand and supply elasticity for the taxed good. For example, the buyer will bear most of the tax if demand for the good is firm despite the tax and production can easily be increased or decreased, for instance automotive fuels. However, the seller will bear most of the tax if supply is difficult to vary and demand responds strongly downwards to higher prices, for example some chlorinated solvents. The burden of taxation on the seller will in turn be shared between capital, labour, and resource owners. On one hand, some environmental taxes are income regressive. That means poorer households may pay a disproportionate share of their income in these taxes relative to richer households. On the other hand, the outcome, in terms of environmental improvement (such as health

benefits and higher standard of living.), will also be unevenly distributed across different groups. Where environmental pressures are distributed in a regressive manner, with low income households being exposed to higher risks, this does not imply that pollution reduction will automatically lead to a progressive distribution of the protection benefits. Richer households may benefit more than poorer households may, particularly if the benefits are measured in monetary terms, since their willingness to pay for improvements will be higher than for low-income households.

#### **1.3.3.2.2 Negative Effects on Competitiveness**

When industry in one country is self-regulated and competing industries in another country are not, distortions of competitive positions may arise. A key issue that has confronted countries which have implemented green tax reform is the possible loss of international competitiveness of some economic sectors. It has been seen that the case for environmental taxes arises because environmental costs generated by production and consumption have failed to be incorporated into the prices of those activities which give rise to them. Inevitably the process of correcting this market failure will be challenging for the sectors concerned, and is unlikely to be welcomed by them. Furthermore, this is not the end of the problem. To respond to the competitiveness issue, a series of mitigation measures (such as some subsidies for energy industry) specifically designed to prevent such possible loss have been offered, where the design of such measures diminishes the environmental effectiveness of green tax.

#### **1.3.3.2.3 Measurement Problem**

In practice, it is very difficult for the market or government to estimate the full extent of environmental damage because it is widespread, often not easily quantifiable, and

it takes a long time to accumulate, thus it is unlikely to set an appropriate tax rate.

#### **1.4. Research Questions, Objectives and Methodologies**

For this project, one main research question is formulated, and then there are three sub-questions with the purpose of breaking down the main research question, followed by a description of research objectives and various methodologies.

##### **1.4.1 Main Research Question**

As a developed economic entity and facing serious environmental problems, Hong Kong should be on the cutting edge of using taxation to help achieve environmental goals. In practice, however, it can hardly find significant progress. As been discussed, the need for more effective environmental instrument in Hong Kong is urgent, and green tax could be this kind of instrument, however, as will be seen in Chapter 4, what the Hong Kong government has done so far does not seem to be enough. Therefore, given the need both to improve the environmental condition and broaden the tax base in Hong Kong, green tax measures in Hong Kong need to be enhanced. As a result, the main research question of this study is formulated as follows:

**How can green tax measures be enhanced in Hong Kong?**

##### **1.4.2 Sub-questions, Objectives and Methodologies**

In order to better approach this main question, it is broken down into three sub-questions which are more manageable.

Firstly, before finding solutions, the problems need to be known first. Thus the current environmental condition in Hong Kong is examined in the first sub-question:

### **Sub-question 1: What is the current environmental situation in Hong Kong?**

#### **Objectives**

To explore the current environmental condition, especially environmental problems in Hong Kong

To find out the major causes of these environmental problems in Hong Kong

#### **Methodologies**

Research Methodologies used for the first sub-question are referring to the environment reports presented by Environmental Protection Department (EPD) of the HKSAR government and green groups in Hong Kong, and reviewing the recent studies on environmental issues in HK.

Secondly, when there is a plan to improve something, it is necessary to be familiar with its current condition, especially the problems existing in the current system. The second sub-question is therefore formulated as follows:

### **Sub-question 2: What green tax measures are currently being used in Hong Kong, and how effective are they?**

#### **Objectives**

To describe current green tax measures in Hong Kong

To find out the problems within present green tax measures

To explore what causes the above mentioned problems

#### **Methodologies**

Reviewing the literature concerning the "green" tax in HK and conducting

interviews with Hong Kong government and green group are the research methodologies used to answer the second sub-question.

Finally, green tax is still a relatively new concept in Hong Kong. In order to enhance green tax measures in Hong Kong, learning from overseas experiences is a very effective way. As a result, the third sub-question is formulated as follows:

**Sub-question 3: What lessons can Hong Kong learn from selected countries?**

**Objectives**

To describe details of green tax measures in selected countries

To conclude the traits of green tax measures in selected countries

To learn experiences from the selected nations

**Methodologies**

Two major methodologies are employed in order to achieve the third sub-question, including referring to the OECD/EEA database on instruments used for environmental policy and natural resources management, and reviewing the literature that analyzes relevant issues of green taxes in selected countries.

In addition, research methodologies, including approaches for country selection, the interview and some limitations within these methodologies.

**1.5 Scope of the Study**

This section discusses five points that limit the scope of this study.

First, as mentioned in Section 1.2.3 above, two economic instruments are primarily

being applied to tackle environmental problems around the world – green tax and ETS. This study focuses on the green tax but not on the ETS. The main reason is that ETS may not be an appropriate and feasible instrument to be applied in Hong Kong. Cap and trade is relatively untried in Hong Kong. It would involve a major new and separate piece of legislation, and Hong Kong lacks the necessary administrative capability and accounting structures to measure emissions and to enforce compliance. A new administration determined to implement ETS would have to be established, and it might take years for the government to pass the ETS programme and set it up for implementation. Additionally, because the disadvantages of ETS – cost uncertainty, less transparency, revenue loss and sending ambiguous signals (mentioned in Section 1.2.3) green tax may be preferable to ETS in Hong Kong. Thus, ETS is not studied in this project.

Second, this study does not deal with trans-boundary environmental issues. A large part of pollution in Hong Kong comes from over the border – primarily from Guangdong province, for example, the air pollutants generated by industries in the Pearl River Delta and river water pollution from Dongjiang. But because of the limited time available for this study, and also because the focus of this study is on providing the HKSAR government with recommendations on green tax measures that could be implemented in Hong Kong, cooperation with Guangdong province is not studied in this project.

Third, because the Hong Kong Special Administrative Region and Mainland China have separate taxation systems due to the Joint Declaration between Chinese and British governments in 1997, this study only deals with the Hong Kong taxation system but not the taxation system of Mainland China.

Fourth, climate change, air pollution, water pollution and waste are the major environmental problems existing in Hong Kong. As a result, because of the limited time and resources to complete the project, this study only concentrates on the above four problems but does not consider other, arguably less important, environmental problems, for example, noise pollution.

Finally, this study investigates green tax measures in all the major pollution fields and is taken from a large economic view, so this study provides recommendations for Hong Kong from a macro perspective rather than a detailed consideration of the affect on individual companies/industries/people.

## **1.6 Structure of the Thesis**

The remainder of this thesis is structured as follows. Chapter 2 describes the research methodologies used in this study, including approaches to select the countries and the interviews. Chapter 3 is concerned with the current environmental situation in Hong Kong and shows the primary environmental problems, including atmosphere problem and air pollution, water pollution and the waste problem. Chapter 4 shows an integrated picture of current green tax measures in Hong Kong followed by an analysis of merits and problems of these measures. Chapter 5 describes and analyzes how green tax measures are used in selected countries, in order to learn from their experiences. Chapter 6 presents recommendations to enhance green tax measures in Hong Kong. Chapter 7 concludes the study and suggests avenues for future research.

## **CHAPTER 2 METHODOLOGY**

Research methodologies have been presented briefly in Section 1.4.2, and it can be seen that the primary research methodologies applied in this study consist of literature review and interviews. In particular, the major conceptual framework of this study is to learn from the experiences of other countries through comparing their green tax measures with those in Hong Kong. It is therefore essential to illustrate how and why the specific countries are selected. Accordingly, the country and interview selection methodology is explained here in detail.

### **2.1 Learning from Overseas Experience: Country Selection**

Learning from overseas experiences is a very effective way to enhance green tax measures in Hong Kong and also is a major part of this study. There are two crucial issues that need to be addressed: the criteria used in country selection and the actual selection of those countries.

#### **2.1.1 Criteria Used in Country Selection**

Economic instruments are more widely used in environmental policy among OECD countries since the early 1990s (OECD, 2001). The prevalent economic instrument to be introduced has been environmental taxes and charges and many countries have made remarkable progress (Speck, 2007). However, in contrast to OECD countries, the usage of economic instruments as environmental protection tools is very rare in non-OECD countries, most of which are developing countries. So studying the green tax experiences from OECD countries has significant value for developing green tax measures, even enhancing the sustainable development strategy, in Hong Kong. As a

result, the countries are picked from OECD members.

Next, the decision of which countries could finally be selected is basing on the following criteria:

- Either, having advanced experiences in constituting and applying green tax.
- Or, suffering from similar environmental problems and having broadly similar national/regional condition with Hong Kong.
- Or, having different green tax provisions or a different focus in dealing with the same environmental problems, the causes of these differences and their implementation effects can be found out, and then which approaches might be more suitable to apply in Hong Kong can be concluded.

A comprehensive database of environmental taxes and charges in all the OECD countries, named “OECD/EEA database on instruments used for environmental policy and natural resources management”, has been developed by the cooperation of OECD and the European Environment Agency (EEA)<sup>6</sup>. Much of the basic information in Chapter 5 is taken from this database. After demonstrating the criteria for choosing the countries, now it leads to another question:

### **2.1.2 Specific Country Selection**

Based on the above criteria and after a systematic literature review, four Scandinavian countries (Denmark, Sweden, Norway and Finland), the Netherlands – to learn from their energy/carbon taxes - and Singapore – to learn from its innovative transport taxes – are finally chosen as the overseas countries for Hong Kong to learn experiences from. The specific reasons for choosing these countries are described

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<sup>6</sup> The database can be found on the OECD’s website at <http://www2.oecd.org/ecoinst/queries/index.htm>

below:

### **2.1.2.1 Reasons for Choosing the Scandinavian Countries**

In this study, four Scandinavian countries are selected as the main leaning objects, and there are three reasons for doing this. First, they conform to the first criterion. For a considerable period, policy makers in the Nordic countries have been considering how environmental policies by promoting resource efficiency as well as product and process innovations may contribute to enhanced competitiveness while insuring the policies' environmental effectiveness. "The Nordic countries have been pioneers in the use of market-based instruments, especially with regard to environmental taxes." (Speck and Andersen, 2006) "Scandinavian countries took the idea of environmental taxes and charges to heart both earlier and more earnestly than other developed countries." (Hoerner and Bosquet, 2001) They have advanced experiences and have been very active in the field of green taxes, not only in dealing with air pollution and climate change problem but also in dealing with water pollution and waste issues, and these experiences will be shown in detail in Chapter 5.

Second, with regard to other European countries, a comprehensive literature review shows that their usage of market-based instruments is following the lead of the Nordic nations. "Nordic initiatives and experiments have frequently inspired similar approaches in the EU" (Speck, Andersen, Nielsen, Ryelund and Smith, 2006). For instance, with regard to the environmental taxes and charges related to air pollution, Scandinavian countries were the first countries to introduce CO<sub>2</sub>-based energy taxation in early 1990s. After this, the use of CO<sub>2</sub>-based energy taxation has spread widely among EU member states, such as the UK, France, Italy, Germany, Austria

and Switzerland, and they all followed Nordic countries' implementation form of energy/carbon taxes. The constitution and implementation of energy/carbon taxes in these countries only have slight differences in tax rates, the taxable energy resources, etc. due to each country's individual energy situation, and in some conditions are less comprehensive than that of the Nordic nations. For example, in Germany coal was never subject to energy taxes, and the revenues of its electricity tax have been earmarked for the subsidization of the German coal industry. However this partiality to the coal industry reduces the environmental effectiveness of the German energy tax. In the UK, its energy tax structure is rather simple when compared to the schemes implemented in the Nordic countries. The scheme relies heavily on the energy/excise taxes levied on transport fuels, in particular, with regard to the revenue generated from these taxes. What is more, a general scheme of energy taxes levied on other energy products does not even exist in the UK (Speck, 2007; OECD/EEA Database, 2009).

Third, referring to other big economic entities, for example the United States, their usage of green tax measures is much less developed than that in European countries. The United States imposes virtually no green taxes, and most programmes to reduce pollution rely on mandatory standards. "Although numerous taxes and user fees are imposed at the state and local level, including paper bag disposal charges for municipal solid waste and deposit-refund schemes for beverage containers and automobile batteries. In general, such policies tax pollution only indirectly and are too low to affect behaviour measurably" (Levinson, 2007). In China, within the existing taxation system, only the resource tax pays attention to the resource protection issue (Wang, 2007). However the scope of the tax is also very narrow – only include eleven resources such as coal and natural gas, and water, forest, etc. are

not included - and the tax rates are not high enough to internalize the externalities, as a result, the resource tax is not very effective in resource protection (Yang, 2008).

In light of the above considerations, and also due to time and resource constraints, the Scandinavian countries are selected as the major objects to learn experiences from.

#### **2.1.2.2 Reasons for Choosing the Netherlands**

The Dutch government was one of the forerunners in Europe with regard to the implementation of energy taxes (Speck, 2007). The Netherlands has innovative modes of implementing energy taxation which is different from the Nordic form and even rather unique in the world (Vollebergh, 2008). For example, in order to reduce the CO<sub>2</sub> emission, rather than imposing a specific CO<sub>2</sub> tax with some exception measures to energy-intensive industries as Nordic countries do, the Dutch government introduced a Regulatory Energy Tax with decreasing rates according to the levels of energy consumption. The Dutch mode of energy taxation is discussed in detail in Chapter 5.

#### **2.1.2.3 Reasons for Choosing Singapore**

First, Singapore has many similarities with Hong Kong. Situated at the southern end of the Malayan Peninsula, Singapore is a tiny island nation with a population of about 4.8 million. This makes it one of the most densely populated nations/regions in the world, Singapore much lacks of energy resources, fresh water resource and other natural and physical resources. Additionally, because it is a small island, it is threatened by rising sea levels and extreme weather events. On the other hand, Singapore has excellent transportation and telecommunication networks and is an

efficient international business centre, positioning itself as the region's financial and high-tech centre. These points are all very similar to Hong Kong, making the two cities very comparable.

Second, Singapore is considered "the model green city in the world".<sup>7</sup> Singapore now has an environment that compares quite well with that of any nation in the world. Singapore is a modern, industrialised city state that maintains clean air, pure water, modern housing and excellent health facilities for its people (Ooi, 1995). It has a global recognition as a green city with 5% of its island reserved for nature. This has proved to be something of a miracle in such a tiny island of 50% built up area with a high population density.<sup>8</sup> In particular, Singapore's air quality has been good and compares well with other urban cities in developed countries, and Singapore has complied well with the World Health Organization (WHO) Air Quality Guidelines. In a 2005 survey by Political and Economic Risk Consultancy (PERC), Singapore was rated highly for good air quality.<sup>9</sup> By contrast, Hong Kong's air pollution concentration has been unhealthily high and has given cause for alarm. For example, in November 2006, roadside concentrations of Respirable Suspended Particulates (RSP) were 300% - 400% over WHO Air Quality Guidelines, while concentrations of sulphur dioxide were 150% of WHO Guidelines (Leverett, Hopkinson, Loh and Trumbull, 2007). Furthermore, in comparison to Hong Kong, which is still facing serious air pollution problems, Singapore is doing especially well in controlling air pollution. Singapore has very innovative tax measures in transport management to

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<sup>7</sup> Koh K.L. (2003). Garden City to Model Green City. Economic and Social Commission for Asia and the Pacific (ESCAP) Virtual Conference.

<sup>8</sup> Ministry of the Environment and Water Resources. State of the Environment 2008 Report. Singapore: Singapore government..

<sup>9</sup> Ministry of the Environment and Water Resources. State of the Environment 2008 Report - Air. Singapore: Singapore government.

reduce vehicle emissions. In the transport sector, rapid growth in real income in many countries of South-East Asia has led to large increases in the ownership and usage of automobiles. In many major cities (including Hong Kong) this has resulted in chronic traffic congestion and so much intensified the air pollution at the same time. Singapore has so far avoided the worst excesses of this problem - despite high income level, only one person in 10 owns a car (Lin, 2003). Singapore provides an interesting example of the application of innovative vehicle tax measures of trying to balance demand for private transport with the constrained supply of road infrastructure and land availability and the need to control transport emissions.

All these characteristics make Singapore a very valuable and suitable example for Hong Kong, which on the contrary is in a poorer environmental condition, to learn from.

## **2.2 Interviews**

With the aim of collecting and confirming information and getting viewpoints from multiple perspectives, interviews were undertaken with three parties: officials from the Hong Kong Government - Environmental Protection Department (EPD), Green group - Greenpeace, and some commerce associations whose members are in opposition to green tax - the Hong Kong Retail Management Association (HKRMA). The findings from these interviews are contained in various chapters relevant to the issues discussed.

First, the official in the Hong Kong Government interviewed is from the EPD. This department was chosen because EPD is the major environmental policy maker in Hong Kong, holding the most cutting-edge information and understanding the most

practical difficulties during the policy-making procedure. Thus the opinions from this department are very valuable and useful while studying which green taxes are suitable to be introduced or revised in Hong Kong and also while investigating how to build the public acceptance of environmental tax. Mr. David Wong, Principal Environmental Protection Officer in EPD, was interviewed on April 21<sup>st</sup>, 2010.

Second, staff from Green group in Hong Kong were also interviewed, mainly for the purpose of comparing with and confirming the information obtained from the Government officials and gaining the opinions, especially to note criticism towards the Hong Kong Government's environmental policies. The green group interviewed is Greenpeace (HK). Greenpeace is one of the most influential Green groups around the world, and the head office of Greenpeace (China) is in Hong Kong. It is also one of Hong Kong's most prominent green groups, having in-depth understanding and research about Hong Kong's environmental problems and environmental protection work. Ms. Gloria Chang, Campaigner of Greenpeace (HK), was interviewed on December 16<sup>th</sup>, 2009.

Third, in order to provide a balanced perspective, an interview was also conducted with those whose interests are potentially in opposition of green tax. Their opinions are especially useful in the study of finding a suitable way for Hong Kong to make green tax measures more acceptable and of solving the competitive issue. In this study, the HKRMA is chosen to be the interviewee.

Indicative questions for the interviews were sent to the interviewees before the interviews took place. The interview questions appear in the Appendix.

### **2.3 Methodological Limitations**

Unavoidably, because of the limited time and resources to do this project, there are some limitations in the research methodologies.

First is the limited number of selected countries. It is nearly impossible to choose all the valuable countries to learn from their experiences, and only six countries (Denmark, Finland, Norway, Sweden, The Netherlands, and Singapore) are selected. As a result the confined number of countries may limit the research result.

The second limitation is the limited number of interviews. There might be more people and groups that are valuable to be taken interviews with - for example, people in the manufacturing industry who are potentially in opposition of green tax, and their opinions might be very valuable in the study of building acceptance of green tax in Hong Kong - but for the limited time, only three interviews are finally taken. As a result, the confined number of interviews may not be able to represent opinions from all the related groups.

## **CHAPTER 3 ENVIRONMENTAL SITUATION IN HONG KONG**

Before finding solutions, the problems need to be known first, thus the first sub-question of this thesis - What is the current environmental situation in Hong Kong? - is approached in this chapter. This chapter deals with the current situation and primarily the major problems existing in Hong Kong's environment, which are mentioned in Section 1.5 Scope of The Study, including climate change and air quality, water quality and waste problems. Then this chapter analyses the sources of the pollution and other causes of these environmental problems and the impacts of these problems are also examined, so that while making recommendations for green tax measures in Hong Kong, those recommendations could be better targeted.

### **3.1 Climate Change**

As briefly introduced in Chapter 1, Hong Kong now is facing serious climate change problems. According to the Intergovernmental Panel on Climate Change (IPCC), Climate Change refers to any change in climate over time, whether due to natural variability or as a result of human activity. The high average temperature and continuous rising sea level in Hong Kong are convincing evidence of this.

#### **3.1.1 Temperature**

Figure 3 gives concrete illustration about the temperature changes, that is, the average temperature in Hong Kong rise at rate of 1.2°C per 100 years, the rate became faster in the latter half of the 20th century, from 1947 to 2009, and the average rise amounted to 0.16°C per decade, accelerating to 0.28°C per decade during 1980-2009. Moreover, the rate of temperature increase in Hong Kong is

higher than the rate of global temperature increase.

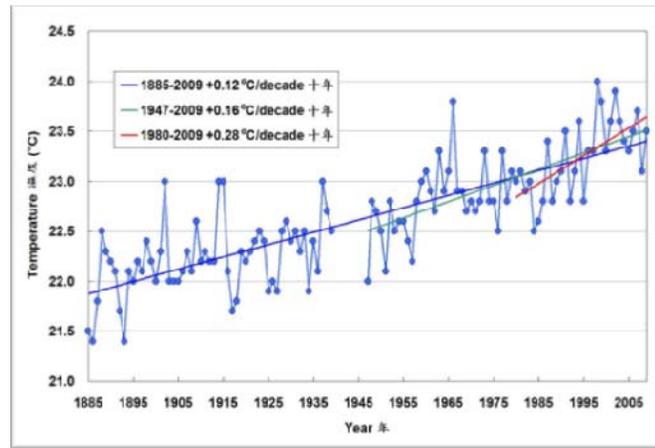


Figure 3: Annual Mean Temperature, 1885 - 2009<sup>10</sup>

The primary reason of why the average temperature in Hong Kong increases faster than the world average is that Hong Kong is a highly urbanized city (HKO, 2003). Buildings and other concrete surfaces in the urban areas absorb the heat from solar during the daytime and release the heat in the form of long-wave radiation during the night. The long-wave radiation is also blocked by the high-rise building from escaping away. This makes temperatures fall slower at night and results in a higher minimum temperature (Leung, Yeung, Ginn and Leung, 2004).

### 3.1.2 Sea Level

In Hong Kong, the tide gauge stations' records show that, as shown in Figure 4, the mean sea level in the Victoria Harbour has risen at an average rate of 2.4 mm per year during the period 1954 to 2008.

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<sup>10</sup> Hong Kong Observatory (2010). *Observed Climate Change in Hong Kong*. HKSAR: the HKSAR government.

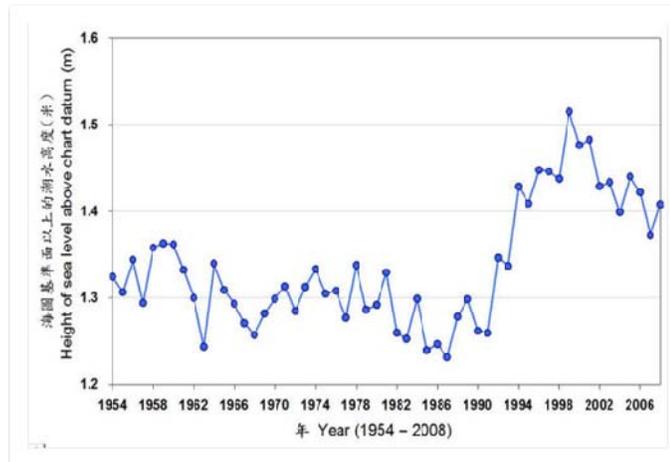


Figure 4: Annual Mean Sea Level, 1954 - 2008<sup>11</sup>

The climate change in Hong Kong can be attributed to both greenhouse gas emissions and localized urbanization (Ginn, 2008). High-rise buildings absorb the heat during the daytime and also prevent the heat escaping away. The higher temperature in urban areas enhances convective activities, and the increase in concentration of suspended particulates from urban activities favours the formation and development of rain-bearing clouds, bringing about the increasing trend of rainfall in Hong Kong. Furthermore, green house gas emissions generated chiefly from motor vehicles and power plants are constantly aggravating the already severe climate change problem. The greenhouse gas emissions in Hong Kong have been continuously increasing since 1998, at a rate around 0.2 tonnes carbon dioxide equivalent per capita per year. Carbon dioxide is the dominant greenhouse gas, making up 86 percent of total greenhouse gases (carbon dioxide-equivalent) emissions in 2007.<sup>12</sup>

<sup>11</sup> Hong Kong Observatory (2009). *Observed Climate Change in Hong Kong*. HKSAR: the HKSAR government.

<sup>12</sup> EPD (2009). *Hong Kong Greenhouse Gas Inventory for the Period 1990 – 2007*. HKSAR: the HKSAR government.

Climate change produces lots of negative consequences. The major impact of global warming in Hong Kong is on the energy-intensive sector. For example, rising the ambient temperature by 1°C will increase electricity consumption by 9.02%, 3.13%, and 2.64% in the domestic, commercial and industrial sectors respectively, and the economic impact on the electricity consumption is HKD 1.72 billion for 1°C temperature rise (Fung, 2004). The increasing risk of Dengue Fever and Malaria in Hong Kong due to the temperature rise was also identified in Fung (2004)'s study. Moreover, extreme events such as tropical storms or heavy rainfall may bring more flooding problems to Hong Kong.

### **3.2 Air Quality**

Hong Kong is mainly faced by two air pollution issues, namely local street-level pollution and the regional smog problem (EPD, 2009). The air quality monitoring data show that the ambient air quality has worsened on average by 13 to 47% (by comparing monitoring data between Year 1990 and Year 2008) for some pollutants. The visibility has been deteriorating due to worsening of the regional background air quality. "Reduced visibility" days, defined as those with a visibility of less than 8 kilometres and relative humidity not exceeding 80%, increased by 207% from 1997 to 2006.<sup>13</sup>

Referring to the pollutants, the air pollutants of greatest concern for Hong Kong are Respirable Suspended Particulates (RSP), Sulphur Dioxide (SO<sub>2</sub>), oxides of nitrogen (NO<sub>x</sub>) and Volatile Organic Compounds (VOC) (Leverett, Hopkinson, Loh and Trumbull, 2007). The source of the majority of the first three pollutants is the

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<sup>13</sup> EPD (2009). *A Report on the Results from the Air Quality Monitoring Network (AQMN) - 2008*. HKSAR: the HKSAR government.

combustion of fossil fuels (oil, coal, gas, and diesel and petrol), predominantly for electricity generation and transport. Volatile organic compounds are released from petrol-fuelled vehicles and in the process of refilling petrol stations as well as from paints, printing inks and a number of other consumer products (Leverett, et al., 2007).

Sources of the air pollution in Hong Kong, except for pollutants from neighbouring Guangdong Province, include transport emissions and emissions from heating and energy generation.

### **3.2.1 Transport Emissions**

Road transport is always considered especially serious by the public, because the pollution was emitted in close proximity to high population centres, increasing the health risk directly. Hong Kong' human and vehicle populations are, in some areas, the densest in the world (Leverett, et al., 2007). Road transport is one of the major sources of NO<sub>x</sub>, Particulate Matter (PM) and Non-methane VOC (NMVOC). It produced 22, 30 and 20 percent of each pollutant in year 2007.<sup>14</sup>

Navigation was minor sources of SO<sub>2</sub> comprising a total of less than 1.4 percent of the emission in early 1990s. Nevertheless, there was a rising trend of emission attributed to the development of Hong Kong into a major regional transportation hub. In fact, navigation has become the second most important emission source of SO<sub>2</sub> since Year 2003 and constituted nearly 5.4 percent on its own in Year 2007.<sup>15</sup>

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<sup>14</sup> Hong Kong Observatory (2009). *Observed Air Pollution in Hong Kong*. HKSAR: the HKSAR government.

<sup>15</sup> EPD (2009). *AQMN-2008*. HKSAR: the HKSAR government.

### 3.2.2 Emissions from Heating and Energy Generation

“Thermal power generation from fossil fuels, particularly coal, is the largest source of air pollutant emissions in Hong Kong” said Ms. Gloria Chang, Campaigner of Greenpeace (HK). In 1997, local power generation was the source of 33 percent of particulates, 84 percent of SO<sub>2</sub> and 51% of NO<sub>x</sub> emissions, and in Year 2007 it contributed to 89 percent of the total emission.<sup>16</sup> However, polluting air emissions from local power station emissions were not mentioned in a Policy Address until 2005.

Hong Kong’s electricity is supplied by two power companies: the Hong Kong Electric Holdings Limited (HEH) and CLP Power Hong Kong Limited (CLP). With over 2.2 million customers, representing 80% of Hong Kong’s population, CLP generates the majority of the electricity used in Hong Kong. The mix of fuel used to generate electricity in Hong Kong has gradually become more diversified since the 1970s. CLP’s generation is primarily fuelled by coal, and other energy used include oil, natural gas and nuclear. Compared with CLP, HEH’s generation fuel is less-varied. HEH’s plant was entirely coal-fuelled until one gas-fired combined cycle unit began operating in October 2006, which uses natural gas as the primary fuel for the generation. At current station, less than one percent of Hong Kong’s electricity is generated from renewable sources (waste, solar and wind), still badly inhibiting the amendment of air pollution emissions.<sup>17</sup>

Deteriorating air quality induces a lot of hazards. First, air pollution affects people’s health. According to the interview with Ms. Gloria Chang in Greenpeace, a survey

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<sup>16</sup> EPD (2009). *AQMN-2008*. HKSAR: the HKSAR government.

<sup>17</sup> EPD (2005). *Government’s Environmental Policy for the Power Sector*. Accessible at: [www.epd.gov.hk/epd/english/environmentinhk/air/prob\\_solutions/air\\_problems.html](http://www.epd.gov.hk/epd/english/environmentinhk/air/prob_solutions/air_problems.html)

they conducted in 2004 shows that 96 percent of Hong Kong people felt uncomfortable with their eyes, noses and throats, 37 percent people had problem in breathing and 30 percent had skin problem due to the worsening air pollution. Second, air pollution also causes some environmental hazards, acid rain is an example. It could destroy forests, soils, quality of water, buildings, machines and etc. In addition, harmful effects on plants and ecosystems, such as interfering with the ability of sensitive plants to produce and store food, making them more susceptible to certain diseases, insects, other pollutants, competition and harsh weather; damaging the leaves of trees and other plants, negatively impacting the appearance of urban vegetation, national parks, and recreation areas(Institute for Environment and Sustainable Development, 2001).

### **3.3 Water Quality**

The water quality in Hong Kong is better than the quality of air and waste in terms of Water Quality Objectives (WQO) in Hong Kong. The overall compliance with marine Water Quality Objectives in Hong Kong has been maintained at a relatively high level in the recent years. Details can be found in Figure 5. Thirty-four (or 83%) of the 41 gazetted beaches in Hong Kong complied with the WQO, the same as in the previous five years (2003 to 2007).<sup>18</sup> The compliance rate in 2007 was at 86%, the same as in 2006 and up from 76% in 1997.

Besides the positive side, the current water quality is still not enough for a clean bill of health (Leverett, et al., 2007). For example, for the reason of marine transportation, oil spillage from ships occasionally contaminates the sea. In addition, there still are

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<sup>18</sup> EPD (2008). *Beach Water Quality in Hong Kong*. HKSAR: the HKSAR government.

quantities of toxic metals and other harmful substances being discharged into the harbour and other marine water.<sup>19</sup> In terms of beach water quality, pollution incidents such as breakdown of sewage pumping or treatment facilities, overflow of sewage, outfall damage, or illegal discharge of high-strength commercial or industrial wastewater, etc., may result in a sudden discharge of a large quantity of raw or partially treated sewage in the catchment area of a beach. In recent years, there have been an increasing number of rivers graded bad or very bad. Mr. David Wong, Principal Environmental Protection Officer in EPD, said that “sewage discharge is the main cause of beach and river water pollution.”

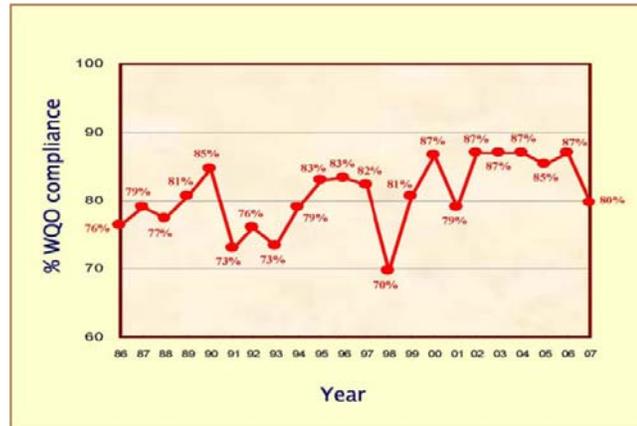


Figure 5: Overall Compliance with the Marine WQO in Hong Kong, 1986-2007<sup>20</sup>

Water pollution can be invisible to the naked eye, but its impacts are for the most part clear enough. Bacteria, nutrients and other pollutants can make swimmers sick, contaminate or kill marine life, give off bad smells and render the beach unsuitable for swimming.

<sup>19</sup> EPD (2008). *Marine Water Quality in Hong Kong*. HKSAR: the HKSAR government.

<sup>20</sup> *ibid.*

### 3.4 Waste Problems

Waste is a common problem of affluent societies. Especially when people can afford greater convenience and more purchases tend to throw away more rubbish. Hong Kong is no exception to this. Like many developed places, Hong Kong has seen its waste loads grow as its economy has grown. According to the Environmental Protection Department, several different types of waste are generated in Hong Kong. Municipal solid waste, construction waste, and chemical waste are three primary types. Apart from these, there are also some special wastes, including clinical waste, animal carcasses, livestock waste, radioactive waste, grease trap waste and waterworks/sewage sludge. The three main types of waste are described below.

#### 3.4.1 Municipal Solid Waste (MSW)

MSW comprises solid waste from households, commercial and industrial sources, and its loads have in general been increasing since 1986 - when the EPD was formed - mirroring Hong Kong's rapid economic expansion over the same period.

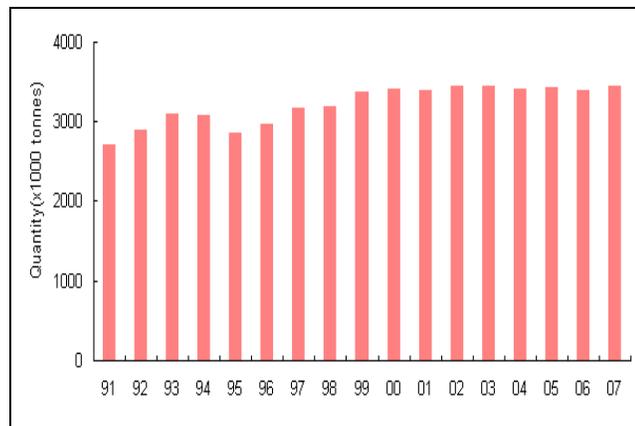


Figure 6: Quantity of Municipal Solid Waste Disposed Of, 1991-2007<sup>21</sup>

<sup>21</sup> EPD (2008). *Monitoring of Solid Waste in Hong Kong*. HKSAR: the HKSAR government.

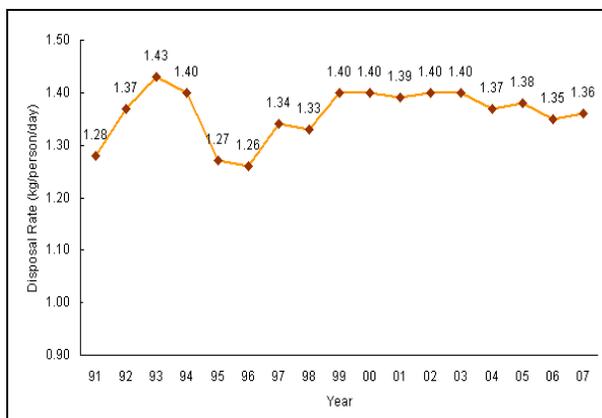


Figure 7: Per Capita Disposal Rates of Municipal Solid Waste, 1991-2007<sup>22</sup>

At the same time, the population has grown by more than one million people and each person is throwing away more waste. The per capita level of municipal solid waste disposal has risen from 1.28 kilograms per person per day in 1991, to 1.36 kilograms in 2007. Figure 6 and 7 respectively present in detail the total quantity and per capita disposal rates of municipal solid waste from 1991 to 2007.

The primary approach of disposing municipal solid wastes is sending them to the landfills. This disposing method is associated with many problems, and generating landfill gas is a representative one and cannot be ignored. Waste degradation produces landfill gas in significant quantities. Landfill gas is made up of several gases and chemicals which are potential flammable and harmful to health. For example, methane, one of the major components of landfill gas, is flammable and will burn when mixed with air between approximately 5% by volume and 15% by volume (the Lower Explosive Limit and Upper Explosive Limit respectively) (Cook and Ng, 2004).

<sup>22</sup> EPD (2008). *Monitoring of Solid Waste in Hong Kong*. HKSAR: the HKSAR government.

### 3.4.2 Construction Waste

In addition to municipal solid waste, recently, Hong Kong is producing around ten million tonnes of construction waste per annum. Figure 8 shows the quantities of construction waste from 1991 to 2007. Construction waste means any substance, matter or thing which is generated as a result of construction work and abandoned whether or not it has been processed or stockpiled before being abandoned. It is a mixture of surplus materials arising from construction, site clearance, land excavation, refurbishment, renovation, demolition and road works. According to the EPD, over 80% of construction waste in Hong Kong are inert and are known as public fill. Public fill includes debris, rubble, earth and concrete which are suitable for land reclamation and site formation. Except being used as fill in reclamation sites, ideally, when properly sorted, materials such as concrete and asphalt can be recycled for use in construction; however, a significant portion of the waste still goes to

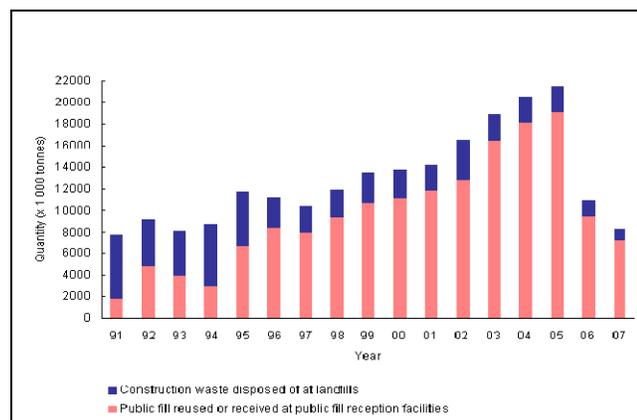


Figure 8: Quantities of Construction Waste, 1991-2007<sup>23</sup>

landfills. The remaining non-inert substances in construction waste include bamboo, timber, vegetation, packaging waste and other organic materials. In contrast to public

<sup>23</sup> EPD (2008). *Monitoring of Solid Waste in Hong Kong*. HKSAR: the HKSAR government.

fill, non-inert waste is not suitable for land reclamation and is always disposed of at landfills.

The government has been examining several ways to promote the reuse and recycling of construction waste during recent years, significantly reducing the total quantity of construction waste. However, in respect of Hong Kong's landfill capacity, disposal of construction waste is still a serious problem. Today, Hong Kong is running out of both reclamation sites and landfill space. According to the interview with Mr. David Wong of the EPD, in view of Hong Kong's continuing infrastructure programme, the government estimates the level of construction and demolition waste arising is likely to remain at a high level for the foreseeable future, and landfills will be full in early to mid-2010s, and public fill capacity will be depleted in the near future. For sustainable development, the city can no longer rely solely on reclamation to accept most of the inert construction waste, and more effective approaches are need to promote the recycling of construction waste.

### **3.4.3 Chemical Waste**

Chemical waste comprises any substance or thing being scrap material, effluent, or an unwanted substance of by-product arising from the application of or in the course of any process or trade activity, and which poses a possible risk to health and/or the environment. The quantity of disposal of chemical waste in Hong Kong has risen by 7,100 tonnes from 2004 to 2007. Compared with 66,700 tonnes in 1999, the quantity of disposal has fallen in recent years, but it remains at a very high level – around 50,000 tonnes. Figure 9 shows the quantities of chemical waste disposed from 1993 to 2007.

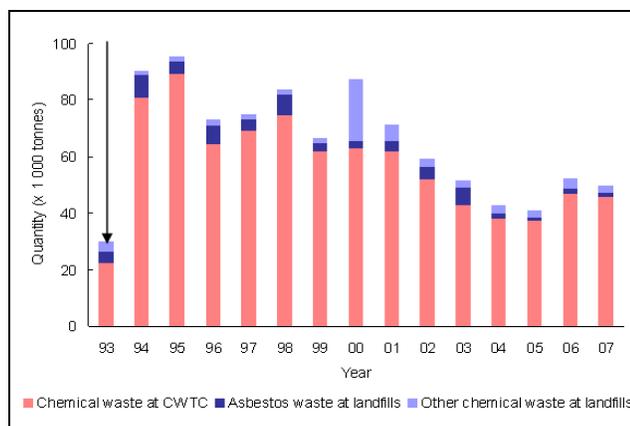


Figure 9: Disposal of Chemical Waste in Hong Kong, 1993-2007<sup>24</sup>

Indiscriminate disposal of chemical waste has very serious health, safety and environmental consequences. Release into coastal waters causes damage to local marine life and accumulation of toxins in sea-food generally creates a serious health hazard to the community. Uncontrolled disposal at municipal waste facilities and into sewerage systems and sewage treatment facilities threatens the health and safety of the operatives. It also results in costly repairs and replacement of these facilities as well as disruption to their operation (EPD, 2007).

### 3.5 Conclusions

The high average temperature and continuous rising sea level show that Hong Kong is facing serious climate change problems, transport emissions and energy generation emissions cause the significant declination in air quality. Although the water quality in Hong Kong is better than the quality of air and waste, it is still not enough for a clean bill of health. Additionally, Hong Kong has seen its waste loads rise as its economy has grown, and if nothing would be done to significantly lower the rising

<sup>24</sup> EPD (2008). *Hong Kong Waste Treatment and Disposal Statistics*. HKSAR: the HKSAR government.

rate, it is expected that by 2015 Hong Kong's landfills will be exhausted. Thus, it is demonstrated that the need for strong and immediate action to address environmental problems in Hong Kong is urgent, and it is reasonable to wonder what has been done by Hong Kong government to deal with these problems by now. Thus the next chapter explains the current green tax measures in Hong Kong.

## **CHAPTER 4 CURRENT GREEN TAX MEASURES IN HONG KONG**

The second sub-question of this study - what green tax measures are currently being used in Hong Kong, and how effective are they? – is approached in this chapter. First, a review and analysis of current green tax measures in Hong Kong are presented, and then the obstacles that hinder the implementation of green taxes in Hong Kong are discussed, expecting to find a suitable way to make green tax measures more acceptable when providing recommendations for Hong Kong.

### **4.1 Review and Analysis of Green Tax Measures in Hong Kong**

This section reviews and analyses the current green tax measures in Hong Kong from the view of the four major environmental problems - climate change, air pollution, water pollution and waste problem – mentioned in Section 1.5.

#### **4.1.1 Green Tax Measures Addressing Climate Change and Air Pollution**

As mentioned in Chapter 2, Hong Kong is mainly faced by two air pollution issues, namely local street-level pollution and the power station emission problem. Although, as mentioned in Chapter 3 section 3.2.2, the combustion of energy for heating and power generation makes up the largest source of air pollution emissions in Hong Kong, accounting for 89 percent of total air pollutants emissions in Year 2007,<sup>25</sup> until now, Hong Kong still has no tax or charge levied on energy use. As a result, in this section, only the green tax measures in dealing with local street-level pollution and some depreciation allowance measures are discussed and analyzed.

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<sup>25</sup> Hong Kong Observatory (2009). *Observed Air Pollution in Hong Kong*. HKSAR: the HKSAR government.

#### **4.1.1.1 Green Tax Measures Addressing Local Street-Level Pollution**

In the area of controlling the local street-level pollution, there are First Registration Tax (FRT) and Vehicle License Fee (VLF) to restrict the amount of motor vehicles, Excise Duties on Transport Fuels to regulate the use of motor fuels in Hong Kong, and tax incentive measures to promote the use of clean energy and enhance the efficiency of burning fuels.

##### **4.1.1.1.1 FRT and VLF**

The Transport Department in Hong Kong regulates that during the first registration of a vehicle, it is required to pay the FRT for the registration and to pay the VLF for licensing of the vehicle. The FRT is calculated basing on the taxable value of the vehicle, and the Motor Vehicles Valuation Group of the Customs and Excise Department is responsible for the assessment of the taxable value of each imported motor vehicle which is to be used in Hong Kong. The tax rates applicable appear in Table 1 below. Since the reform of the tax level in 1982, in which the level of FRT was increased to discourage private car ownership and also as an incentive to buy smaller, more efficient cars, smaller cars have less tax levied on them. The VLF is set on a gradated scale with the fee rising with the engine size, and different tax levels are applied to different types of vehicles (including Private Car, Goods Vehicle, Bus, Taxi, Motor Cycle and Motor Tricycle and Electrically Powered Passenger Vehicle) with the highest level on private cars and the lowest level on buses.<sup>26</sup>

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<sup>26</sup> Transport Department (2010). Fees & Charges: Vehicle License. Accessible at: [www.td.gov.hk/en/public\\_services/fees\\_and\\_charges/index.html](http://www.td.gov.hk/en/public_services/fees_and_charges/index.html)

<b>Class of Motor Vehicle</b>	<b>Rate of Tax</b>
Private cars	
a. the first \$150,000 of taxable value	35%
b. on the next \$150,000	65%
c. on the next \$200,000	85%
d. on the remainder	100%
Motor cycles and motor tricycles	35%
a. Goods vehicles, other than van-type light goods vehicles (LGV)	15%
b. Van-type LGV not exceeding 1.9 tonnes permitted gross vehicle weight:	
i. on the first \$150,000	35%
ii. on the next \$150,000	65%
iii. on the remainder	85%
c. Van-type LGV exceeding 1.9 tonnes permitted gross vehicle weight	17%
Taxis, Light buses, Buses and Special purpose vehicles	3.7%

Table 1: First Registration Tax Rates<sup>27</sup>

The imposition of First Registration Tax and Vehicle License Fee does not seem to have had much effect on restricting the number of motor vehicles in Hong Kong, and the higher level of tax on private cars also appears not to have decreased the number of private cars in the SAR. Every day about 11 million passenger journeys - over 90% of the daily journeys - are made on a public transport system which includes railways, trams, buses, minibuses, taxis and ferries, making it the highest rate in the world. However, there are 385,675 licensed private cars, accounting for 67 per cent of all vehicles as at the end of June 2009. Furthermore, there are about 283 licensed vehicles for every kilometre of road, amongst the highest in the world, and the topography makes it increasingly difficult to provide additional road capacity in the

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<sup>27</sup> Transport Department (2009). *Guidelines for Importation and Registration of Motor Vehicle*. HKSAR: the HKSAR Government.

heavily built-up areas.<sup>28</sup>

As mentioned in the economic theory of green tax in Chapter 1, pollution would reach the optimum amount when the tax totally internalises the negative externality (environmental damage) in the private market decision. It can be inferred from this that the likely reason why the FRT and VLF have not had much effect in reducing the vehicle population is that the First Registration Tax and Vehicle License Fee are currently not enough to reflect the real externalities produced by road travel.

#### **4.1.1.1.2 Excise Duties on Motor Fuels**

There is no tariff on goods entering Hong Kong, but excise duties shall be payable on hydrocarbon oil (other than ultra low sulphur diesel and Euro V diesel) at the following rates:<sup>29</sup>

- |                      |             |
|----------------------|-------------|
| (a) aircraft spirit  | HK\$6.51 /L |
| (b) light diesel oil | HK\$2.89 /L |
| (c) leaded petrol    | HK\$6.82 /L |
| (d) unleaded petrol  | HK\$6.06 /L |

Additionally, since July 2008 Euro V diesel has been zero-rated, and there is an absence of tax on Liquefied Petroleum Gas (LPG) to encourage taxis and light buses to switch from diesel to LPG-burning engines.

Hong Kong sits alongside one of the world's busiest shipping lanes, but there is no fee levied on the use of fuel by ships (Cheung, 2008). While trucks using ultra-low

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<sup>28</sup> Transport Department (2009). *Hong Kong: the Facts – Transport*. HKSAR: the HKSAR Government.

<sup>29</sup> Customs and Excise Department (2009). *Dutiable Commodities in HKSAR*. HKSAR: the HKSAR government.

sulphur diesel oil are taxed HK\$2.89 per litre, ships are burning duty-free bunker fuel that is much dirtier. One reason might be that Pearl River Delta ports, including the Kwai Chung container terminal in Hong Kong, is one of the busiest port facilities in the world, handling about 12 percent of global container traffic, and the government is concerned that levying fees on bunker fuel would impose financial burdens on business operators and hamper the port's competitiveness. However, the harmful side of burning bunker fuel provokes serious concern. Primary sulphate, or SO<sub>4</sub>, is produced when ships burn bunker fuels. Bunker fuel is a viscous and highly polluting substance left over from refining oil. It has high nitrogen oxide contents and contains as much as 4.5 percent sulphur, making the exhausts especially noxious for those who inhale them. Furthermore, SO<sub>4</sub> particulates are particularly harmful to humans because they are especially fine microscopic particles that can remain in the lungs. The tiny particles can also travel long distances (Derwent et al., 2005). "At least 3.8 million people living around Kwai Chung Container Port had been exposed to health risks because of port-related air pollution."<sup>30</sup>

#### **4.1.1.1.3 Tax Incentive Measures**

Except for restricting the use of fuel, the Hong Kong government also has made an effort to promote the use of clean energy and enhance the efficiency of burning the fuel. The government has adopted some tax exemption or reduction measures on some specific types of cars. Details are addressed below:

##### **4.1.1.1.3.1 Tax Incentives for Environment-friendly Commercial Vehicles**

Starting from 1 April 2008, buyers of newly registered environment-friendly

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<sup>30</sup> Cheung C.F. (2008). Use policies on fuel tax to lower port pollution. South China Morning Post. June 18th, 2008. p. 2.

commercial vehicles, including taxis, light/medium/heavy goods vehicles, public/private light buses, public/private non-franchised buses and special purposes vehicles, could receive a reduction on the FRT. The rates of reduction of the first registration taxes for different vehicle classes qualified under the scheme are as follows:

- 100% for taxis, light buses, non-franchised buses and special purpose vehicles;
- 50% for goods vehicles (except van-type goods vehicles up to 1.9 tonnes permitted gross vehicle weight); and
- 30% for van-type goods vehicles up to 1.9 tonnes permitted gross vehicle weight.

As a start, the qualifying standard for environment-friendly commercial vehicles is set at Euro V level, and the qualifying standards for environment-friendly commercial vehicles also will be reviewed annually by the EPD.<sup>31</sup>

#### **4.1.1.1.3.2 Tax Incentives for Environment-friendly Petrol Private Cars**

Starting from 1 April 2007, a 30% reduction in the First Registration Tax (FRT) was offered to buyers of newly registered environment-friendly petrol private cars, subject to a cap of HK\$50,000 per car.<sup>32</sup> There are also qualifying standards for environment-friendly petrol private cars, including Emission Requirements and Fuel Efficiency Requirements, which are set out by the EPD. The EPD will review the

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<sup>31</sup> EPD (2010). Tax Incentives for Environment-friendly Commercial Vehicles. HKSAR: HKSAR Government. Accessible at: [http://www.epd.gov.hk/epd/english/environmentinhk/air/prob\\_solutions/environment\\_friendly\\_commercial\\_vehicles.html](http://www.epd.gov.hk/epd/english/environmentinhk/air/prob_solutions/environment_friendly_commercial_vehicles.html)

<sup>32</sup> Environment-friendly petrol private cars emit about 50% less hydrocarbons (HCs) and nitrogen oxides (NOx) and consume about 40% less fuel than conventional petrol Euro IV private cars. Owing to their higher fuel efficiency, they also emit about 40% less carbon dioxide (CO<sub>2</sub>), a key greenhouse gas contributing to global warming.

qualifying standards annually in the light of technological advancement to restrict the tax incentive to vehicles of truly outstanding emission and fuel efficiency performance.<sup>33</sup>

#### **4.1.1.1.3.3 Tax Incentives for Electric Cars**

To encourage the use of electric cars in Hong Kong, the government offered exemption of First Registration Tax for electric vehicles. This exemption was first granted in the financial year of 1994/95 and has been extended several times until now. Moreover, the annual license fee costs only HK\$440, compared to the minimum annual charge of HK\$3,929 for conventional private cars.<sup>34</sup>

The promotion of electric vehicles brings about more opportunities to local business and provides an incentive for innovation to develop advanced technologies and less-polluting products. “Mycar” is a good example. "Mycar", jointly developed by the Hong Kong Polytechnic University and EuAuto Technology Limited, was officially launched from its birthplace in October 2009. It is Hong Kong's first home-grown electric vehicle and marked a milestone in the history of Hong Kong's electric vehicle development (Li, 2009).

There are some deficiencies existing in the above-mentioned tax incentive measures. Firstly, the tax incentive scheme for environment-friendly private and commercial vehicles got some disappoint results. Until early 2009, only 196 vehicles have been registered under the scheme, compared to the total more than 150,000 commercial vehicles registered in the city, representing tax forgone by the government of HK\$ 4

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<sup>33</sup> EPD (2010). Tax Incentives for Environment-friendly Petrol Private Cars. HKSAR: HKSAR Government. Accessible at: [www.epd.gov.hk/epd/english/environmentinhk/air/prob\\_solutions/environment\\_friendly\\_private\\_cars.html](http://www.epd.gov.hk/epd/english/environmentinhk/air/prob_solutions/environment_friendly_private_cars.html)

<sup>34</sup> EPD (2010). Air – problems and solutions. HKSAR: HKSAR Government.

million, as opposed to the HK\$26 million annual budget for the programme (Sin, 2009).

Secondly, the promotion scheme of electric cars has some shortcomings. The current assisted condition is not mature enough for using electric cars. For example, the electric cars' operation depends heavily on the infrastructure of recharging stations. But at present there are only 21 recharging stations in Hong Kong (Lam, 2009). Moreover, the technique of electric cars is also immature. So promoting the use of electric cars will be a very long way.

#### **4.1.1.2 Depreciation Allowances Measures Addressing Climate Change and Air Pollution**

In recent years, the Hong Kong government put in force certain new depreciation allowance provisions to encourage companies to use environmentally-friendly facilities and vehicles, thereby reducing air pollution.

##### **4.1.1.2.1 Tax Concession Scheme on Environmentally-Friendly Facilities**

At present, there is a tax concession scheme on environmental-friendly facilities. Starting from the year of assessment 2008/09, there will be a tax concession if capital expenditure was incurred on environmental protection machinery or installation (collectively “environmental protection facilities”). Eligible environmental protection machinery will receive a 100% deduction of the cost from the year of assessment instead of 60% of the cost as previously the case. Eligible environmental protection installations will now receive an accelerated rate of 20% deduction of cost for five consecutive years.<sup>35</sup>

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<sup>35</sup> EPD (2009). Tax Concession Scheme on Environmental-Friendly Facilities. HKSAR: HKSAR

The eligible environmental protection machinery currently on the list includes:

- (a) low noise construction machinery or plant registered under the Quality Powered Mechanical Equipment system administered by the Environmental Protection Department
- (b) air pollution control machinery or plant in compliance with the requirements under the Air Pollution Control Ordinance (Cap 311)
- (c) waste treatment machinery or plant in compliance with the requirements under the Waste Disposal Ordinance (Cap 354), and
- (d) waste water treatment machinery or plant in compliance with the requirements under the Water Pollution Control Ordinance (Cap 358).

The list of eligible environmental protection installations currently includes energy efficient building installations registered under the Hong Kong Energy Efficiency Registration Scheme for Buildings administered by the Electrical Mechanical Services Department and the following:

- (a) solar water heating installations
- (b) solar photovoltaic installations
- (c) wind turbine installations
- (d) offshore wind farm installations
- (e) landfill gas installations
- (f) anaerobic digestion installations
- (g) thermal waste treatment installations
- (h) wave power installations
- (i) hydroelectric installations

- (j) bio-fuel installations
- (k) biomass combined-heat-and-power installations, and
- (l) geothermal installations.

#### **4.1.1.2.2 Tax Deduction for Capital Expenditure on Environmentally-Friendly Vehicles**

In the HKSAR government's 2010-11 Budget, there is a proposal to accelerate the tax deduction for capital expenditure on environmentally-friendly vehicles. Enterprises will be able to enjoy a 100% profits tax deduction in the first year of purchase under the proposal. The proposed list of specified environmentally-friendly vehicles will be announced when the relevant amendment bill to the IRO is published in the gazette. Though the relevant bill is not yet available at this time, it is strongly believed that the related framework for the accelerated deduction of environmentally-friendly vehicles should be similar to the provisions as contained in section 16I of the IRO (Cheung, 2010).

The conclusion can be drawn from above discussion that comparing to the deteriorative air quality, the government's action of controlling the major cause of air pollution and climate change is insufficient. The energy used for heating and power generation is not subject to excise duties, and there is no direct tax or charge levied on power plants emissions. As a result, the government should pay closer attention to the major cause of air pollution and climate change.

#### **4.1.2 Green Tax Measures Addressing Water Pollution**

Hong Kong government introduced a Sewage Charging Scheme in 1995. All premises connected to the public sewerage system have been required to pay sewage

charges. The Sewage Charging Scheme contains two components: the Sewage Charge (SC) and the Trade Effluent Surcharge (TES).<sup>36</sup> The SC aims at recovering the cost of collecting and treating wastewater at or below the pollution strength of domestic sewage, and the TES aims at recovering the additional cost of treating trade effluent with pollution strength exceeding the domestic sewage.

Both domestic households and the trade, business and manufacture sectors have to pay SC, while the domestic households could receive an exemption for the first 12 cubic metres of water consumption for every 4-month period. In 2008, the government launched a plan to gradually increase the Sewage Charge over the coming ten years. From 1st April 2008 onwards, the SC rate has been increased from the original \$1.2 to \$1.31 per cubic metre of water supplied. The rate will then be gradually increased by 9.3% per annum until \$2.92 per cubic metre of water supplied on 1st April 2017.

In addition to SC, 30 prescribed trades are required to pay TES in addition to SC to reflect the additional cost of treating their more polluting effluents. TES is calculated based on water consumption readings and the prescribed charging rates for the respective trades. In 2008, the government revised the rates of TES according to the results of a trade effluent survey. Under the new proposal, different businesses are categorized into two schedules – Schedule B & C – based on their pollution level. Trades listed in Schedule B are required to pay TES in addition to SC because the pollution level of the wastewater discharged by them exceeds that of the domestic level. Under the TES charging scheme, the Chemical Oxygen Demand (COD) values (i.e.  $COD_{total}$  and  $COD_{settled}$ ) of the trades are used as the measurement of their

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<sup>36</sup> Drainage Services Department (2009). Sewage Services Charging Scheme. HKSAR: the HKSAR government.

pollution level. The generic COD values and the corresponding TES rates for different trades are also listed in Schedule B. For the trades listed in Schedule C, the amount of TES chargeable is based on 80% of the water supplied to account for the water consumed in the production process which is not discharged into the public sewers. The others are charged at 100% of the water supplied.<sup>37</sup>

This Sewage Charge Scheme, to some extent, reflects the Polluter Pays Principle and controls the sewage pollution. The TES reflects the additional cost for treating the stronger effluent generated by some industrial and commercial operations. With the introduction of the sewage services charging scheme, dischargers are required to pay the cost of the sewage services according to the pollution level and quantity of their discharge, making people and companies aware of the "price" of producing wastewater and changing people's polluting behaviour - they will be encouraged to produce less wastewater and, hence, pay less sewage charges.

However, while the Sewage Charging Scheme has seen some of its achievement, which has been presented in Chapter 3, when taking the overall water-quality situation into consideration, the water pollution problem is still serious. For example, 450,000 tonnes of almost untreated waste is discharged into Victoria Harbour from the northern and western shores of Hong Kong Island every day, and the continued degradation of western waters has forced the closures of four beaches in the Tsuen Wan area including Gemini, Casam, Hoi Mei Wan and Lido beaches.<sup>38</sup> Thus this charging scheme still needs to be enhanced.

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<sup>37</sup> Drainage Services Department (2009). *Sewage Services Charging Scheme*. HKSAR: the HKSAR Government.

<sup>38</sup> EPD (2008). *Beach Water Quality in Hong Kong*. HKSAR: the HKSAR Government.

### **4.1.3 Green Tax Measures Addressing Waste Problem**

In dealing with the waste problems, the HKSAR government has introduced a Construction Waste Disposal Charging Scheme and Plastic Bag Tax.

#### **4.1.3.1 Construction Waste Disposal Charges**

As mentioned in Chapter 3, if the per capita level of municipal solid waste disposal keeps on increasing at its current rate, it is expected that by 2015 Hong Kong's landfills will be exhausted. It is a very serious and urgent problem. Concerning this serious condition, the Hong Kong government introduced the Construction Waste Disposal Charging Scheme to charge for construction waste disposed of at landfills, sorting facilities and public fill reception facilities in December 2005. Construction waste producers, such as construction contractors, renovation contractors or premises owners, prior to using government waste disposal facilities, need to pay the construction waste disposal charge. The charges rates are different in light of different disposal approaches: \$125 per tonne at landfills, around \$100 per tonne at sorting facilities and \$27 per tonne at public fill reception facilities.<sup>39</sup>

The government has two primary purposes for introducing this charging scheme: one is to fully recover the capital and recurrent costs of the facilities and make the polluters pay, the other is to preserve the landfill space - through the Charging Scheme, construction waste producers are encouraged to reduce, sort and recycle construction waste so that their disposal costs can be minimized and our valuable landfill space can be preserved. At the same time, the disposal charges are also levied with an incidental purpose to reduce the noise incidences of illegal dumping. This charging scheme is notably effective. Referring to Figure 8 in Chapter 3, which

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<sup>39</sup> EPD (2009). *Construction Waste Disposal Charging Scheme*. HKSAR: the HKSAR government.

shows that since the commencement of this disposal charging scheme in 2005, the total quantity of construction waste has been reduced significantly. With regard to the construction waste disposal charges scheme, although it has had significant effect on reducing the quantity of construction waste, in dealing with the whole waste problem in Hong Kong, the construction waste disposal charges alone is not enough, and problems of other types of waste (including municipal solid waste and chemical waste) keep on intensifying – as seen from the figure 6, 7 and 9 in Chapter 3. What's more, despite the significant effort the current charging scheme made, in respect of Hong Kong's landfill capacity, the city can no longer rely solely on reclamation to accept most of the inert construction waste, and there is an urgent need to develop more effective approaches to promote the recycling of construction waste. As a result, introducing new taxes/charges on other sorts of waste and carrying out an integrated charging scheme for the whole waste problem might be a valuable choice.

#### **4.1.3.2 Plastic Bag Tax**

A plastic bag tax was levied in Hong Kong in July 2009, and at present the tax is in its first stage - 50 Hong Kong cents for every plastic bag and is levied in a total of 2,000 shops, including every major supermarket.

This preliminary levy on plastic bags has already seen its good effect -- in the first two days, there is a dramatic 85 percent drop in the issue of plastic bags by shops and supermarkets involved in the scheme.<sup>40</sup> After the tax, according to the interview with HKRMA, a survey they conducted in 2009 shows that the number of plastic bags handed out in 18 supermarkets during a peak shopping hour fell from 2,742 to 403. Additionally, in the view of Hong Kong people's attitude towards plastic bag tax,

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<sup>40</sup> EPD (2009). *Environmental Levy on Plastic Shopping Bags*. HKSAR: the HKSAR government.

with an understanding that plastic bags are bad for the environment, people have accepted the levy. A survey in October 2009 conducted by Friends of the Earth found 98 percent of interviewees have green shopping bags at home, and 85 percent said they will use these bags. In other words, the majority of citizens do not strongly object taxing the use of plastic bags.

Beside these good effects mentioned above, it should be noted that the plastic bag problem in Hong Kong, in general, is still serious. According to the interview with HKRMA, there are totally 55,000 retail stores in Hong Kong, but at present only four percent of all retail outlets are subject to the levy, including the big supermarkets. In other words, at the first stage of plastic bag tax, still plenty of stores are exempted from the levy, such as bakeries. Many retailers still have the right to deliver free plastic bags randomly. HKRMA said that “the Environmental Levy Scheme on Plastic Shopping Bags has only made a very limited contribution to the reduction of indiscriminate use because plastic shopping bags that are distributed in 96% of all retail outlets are not subject to a levy, and it is also unfair to the 4% retailers who are subject to the tax.”

As a result, the HKRMA advocates that the tax move on to the next stage – extending the tax and including all the rest of retailers – as soon as possible. For example, according to the interview with HKRMA, they said that “The Environmental Levy Scheme on Plastic Shopping Bags has only made a very limited contribution to the reduction of indiscriminate use because plastic shopping bags that are distributed in 96% of all retail outlets are not subject to a levy, and it is also unfair to the 4% retailers who are subject to the tax,” and “the reduction in plastic bag usage has been modest and the government should extend the levy to include all retail outlets”.

Admittedly, expending the tax might involve some difficulties and result in some problems. For example, some small retailers may be not able to afford computerized or new cashier systems to handle the levy, and there may be a flood of reusable bags following the tax extending, because such non-woven products are much harder to break down than plastic bags, and would create even worse environmental hazard if discarded. But all the difficulties and problems can be resolved through careful design of the tax and more active, extensive propaganda. According to the interview with the HKRMA, “to solve the small retailers’ difficulties, the government could allow them to collect the cash and submit it to the Environmental Protection Department.”

#### **4.2 Obstacles that Hinder the Implementation of Green Taxes in Hong Kong**

Considering theoretical advantages of green taxes mentioned in Chapter 1 and at least their partial success to date in Hong Kong, green tax measures have not been more widely applied yet. Besides the theoretical disadvantages of green tax, the reasons for this situation are discussed below:

The first possible reason is the increasing gap between rich and poor in Hong Kong. Some environmental taxes are income regressive, meaning that poorer households pay a disproportionate share of their income in these taxes relative to richer households. The wide income disparities in Hong Kong mean that any broadening of the tax base is open to the criticism that it redistributes the tax burden onto those least able to afford it.

The second possible reason is the political structure in Hong Kong. It is widely recognized by scholars and also by government officials that Hong Kong’s political

structure can make it difficult for the government to get policies past vested interests. (Chan, 2008) In particular, functional constituencies give various groups influence in the legislature and thus over government. Thus it would be very difficult for the Government to take any action that may impact on these groups' interests. For example, there was fierce opposition from the Hong Kong Retail Management Association and the Hong Kong Plastic Bags Manufacturers' Association when the Hong Kong government first raised the possibility of taxing plastic bags in 2006. This opposition was one reason why it took so long for the Government to put the levy into effect. "They have powerful right of speak, and "the government also has related interest with these groups" said Ms. Gloria Chang (2009), Campaigner of Greenpeace - Hong Kong. As a result, it might be very difficult for the government to take actions that may impact these groups' interest.

### **4.3 Conclusions**

Current green tax measures in Hong Kong government only contain the following: first, for air pollution, there are FRT and VLF to restrict the amount of motor vehicles, excise duties on motor fuels to regulate the use of transportation fuels and some tax incentives to encourage the use of energy-efficient vehicles and the investment in environmentally-friendly machinery, plant, or construction; second, the Sewage Charging Scheme was introduced to reduce the water pollution; finally, for the waste, a Construction Waste Disposal Charging Scheme and a plastic bag tax have been introduced. Therefore, what the Hong Kong government has done so far does not seem to be enough, and the application of green tax measures is expected to be enhanced. As mentioned in Chapter 1, at present, green tax has become a topical research area and been accepted and applied by more and more countries, and Hong Kong could

learn from overseas and make improvements. Thus in the next chapter, green tax measures applied in six selected countries are explored.

## **CHAPTER 5 GREEN TAX MEASURES: OVERSEAS EXPERIENCES**

In order to enhance green tax measures in Hong Kong, learning from overseas experiences is very effective, Thus the purpose of this chapter is to approach the third sub-question of this thesis - What lessons can Hong Kong learn from selected countries? Green tax measures in the six selected countries – Denmark, Finland, Norway, Sweden, The Netherlands and Singapore – are introduced and analysed in this chapter also from the views of four major environmental problems in Hong Kong – climate change, air pollution, water pollution and waste problem - mention in Section 1.5, and all data of green tax measures in this chapter are taken from “OECD/EEA database on instruments used for environmental policy and natural resources management” mentioned in Chapter 2.

### **5.1 Green Tax Measures in Climate Change and Air Pollution Area**

In this section, different or similar provisions of green tax measures related to climate change and air pollution in the four Nordic countries are explained in five parts - (1) Excise Duties on Fossil Fuels for Energy Purpose; (2) Exception to the Excise Duties on Fossil Fuels; (3) Excise Duties on Electricity Consumption; (4) Green Tax Measures Addressing Transportation Sector; (5) Renewable Energy Sources Support Schemes - applying the categorizing approach in the regular overview reports on the use of economic instruments in Nordic environmental policy presented by the Nordic Council of Ministers. In particular, the unique energy tax structure in the Netherlands is discussed in the first part, and Singapore’s innovative transport tax structure is explored in the fourth part.

## **5.1.1 Excise Duties on Fossil Fuels for Energy Purpose**

### **5.1.1.1 Denmark**

The Danish excise duties on fossil fuels are divided into three separate tax categories: Energy Tax, CO<sub>2</sub> Tax and Sulphur Tax.

#### **5.1.1.1.1 Energy Tax**

The energy tax on fossil fuels was introduced in 1977 as a response to the oil crisis in the 1970s, providing consumers with a financial incentive to save energy. The energy tax was initially levied only on oil products, but the energy tax scheme was expanded to include coal products and further to include natural gas. The tax rates are differentiated across the different energy products according to the energy content of each fuel type. The tax rates have gradually been increased (except in 1992, the tax level was lowered by the Government as a response to the introduction of CO<sub>2</sub> tax – to maintain the overall tax burden on energy), and now the energy tax became the dominant part among all the excise duties on fuels in Denmark.

#### **5.1.1.1.2 CO<sub>2</sub> Tax**

The CO<sub>2</sub> tax was introduced in 1992 as a reaction to the increased attention on climate change, intending to create economic incentives for consumption of less CO<sub>2</sub> intensive energy sources. The tax is levied on heavy fuel oil, light fuel oil, natural gas and coal according to the carbon emission from the specific fuel. The tax adopted a fixed rate of 100 DKK/tonne CO<sub>2</sub> regardless of fuel type. In 2005, the tax rate was lowered to 90 DKK/tonne CO<sub>2</sub>, and the energy tax was increased accordingly.

### **5.1.1.1.3 Sulphur Tax**

The sulphur tax was introduced in 1996 and was phased in gradually from 1996 to 2000. As the sulphur content varies, even within each overall fuel category (such as heavy fuel oil or coal), it is necessary to treat the sulphur tax separately from the energy and the CO<sub>2</sub> tax. As a result, the sulphur tax has been levied on all fossil fuels with a sulphur content exceeding 0.05 percent (based on weight), and the tax can be calculated either according to the sulphur content in the energy product or based on the SO<sub>2</sub> emissions - 20 DKK per kg sulphur of the product or 10 DKK per kg SO<sub>2</sub>. These two choices give the energy consumer economic incentives to choose energy products with low sulphur content or abate SO<sub>2</sub> emissions by means of the installation of smoke scrubbers.

### **5.1.1.2 Finland**

Finnish energy policy strives to pursue three goals simultaneously – energy security, economic development and environmental sustainability. Under these settled purposes, the Finnish excise duties on fossil fuels are quite different in comparison with other Nordic countries and comprise four elements: a Basic Excise Tax levied on mineral oils, CO<sub>2</sub> Tax, the Precautionary Stock Fee and the Oil Pollution Fee levied on mineral oils.

#### **5.1.1.2.1 Basic Excise Tax**

The basic excise tax levied on mineral oils was introduced in 1993. It can be seen as similar to the Danish energy tax. There are differentiated tax rates across the different energy products according to the energy content of each fuel type. But since 1997 this tax has only been levied on light fuel oil.

#### **5.1.1.2.2 CO<sub>2</sub> Tax**

In 1990 Finland was the first country in the world ever to introduce CO<sub>2</sub>-based tax on energy consumption, and today, the CO<sub>2</sub> tax is the most dominant of the various duties on fossil fuel consumption in Finland (Parkkinen, 2008). The CO<sub>2</sub> tax was levied on heavy fuel oil, light fuel oil, natural gas, and coal. At first, CO<sub>2</sub> was the sole base for calculating the tax rates (therefore, the OECD/IEA has labelled this initial tax as an “environmental damage tax”). In 1994, the CO<sub>2</sub> tax was changed to based on both the energy content and the carbon content (75 percent of the tax determined by the carbon content and 25 percent by the energy content), in other words, a CO<sub>2</sub>/energy tax. In 1997 the CO<sub>2</sub> tax became again basing solely on carbon content, but this time applying only to heat generation. The tax rate is also a fixed rate regardless of the fuel type and has been increased several times since the introduction. The increase was especially dramatic in the year of 1997 - the rate nearly doubled in 1995. Because natural gas has much less carbon content per unit of energy than other kinds of fossil fuels, the Finnish Government created incentives for wider use of it: the consumption of natural gas was only subject to 50 percent of the general CO<sub>2</sub> tax level and this still applies today.

#### **5.1.1.2.3 Precautionary Stock Fee and Oil Pollution Fee**

The precautionary stock fee and the oil pollution fee levied on mineral oils are the first two taxes to be levied on fossil fuels in Finland. They were introduced for fiscal and trade balance reasons without environmental protection intention and initially levied on mineral oils only. Since 1997, the precautionary stock fee has been expanded to natural gas, coal and electricity.

### **5.1.1.3 Norway**

Norway has a unique situation concerning energy consumption and air pollution when compared with other Nordic countries – almost all electricity in Norway is generated by hydropower instead of fossil fuels, so there are limited opportunities in relation to achieving domestic reductions in greenhouse gas emissions. But the Norwegian government has taken an active position on energy regulation and has introduced several environmental tax measures over the past two decades. There are three elements constitute the excise duties on fossil fuels in Norway: Energy Tax, CO<sub>2</sub> Tax and SO<sub>2</sub> Tax.

#### **5.1.1.3.1 Energy Tax**

The energy tax was introduced in 1970 with a tax base on mineral oil only – not including coal and coke. The same as in other Nordic countries, the tax rate was increased gradually after the introduction, and was lowered in 1992 to keep the overall tax burden on fossil fuels constant when the Norwegian Government introduced the CO<sub>2</sub> tax. However, the energy tax was abandoned in 1993 with a purpose to allow the excise duties on energy products to be based exclusively on environmental characteristics – i.e. the carbon and sulphur content – of the fossil fuels. But it was reintroduced in 2000, for the energy used for space heating, to discourage increased use of heating oil. After the reintroduction, almost half of the total tax burden on energy consumption stems from the energy tax.

#### **5.1.1.3.2 CO<sub>2</sub> Tax**

Norway introduced CO<sub>2</sub> tax in 1991. At that time, the tax was only levied on mineral oil, but in 1992 the CO<sub>2</sub> tax scheme was extended to coal and coke (however, the CO<sub>2</sub> tax on coal and coke was removed in 2003). In contrast to the tax rate in

Denmark and Finland, there is a differentiation in the tax rate among different types of fuels, and these rates have been increased several times since the introduction. In 2005 the CO<sub>2</sub> tax on heavy fuel oil was equivalent to 171 NOK/ tonne CO<sub>2</sub>, the tax on light fuel oil was equivalent to 198 NOK/tonne CO<sub>2</sub> emissions. Same as other Scandinavia countries, in order to provide incentives for consumers to use the cleaner fuel - natural gas, the Norwegian Government exempted the consumption of natural gas on the mainland from both energy tax and CO<sub>2</sub> tax.

#### **5.1.1.3.3 SO<sub>2</sub> Tax**

Sulphur tax or SO<sub>2</sub> tax was introduced in 1971. The sulphur tax was first levied on mineral oil only and then was extended to coal and coke consumption in 1999 (however this tax on coal and coke was abandoned in 2001), and the industry that was most affected by this extension was metal and cement industry (Speck, Andersen, Nielsen, Ryelund and Smith, 2006). Regarding mineral oil, oil products with less than 0.05 percent sulphur content are exempt from the sulphur tax, and the rate was increased several times and is currently 0.07 NOK per litre oil for each 0.25 percent of sulphur content by weight commenced upon; regarding the coal and coke, the tax was fixed at 3 NOK per kg SO<sub>2</sub>.

#### **5.1.1.4 Sweden**

The objective of Swedish energy policy is to secure a reliable supply of energy and electricity while meeting national and international commitments to reduce emissions. The electricity generation in Sweden also differs from Denmark and Finland as Sweden relies heavily on hydropower and nuclear power. As a result, similar to Norway, Sweden also has relatively low degree of greenhouse gas emissions from electricity consumption. The Swedish taxation schemes on fossil fuels include four

elements: Energy Tax, CO<sub>2</sub> Tax, Sulphur Tax and NO<sub>x</sub> Tax.

#### **5.1.1.4.1 Energy Tax**

The energy tax was levied on mineral oil and coal when first introduced in 1957, and then the tax was expanded to Liquefied petroleum gas and further to natural gas. The tax rate and the development of the energy tax in Sweden are very similar to that in Denmark, so here will not go into details of the Swedish energy tax.

#### **5.1.1.4.2 CO<sub>2</sub> Tax**

The CO<sub>2</sub> tax was introduced in Sweden in 1991, and the introducing intention, the tax rates and the development are all very similar to that of Denmark too. But there is one distinct difference between the two CO<sub>2</sub> tax scheme - the cost distribution of energy and CO<sub>2</sub> tax. In Denmark, the CO<sub>2</sub> tax holds a relatively small proportion of the total excise duties on energy, as discussed above; on the contrary, in Sweden, the CO<sub>2</sub> tax constitutes the most significant part of the excise duties levied on energy. In 2005, the CO<sub>2</sub> tax constituted more than three-quarters of the total tax on fossil fuel consumption.

#### **5.1.1.4.3 Sulphur Tax**

The sulphur tax which was introduced along with the CO<sub>2</sub> tax not levied on all fossil fuels, only on heavy fuel oil, coal and peat, which are the fuel categories with the highest sulphur content. The tax rate has remained constant at 30 SEK/kg sulphur for solid fuels and 27 SEK/kg for each thousandth of sulphur content by weight in such oils.

#### **5.1.1.4.4 NO<sub>x</sub> Tax**

Sweden is the only one who taxes nitrogen oxides emissions among the Nordic

countries. When the NO<sub>x</sub> tax was introduced in 1992, it only applied to certain large combustion plants with emission more than 50 GWh. After 1997 and onward, the scope of NO<sub>x</sub> tax was broadened and applied to plants with emission more than 25 GWh. It is worth noting that the revenues generated by the NO<sub>x</sub> tax are refunded to the combustion plants according to the energy produced in each plant. This means that the plants with higher energy efficiency could get more refund than the less energy-efficient combustion plants. As a result, this scheme promotes the combustion plants' energy efficiency at the same time.

#### **5.1.1.5 The Netherlands**

The Dutch structure of excise duties on fossil fuels is quite different from the Nordic countries, even quite unique in the world (Vollebergh, 2008). There are two important elements in the Dutch energy tax scheme: Fuel Tax and the Regulatory Energy Tax.

#### **5.1.1.5 Fuel Tax**

The fuel tax was transformed from a set of small charges with the purpose of financing environmental policy expenditures and in 1988 with the purpose to finance environmental policy expenditures. The fuel tax is collected on all fossil fuels, including refined mineral oils, coal, and natural gas, and since 1997 nuclear power has been taxed under this tax too. The tax is based on both the energy content and carbon content of fuels, and the proportion is 50/50. The tax rates are differentiated among different types of fuels, and the tax level on natural gas is the lowest. The fuels used for electricity production are exempted from fuel tax to avoid the double taxation, as the electricity is taxed under the regulatory energy tax which is explained below.

#### **5.1.1.5 Regulatory Energy Tax**

The Netherlands does not have a specific CO<sub>2</sub> Tax to control the CO<sub>2</sub> emissions, instead the Dutch government introduced a regulatory energy tax in 1996 to alter behaviours towards greater energy efficiency and reduce CO<sub>2</sub> emissions (Vermeend and Vaart, 1998). The regulatory energy tax only taxes energy products used for heating purposes (mainly natural gas in The Netherlands) or power generation (electricity) by small consumers, like households and small firms, because the Dutch Government was worried that a unilateral CO<sub>2</sub> tax would harm the export competitiveness of large Dutch energy-intensive companies and also because large companies are all covered by the fuel tax. However, the tax base has been broadened since the introduction and now also includes consumption by intermediate firms. The tax rates are decreasing with the higher levels of energy consumption, and very large consumption levels (natural gas: > 10 million m<sup>3</sup>; electricity: > 10 million kWh) face a zero rate. The regulatory energy tax was the first revenue-neutral tax in the Netherlands, with the revenue of the tax recycled to firms and households in several ways. Recycling to firms occurred by cutting the rate of employers' social security contributions, raising the tax credit for self-employed people and reducing the corporate profits tax. Recycling to households was accomplished by reducing the personal income tax, increasing the standard income tax-free allowance and increasing the tax-free allowance for older citizens (Vermeend and Vaart, 1998).

#### **5.1.2 Exemptions to the Excise Duties on Fossil Fuels**

All the five countries have adopted exemptions in their comprehensive schemes of excise duties on energy for some political realities and special political interests, especially for the energy used by industry, aiming to secure the national companies'

international competitiveness. The exemption provisions in each country are discussed in detail below.

### **5.1.2.1 Denmark**

#### **5.1.2.1.1 Exemption Provisions in Energy Tax**

The energy tax legislation is the most “enterprise-friendly” of the three types of excise duties (Speck et al, 2006). All VAT registered enterprises in Denmark were exempted from paying the energy tax before 1996. In 1996, as a result of the energy/CO<sub>2</sub> tax reform and for the increasing concern of the environmental condition, the energy taxes levied on industry were changed – since then, the energy used for space heating purposes has to be subject to the energy tax, while that used for process purposes was still exempted. After the changes, the space-heating tax for companies was gradually increased to the household energy tax level, but the companies could get a certain amount of refunds for the Government’s purpose of building acceptance of the change among enterprises. However, the amount of refunds was gradually decreased by the Government, and since 1998 the VAT registered companies have to pay the full energy tax on energy consumption for space heating purposes.

#### **5.1.2.1.2 CO<sub>2</sub> Tax Exemption Scheme**

Denmark has a specially designed CO<sub>2</sub> tax exemption scheme with the Government’s anticipation of reducing the CO<sub>2</sub> emission from industry without the competitive power of companies, especially energy-intensive industries, being significantly weakened. Under this scheme, the industrial processes were divided into heavy and light – energy-intensive and non energy-intensive, and the heavy processes could get

the largest CO<sub>2</sub> tax rebates while the light got smaller rebates. For example, from 1993 to 1995, light processes could get refunds equivalent to 50 percent of the overall CO<sub>2</sub> tax, and energy-intensive enterprises were able to obtain a 95 percent refund of the share of the CO<sub>2</sub> tax that exceeded 3 percent of gross value added. Similar to the amount of energy tax refunds given to companies, the amount of CO<sub>2</sub> tax rebates was also decreased several times after the introduction. Furthermore, there was one noteworthy action by the Danish Government – in 1996, an agreement scheme was introduced to cooperate with the CO<sub>2</sub> tax and in order to further promote companies' enthusiasm in reducing their CO<sub>2</sub> emissions. Enterprises entering into an agreement with the Energy Agency are eligible for a tax rebate, but are obliged to undertake certain investments to improve energy efficiency; and the CO<sub>2</sub> tax refund rate was gradually decreased for enterprises that have not entered an agreement.

#### **5.1.2.1.2 Exemption Provisions in Sulphur Tax**

Differing from the energy tax and CO<sub>2</sub> tax, the Danish Government is not so “generous” in the sulphur tax scheme – the industrial enterprises are not exempted from paying the sulphur tax.

#### **5.1.2.2 Finland**

While the Danish energy tax legislation is considered to be generous, the excise duty schemes on fossil fuels in Finland are known as the most homogeneous in the Nordic countries, as there were not any exemptions from taxes on fossil fuels, reduced tax levels or tax refund schemes for specific energy consuming industries before 1998. In 1998, the Government finally introduced a refund scheme for special energy-intensive industries – companies could get a refund of up to 85 percent of the taxes paid exceeding 50,000 EUR when their total burden of excise duties on energy

exceeds 3.7 percent of the value added in the given company. Under this refund scheme, primarily the paper and pulp sector is benefited.

### **5.1.2.3 Norway**

A number of industries are subject to CO<sub>2</sub> tax reductions in Norway. Regarding the consumption of mineral oil, fishmeal industry and the paper and pulp industry can enjoy a half of the normal level cut in CO<sub>2</sub> tax. And regarding the use of coal and coke, the use for non-energy purposes are totally exempted from the CO<sub>2</sub> tax. Apart from this, one of the most energy intensive industries – the cement industry's consumption of coal are also exempted.

### **5.1.2.4 Sweden**

As in Denmark, the industrial sectors are all eligible for generous exceptions from excised duties on energy in Sweden. First of all, industry, agriculture, forestry and fisheries have been entirely exempted from energy tax since 1993. Second, all the above mentioned economic sectors only have to pay a small proportion of the total CO<sub>2</sub> tax. For example, in 2005 the proportion was 21 percent. Furthermore, the energy-intensive industries can receive more generous tax reductions. If the CO<sub>2</sub> tax paid exceeds 1.2 percent of the value of sales, the company will receive a full refund of the share of the tax exceeding 1.2 percent.

### **5.1.3 Excise Duties on Electricity Consumption**

Electricity has its particularity: it has close connection with fossil fuels and other types of energy, but is the downstream production of energy. As a result, there are issues about double collection existed in the implementation of excise duties on electricity. Thus the tax measures on electricity consumption are discussed separately

here.

#### **5.1.3.1 Denmark**

In Denmark, the excise duties on electricity are levied on all electricity consumption regardless of where and by use of which kind of energy it was produced, and since the introduction of CO<sub>2</sub> tax in 1992, electricity consumption also has been charged with the CO<sub>2</sub> tax. Because of the levy on electricity, the fossil fuels used for the generation of electricity are exempted from energy and CO<sub>2</sub> tax in order to avoid the double taxation on the fossil fuels. Similar to the tax rate of excise duties on fossil fuels, the electricity tax rates are different between households and industry. Generally, the electricity consumed by the households is subject to the total electricity energy and CO<sub>2</sub> tax while the industry is only charged with a reduced level. However, the energy used for space heating purpose is unique. Regarding the households sector, permanent residents registered as being heated by electricity and with electricity consumption above 4,000 kWh are charged with a lower tax rate for the share of the consumption above the 4,000 kWh; regarding the industry sector, while the electricity consumption for process purposes are only charged with a significantly reduced level of energy and CO<sub>2</sub> tax, the electricity used for space heating is subject to the normal tax rate.

#### **5.1.3.2 Finland**

Currently, the Finnish electricity tax scheme is an output-based scheme, i.e. excise duties are levied on the consumption of electricity. There is a differentiation between the tax rates levied on the consumption of electricity by households/service sector and industry respectively. For example, in 2005, the tax rate is 0.74 Eurocent/kWh for household and 0.45 Eurocent/kWh for industry. The differentiation was

introduced to safeguard the competitiveness of the industrial sector. Additionally, to improve the competitive situation for electricity from renewable energy sources, the Finnish government has been granted subsidies to energy production from renewable sources, including wind power plants, small-scale hydro power plants and small power plants using biomass and peat.

#### **5.1.3.3 Norway**

The Norwegian excise duty on electricity consumption was introduced in 1951 and has been gradually increased. It is also an output-based tax and also has differentiated tax rates between the consumption by households and industry. But, different from electricity production in other Nordic countries, in Norway it is primarily based on hydropower and is, therefore, characterized by low emissions of CO<sub>2</sub>, SO<sub>2</sub> and other pollutants. As a result, there is no CO<sub>2</sub> tax on electricity consumption, and the excise duties on electricity are generally lower in Norway than in Denmark, where electricity production is primarily based on coal. For example, in 2010, the tax rate in Norway is EUR 0.0126/kWh, while in Denmark it is EUR 0.0732/kWh. In addition, the revenue from the electricity tax was explicitly earmarked for building and improvement of hydropower plants.

#### **5.1.3.4 Sweden**

The electricity tax in Sweden is also an end-user tax and has been gradually raised since it was introduced in 1951, and Sweden is the only country with a separate tax on nuclear power generation (Speck et al, 2006). The current tax rates for households are differentiated according to high and low consumption, leaving large consumers - whose consumption is higher than 2 MW - with a higher tax rate than smaller consumers – whose consumption is lower than 2 MW. Although now the industrial

electricity consumption is no longer exempted from the electricity tax, Swedish companies can still opt for a zero electricity tax when they are participating in a voluntary programme to improve energy efficiency and by taking actions to reduce electricity consumption.

#### **5.1.4 Green Tax Measures Addressing Transportation Sector**

Environmental taxes on transportation can be divided into two independent subcategories: green taxes on transportation fuels and green taxes on motor vehicles. In particular, as mentioned in Chapter 2, Singapore has very innovative tax measures in transport management, this section describes and analyses the green tax measures addressing transportation in selected countries with a focus on Singapore.

##### **5.1.4.1 Scandinavian Countries**

Green tax measures in four Scandinavian countries are similar to each other. Transportation fuels, including leaded petrol, unleaded petrol, heavy diesel oil and light diesel oil, are subject to the energy and the CO<sub>2</sub> tax and, in addition, the acquisition and use of motor vehicles are charged with various vehicle taxes.

Nordic nations have long-standing tradition for levying taxes on transportation fuels, and there are basically three objectives behind the taxes on transportation fuel: creating revenue, controlling imports of oil, and regulating the environmentally harmful effects arising from the consumption of transportation fuel (Speck et al, 2006). The tax rates of excise duties on all the taxable transport fuels have been increased continually since the introduction, and the increase was considerable during the 1990s. Particularly, in Finland, the tax rates for petrol are differentiated not only according to the lead content but also according to the sulphur content, and

this differentiation basing on sulphur content was specifically introduced to promote environmental protection. The tax rates of excise duties and CO<sub>2</sub> tax on transport fuels in 2005, taking Denmark as an example, are presented as follows: with regard to petrol, the excise duty on leaded petrol is 60.49 EUR cent/l, the duty on unleaded petrol is 51.57 EUR cent/l, and the CO<sub>2</sub> tax on gasoline is 2.96 EUR cent/l; with regard to diesel, heavy diesel oil is subject to an excise duty of 37.5 EUR cent/l, the excise duty on light diesel oil is 36.16 EUR cent/l, and the CO<sub>2</sub> tax on diesel is 3.23 EUR cent/l.

Motor vehicles in Nordic countries, except Sweden, are all charged with a one-time registration tax. The registration tax is levied on passenger cars, delivery vans, trucks and other motor vehicles when the vehicles are registered for the first time in each country. The tax has different tax base in the three countries – it is based on the purchase price of new motor vehicles in Denmark, on taxable value of the vehicle in Finland and entirely on environmental merit (weight, horsepower and piston displacement) in Norway. One of the aims of the tax in Norway was to encourage consumers to buy smaller cars – in terms of weight and power – and hence cars with a lower environmental impact. Motor vehicles used for freight transportation such as delivery vans and heavy-duty trucks are all charged with a lower registration tax in the three countries. For example, in Denmark, ordinary passenger cars are charged with a 105 percent tax of the gross value below 62,700 DKK and 180 percent tax of the remaining value of the car, while trucks weighing above two tonnes are charged with a 60 percent tax for the value above 12,100 DKK, while the value below 12,100 DKK is free of a charge. Finland has a unique measure that the tax is reduced by 450 EUR in the case that the car is powered by diesel fuel and reduced by 650 EUR if fuels other than petrol or diesel power the vehicle, with the purpose to protect the

diesel use and promote the use of renewable and greener energy.

The vehicle taxes in Nordic countries also include an annual tax. Weight of the car is the general tax base of the annual tax - light vehicles are always charged a lower duty than heavy vehicles. The tax base in Denmark is unique among Nordic countries, the annual tax is based on fuel economy rather on weight, i.e., the tax is based on the number of kilometres driven per litre of transport fuel. For example, in 2005 the annual tax rates are as low as 520 DKK for petrol driven vehicles driving more than 20 km/l and as high as 18,460 DKK for petrol driven vehicles driving less than 4.5 km/l. As a result, the annual tax is also known as “the owners green tax” (Speck et al, 2006). The tax rates on buses and heavy-duty trucks are generally set at a level lower than that on passenger cars. However, in Norway, heavy-duty trucks weighing more than 12,000 kg are charged with an annual road tax according to the weight, suspension system and number of axels on the truck. For example, in 2005, a two axle truck with air suspension weighing between 12,000 and 12,999 kg is charged with an annual road tax of 43.75 EUR, while a truck with 4 axles weighing more than 29,000 kg is charged with an annual road tax of 448 EUR. The tax rate at the same for passenger cars is 344 EUR.

#### **5.1.4.2 Singapore**

The transportation taxes in Singapore are very innovative around the world (Lin, 2003), and these taxes are administrated by the Land Transport Authority (LTA). The transport tax structure in Singapore can be broadly classified into four categories according to their objectives - green taxes concerning vehicle population, green taxes concerning fuel burning, green taxes concerning road usage, and tax incentive and penalty measures. Green tax measures under each category are examined in turn, and

then the usage of revenue generated by these transport taxes is also illustrated.

#### **5.1.4.2.1 Green Tax Measures Concerning Vehicle Population**

Controlling the growth of the vehicle population could indirectly reduce the emission of air pollutants. In Singapore, there are a unique Vehicle Quota Scheme (VQS) and Certificates of Entitlement (COE), excise duties on vehicle importation, registration fees and additional registration fees in order to realize this vehicle population control objective.

##### **5.1.4.2.1.1 VQS and COE**

The Vehicle Quota System was implemented on 1 May 1990. Until present, it remains the only scheme in the world to directly control the growth rate of the vehicle population to manage urban congestion (Lin, 2003). Under this system, LTA determines the number of new vehicles allowed for registration basing on the road's capacity while the market determines the price of owning a vehicle, taking into account the prevailing traffic conditions and the number of vehicles taken off the roads permanently. The quota allocated to each vehicle category is in proportion to that category's share of the total vehicle population. The vehicle quota for a given year is administered through the monthly release of Certificates of Entitlement (COEs). The COEs are valid for ten years and can be obtained in public auctions. Upon the expiration of this period, the owner can elect either to purchase another COE for duration of five or ten years or de-register the car and sell it for scrap. There are financial incentives for the latter – Preferential additional registration fee (PARF), which will be discussed latter in this section.

This COE system has a lot of advantages, for example, greater degree of

transparency to the COE bidding exercise, better access to information on prevailing bidding situation during the bidding process for bidders to make more informed decisions, easy to use, and less volatility in COE prices.<sup>41</sup>

#### **5.1.4.2.1.2 Excise Duty on Vehicle Importation**

Every motor vehicle in Singapore is imported, as Singapore does not have a motor vehicle manufacturing industry. Import taxes on motor vehicles were first introduced in 1967. It was then at an *ad valorem* rate of 10% of the open market value (OMV).<sup>42</sup> Now the excise duties are 20% of the OMV for cars, 12% of OMV for motorcycles, 20% of OMV for taxis, and all types of buses and good vehicles are exempted now.

#### **5.1.4.2.1.3 Registration Fee (RF) and Additional Registration Fee (ARF)**

There is a very high Registration fee in Singapore, which introduced in 1968, and the fee was once as high as S\$1,000 until the introduction of the Electronic Road Pricing system on 1 April 1998. Today, all new vehicles have to pay a registration fee of S\$140. During vehicle registration, car owners also need to pay the Additional Registration Fee (ARF). For cars registered with COEs obtained from March 2008 tender exercises and onwards, the ARF is 100% of the OMV; for motorcycles, it is 15% of OMV; for good vehicles, in light of different types, the ARF are as follows: 5% of OMV for Light Goods vehicle (LGV), Heavy Goods vehicle (HGV) and Very Heavy Goods vehicle (VHGV), 100% of OMV for Goods-cum-passenger vehicle (GPV), and Engineering Plant vehicle (EPV) is exempted; for buses, 5% of OMV is

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<sup>41</sup> The Land Transport Authority (2009). *Motoring – Vehicle Ownership*. Singapore. Accessible at: [www.lta.gov.sg/motoring\\_matters/index\\_motoring\\_vo.htm](http://www.lta.gov.sg/motoring_matters/index_motoring_vo.htm).

<sup>42</sup> The open market value of a car is assessed by the Customs and Excise Department (CED), taking into account the purchase price, insurance, freight, handling and all other charges incidental to the sale and delivery of the car from country of manufacture to Singapore.

need to be paid as ARF; and the ARF is 100% of OMV for the new taxis registered after March 2008.<sup>43</sup>

#### **5.1.4.2.2 Green Tax Measures Concerning Fuel Burning**

Local-street level emissions are mainly generated by the burning of transport fuels, thus in order to discourage the dirty fuel burning, the LTA introduced a petrol duty that controls the use of petrol and a special tax mainly targeted at the use of motor fuels other than petrol.

##### **5.1.4.2.2.1 Petrol duty**

The Singapore Government has implemented high taxes on petrol, and the taxes vary for various grades of petrol. Petrol is taxed at S\$0.44 (US\$0.32) per litre, or 35% of pump prices (whichever is higher) for that rated 97 octane and above, and S\$0.41 (US\$0.30) per litre of 35% of pump prices (whichever is higher) for 92- and 95-octane petrol.<sup>44</sup>

##### **5.1.4.2.2.2 Special Tax**

The non-petrol vehicles have to pay a Special Tax (Compressed Natural Gas (CNG) cars, Bi-fuel cars, taxis, buses and commercial vehicles are exempted). This is because there is a petrol duty which is meant to encourage fuel conservation and discourage excessive use of vehicles that contribute to congestion and pollution. However, there is no diesel and CNG duty. Hence, a special tax is levied on any non-petrol car in lieu of fuel duty to narrow the difference in the cost of fuel

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<sup>43</sup> The Land Transport Authority (2009). *Motoring – Vehicle Ownership*. Singapore. Accessible at: [www.lta.gov.sg/motoring\\_matters/index\\_motoring\\_vo.htm](http://www.lta.gov.sg/motoring_matters/index_motoring_vo.htm).

<sup>44</sup> *ibid.*

consumption between petrol and non-petrol cars. For a diesel car that does not comply with Euro IV or Euro V emission standard, the current special tax is 6 times of the road tax of an equivalent petrol-driven vehicle; for a Euro IV or Euro V compliant diesel car, the special tax is \$0.625 per cc with a minimum payment of \$625 and is paid twice a year.<sup>45</sup>

#### **5.1.4.2.2 Green Tax Measures Concerning Road Use**

With the purpose to regulate the road usage and to change people's behaviour to choose different mode of transport (e.g. public transport), the LTA introduced road tax and Electric Road Pricing System (ERP).

##### **5.1.4.2.2.1 Road Tax**

All cars in Singapore have to pay a road tax without which they cannot be used on the roads. The collection of road tax is co-ordinated with the renewal of insurance coverage for the driver and his passengers. Charges are imposed according to vehicle's engine capacity, and depending on different extend of road damage caused by different types of vehicles (Motorcycles, Good Vehicle, Buses, Taxis, CNG & Bi-fuel (CNG/Petrol) cars), the Government set down different tax rates on each type of vehicles, among which the lowest rate is on motorcycles, and the highest is on Very Heavy Goods Vehicles.<sup>46</sup>

##### **5.1.4.2.2.2 Electric Road Pricing System (ERP)**

ERP system is an electronic system of road pricing based on a pay-as-you-use

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<sup>45</sup> The Land Transport Authority (2009). *Motoring – Vehicle Ownership*. Singapore. Accessible at: [www.lta.gov.sg/motoring\\_matters/index\\_motoring\\_vo.htm](http://www.lta.gov.sg/motoring_matters/index_motoring_vo.htm).

<sup>46</sup> *ibid.*

principle. It is designed to be a fair system as motorists are charged when they use the road during peak hours. LTA reviews the traffic conditions on the expressways and roads, where the ERP system is in operation, on a quarterly basis and during the June and December school holidays. After the review, the ERP rates would then be adjusted where necessary to minimise congestion on the roads.

The ERP System has many advantages and has already been operating successfully in Singapore: first, it is possible to make fine adjustments in the rates to account for differences in usage at different times and along different highways; second, it is possible to charge road usage for frequently used roads, making the user/polluter pay; third, the ERP is a move towards the optimal tariff structure which allows for each toll to equal the congestion externality (Lin, 2003).

#### **5.1.4.2.3 Tax Incentive and Penalty Measures**

In the effort to encourage the use of environmentally-friendly vehicles and maintain the cars running on the road relatively new, which are less pollutive than the old ones, the LTA has implemented various incentive and penalty measures.

##### **5.1.4.2.3.1 Green Vehicle Rebate**

The Singapore Government encourages the use of green vehicles - including Compressed Natural Gas (CNG), Hybrid and Electric Cars - by introducing the Green Vehicle Rebate Scheme. This scheme was first introduced in January 2001 for the registration and use of electric and hybrid cars to encourage the use of green vehicles. It was later extended to (CNG) vehicles in October 2001. The GVR is an inter-agency effort by various Government agencies (Ministry of Finance, Ministry of the Environment and Water Resources, Ministry of Transport, Land Transport

Authority and National Environment Agency) and offers incentives to promote green vehicles which are more fuel-efficient and emit less air pollutants than their conventional petrol or diesel equivalents.

Under the current GVR scheme, owners of green vehicles can enjoy an ARF rebate (which means the rebate can be used to offset the ARF payable at registration) as follows: 40% of the vehicle's OMV for electric, hybrid and CNG passenger cars, 5% of the vehicle's OMV for electric, hybrid and CNG buses and commercial vehicles, and 10% of the vehicle's OMV for electric motorcycles.

Resulting from this scheme, there was a great increase in green vehicles' quantity in Singapore – increased 7.8 times by end 2007 compared to the quantity in 2005.<sup>47</sup>

#### **5.1.4.2.3.2 Preferential additional registration fee (PARF) and Road Tax Surcharge**

Except for tax incentives to encourage the use of green vehicles, with the purpose to encourage car-owners to de-register their cars and sell it for scrap, and in order to maintain the cars relatively new, the Singapore government also introduced PARF and Road Tax Surcharge to achieve the purpose. They are explained in turn.

There is a rebate in registration fees called PARF if the car owner that is registering a new car after de-registered and either scrapped or exported his former car which is not more than ten years old. Because as the ARF rate rose, it also discouraged existing vehicle owners from replacing their cars and encouraged new car buyers to buy used cars. Concerned with a stock of aging vehicles, the PARF was introduced to counterbalance the disincentives on vehicle renewal, when the applicable ARF

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<sup>47</sup> National Environment Agency (2008). *State of the Environment - 2008 Report*. Singapore. Accessible at: [app.mewr.gov.sg/web/Contents/Contents.aspx?Id=80](http://app.mewr.gov.sg/web/Contents/Contents.aspx?Id=80).

rate was raised to 100 per cent in 1975. This scheme was introduced in December 1975 to encourage the scrapping/export of older vehicles, as they will be less efficient and more pollutive. Imported second-hand cars and company registered cars are not eligible for PARF. The PARF benefits vary with the age of the vehicle at de-registration, starting from 75% of ARF paid if the vehicle is less than five years old, being cut 5% for each additional year of use, and finally down to 50% of ARF paid if it is above 9 years but not exceeding 10 years old. As a result, through the cooperation of ARF and PARF, the Government ensures that the high ARF would not take the opposite effect, balancing the control of vehicle ownership and the encouragement of vehicle renewal.

Apart from the PARF – a tax incentive, there is also a penalty measure on the cars used more than ten years - Road Tax Surcharge. The road tax for a car that exceeds ten years old increases by 10% each year, reaching a plateau of 150% for cars that are 15 years or older.

#### **5.1.4.2.4 Usage of Revenue Generated by Transport Taxes in Singapore**

Motor vehicle related taxes are a very important source of revenue for the government. According to a study by Lin (2001), motor vehicle taxes and levies accounted for approximately: one-third of tax revenue; one-fifth of government's operating revenue and one-twentieth of the GDP. The revenues are used to finance the development of transport infrastructure, such as the expansion of the mass rapid transit (MRT) rail system and the construction of the underground rail system, and increase the capacity of the road networks. The development of transport infrastructures encourages more commuters switched to the public transport, reduced urban congestion, further assisting the vehicle taxes to achieve its objectives.

In conclusion, the tax measures implemented on vehicle ownership and usage in Singapore are very comprehensive and the tax level is very high. All these taxes and fees make the purchase, resale and use of vehicles in Singapore cost much more than in other countries (Lin, 2001). Stimulated by this high cost, more and more people in Singapore are turning to the use of public transport. In addition, the motor vehicles have a limited life span in Singapore. It can also be seen from the COE rebates and PARF that the Singapore government quite highly encourages car owners to de-register their old cars, as the old cars will be less efficient and more pollutive than the new one. The result is that roads in Singapore are relatively congestion-free, and most cars in Singapore are relatively new (less than ten years old), well maintained and therefore less likely to pollute. This, in turn, has much helped to improve air quality in Singapore.

#### **5.1.5 Renewable Energy Sources Support Schemes**

In Scandinavian countries, they all introduced either an integrated scheme or some specific measures to support renewable energy sources. Renewable energy, including wind power, hydropower, solar energy, bio fuel, etc., is friendlier to the environment. The scheme generally includes three parts: providing tax incentives/refund or subsidies to the use of green energy, investing in the development of green energy technologies, and granting funds for R&D. The four countries' schemes are similar to each other, and the scheme in Sweden is more systematically compared to other three, thus next Sweden's scheme is taken as an example to explain.

Swedish energy policy includes a whole range of different green tax measures. Firstly, although the Swedish energy tax legislation excludes bio fuels from all energy related taxes, "the tax exemptions granted to bio fuels have not been

sufficient as an economic tool to make renewable energy competitive in relation to other energy sources” (Speck et al, 2006, p. 198). Thus the Swedish authorities, therefore, granted an investment subsidy for energy facilities relying on renewable energy sources. “The investment subsidy, together with the rules under the energy taxation scheme, has had the intended effect with regard to improving the competitive situation between bio fuels and oil in the combined heat and power (CHP) sector” (Speck et al, 2006, p. 198). Secondly, from 2004, CHP generators are fully exempted from paying energy tax and are only subject to 21 percent of the CO<sub>2</sub> tax. Thirdly, the Sweden government also grants funds to support research in and development of green energy technologies. The Swedish budget on the research and development of renewable energy sources and new energy technologies has amounted to around 93 million EUR per year over recent years.

## **5.2 Green Tax Measures Concerning Water Pollution**

In this section, water charges applied in the selected four Scandinavian countries are discussed. Water charge policies in the four countries are similar to each other and are usually divided into two categories in the light of their implementation purpose: one is to prevent depletion - represented by the Water Supply Charge and Groundwater Extraction Charge, and the other is to reduce pollution – represented by the Wastewater Charge. All the charges comply with the “full-cost recovery” principle, meaning that governments should set water charges at a level that will cover all the associated costs, such as costs from the services of providing municipal drinking water and of building and maintaining wastewater treatment plants. Because Hong Kong’s primary sources of water are supply from Dongjiang and rainfall from natural catchment, the water issues in Hong Kong do not involve the groundwater. Thus below

only the contents and effects of water supply charge and wastewater charge in the four countries are described.

### **5.2.1 Water Supply Charge**

Denmark introduced a tax on water supply in 1994. Only households are subject to it (agriculture and industry are exempted, as in Finland and Norway, because they largely meet their water needs from their own sources). The tax rate was increased from the start until 1998, since when the rate has remained stable. In 2003, the tax accounted for approximately 13 percent of the average m<sup>3</sup> price of combined water services. In Norway and Finland, the tax is calculated differently – the tax can be paid according to actual metered usage, fixed rates or a mixture of the two systems. In Sweden, both industry and households are subject to the water supply tax, and the taxes are generally made up of both a fixed charge and a charge which varies according to water consumption. Practically all water supplies are metered in order to promote fairness.

The increasing water supply charges result in a very high price for water. For example in Denmark, the water price increased from 18.5DKK (HK\$26.1) per m<sup>3</sup> in 1993 – before the introduction of taxes – to 39.4DKK (HK\$55.6) per m<sup>3</sup> in 2003. The high water supply tax has been a very effective tool in encouraging citizens to save water. Again taking Denmark for example, from 1993 to 2002, household water consumption fell by 21 percent and consumption in institutions by 29 percent.<sup>48</sup>

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<sup>48</sup> Danish Environmental Protection Agency (DEPA), (2002). *Groundwater Protection in Selected Countries*. Environmental Project No. 667, 2002. Denmark. Available at: [www.mst.dk/udgiv/Publications/2002/87-7972-025-0/html/kap17\\_eng.htm](http://www.mst.dk/udgiv/Publications/2002/87-7972-025-0/html/kap17_eng.htm)

### 5.2.2 Wastewater Charge

In Denmark, the tax is levied on direct dischargers (e.g., industry, municipal wastewater treatment plants) and water received at wastewater treatment plants (e.g. the majority of households). The charges are proportional to the pollution loads, and different tax rates apply to different pollutants, for example, BOD (11 DKK/kg), nitrogen (20 DKK/kg) and phosphorous (100 DKK/kg). The charges are always set at a fixed rate, a rate based on the actual volume of water used or a mixture of the two methods. The mixture method aims to reflect both the constant and variable costs involved in providing the service. Particularly, for the waterworks companies, they are subject to a tax if they lost water exceeding 10 percent of the water they actually produced. By making those companies pay the tax, the marginal price for lost water exceeding 10 percent rose a lot, forcing the waterworks to pay a lot of attention of water savings and actually do a lot of repairs on the pipes (Dyck-Madsen and Barras, 2003). In Finland and Norway, as mentioned in the section 5.2.1 above, industry and agriculture often directly abstract their water by themselves, so they are responsible for treatment of the wastewater produced; as a result, they are not applied to the wastewater tax. In Sweden, Where the character of industrial wastewater differs from that of normal wastewater by way of e.g. BOD, then industrial users can be charged additional wastewater charges calculated as a function of trade effluent loads.

Wastewater taxes, when they are related to pollution load or volume, result in an increasing pollution reduction in wastewater. An analysis of the wastewater tax by the Danish EPA estimates that, in the first four years of the operation of wastewater tax (1997 to 2000), nitrogen has been reduced annually by 5 percent, phosphorus by 17

percent and organic matter by 3 percent.<sup>49</sup>

Based on the above-mentioned experiences in water charges of the four Nordic nations, some conclusions can be made. First, in terms of households, they usually face higher tax on their water consumption (water supply tax) compared to the agriculture and industry. By contrast, agriculture and industry are subject to higher wastewater tax – in most countries, standard sewerage charges are supplemented by “special strength” charges designed to recover the costs of any extra capacity required to treat particular industrial effluents. Second, the main objective of implementing water charges in these countries is to cover the operating costs, certifying governments to providing high-quality water services. Finally, the efficient and effective water taxes provide incentives for efficient water use and for water quality protection.

### **5.3 Green Tax Measures Concerning Waste**

In this section, the green tax measures used to address waste issue in Denmark, Finland, Norway and Sweden are discussed, among which Denmark’s system is the most comprehensive. Thus this section first discusses three common taxes/charges existing in all the four countries, and then describes Denmark’s other taxes/charges in the waste area in particular.

Before discussing the tax measures, it would better to know first the differences in the approach to waste treatment amongst the four countries, so that different emphases within their tax measures could be better understood. Currently, in Denmark, recycling

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<sup>49</sup> Danish Environmental Protection Agency (DEPA), (2002). *Groundwater Protection in Selected Countries*. Environmental Project No. 667, 2002. Denmark. Available at: [www.mst.dk/udgiv/Publications/2002/87-7972-025-0/html/kap17\\_eng.htm](http://www.mst.dk/udgiv/Publications/2002/87-7972-025-0/html/kap17_eng.htm)

is the most important treatment method, accounting for approximately 65 percent of the total of waste treated, while the importance of incineration is gradually increasing and exceeded the importance of landfill becoming the second significant method, accounting for 26 percent in 2008; in Norway and Finland, landfill still represents the most important treatment type for waste, but the use of landfill decreased sharply in the preceding ten years, and the Government is still working at reducing its use, for the reason of preventing the deterioration and pollution to land; and in Sweden, incineration of household waste with energy recovery accounted for around 45 percent of total household waste in 2003 and is the most important waste treatment method.

The three common kinds of green tax measures in waste policy that every Nordic country has applied are Municipal Waste Charges, Waste Tax and Tax on Packaging, and they are discussed below .

### **5.3.1 Municipal Waste Charges**

Municipal Waste Charges are still the most common type of economic instrument applied in waste policy. In general, these charges are set to cover the costs associated with provision of waste management services, for example, transport, treatment, information and advisory services, planning and administration. There is an apparent tendency throughout the Nordic countries for raising waste charges rapidly, to cope with the increasing pressure on the waste management services. Also a tendency towards the differentiation of waste user charges can be seen recently to have become more common in the Nordic countries, whereby rates are commonly set according to the volume of waste produced, its weight or the frequency of collection or the establishment of home composting and, providing economic motivation to reduce and recycle household waste.

### **5.3.2 Waste Tax**

Waste taxes are in place in all the four selected Nordic countries but differ in each individual nation. In Finland and Sweden, only waste disposed of at landfill sites is subject to a tax in order to promote recovery of waste and also to promote incineration over landfill. Finland doubled its waste tax between 2002 and 2005 aiming to improve the incentive effects of the tax, in response to pressures within the field of waste policy. In Sweden, the introduction of an incineration tax is currently under discussion. On the other hand, in Denmark and Norway the tax applies to waste delivered to both landfill sites and incineration plants.

Particularly, in Denmark the waste tax does not apply to hazardous waste, while there is a charge specially levied on hazardous waste. Because the hazardous waste is disposed of at special treatment plants, charging it separately can better address the problem.

Additionally, the most interesting development is reported in Norway, where the whole structure of the landfill and the incinerator waste taxes has been changed. Since 2003, the landfill tax has been differentiated according to environmental standards allowing a higher tax rate to be charged on waste disposed of at landfill sites which have lower environmental standards. Also, under this new scheme, the incineration tax is based on air emissions, thereby providing a clear incentive for the operator of the incinerator to minimise air pollution.

### **5.3.3 Packaging Taxes**

Municipalities are responsible for the collection of packaging from households, and except Sweden, all other three Nordic nations have taxes specially levied on packaging.

Here “packaging” usually refers to beverage containers, so the tax can also be called tax on beverage containers. In Denmark, packaging taxes can be calculated basing on the weight or the volume of the package. In Norway and Finland, the beverage containers are always divided into two types: refillable and non-refillable, and they are taxed respectively. The rates applied to the non-refillable beverage containers are usually high – in Finland the tax rate has been 0.51 EUR per litre since 2005. Regarding to the refillable containers, taxes are differentiated according to the type of material the container is made of in Norway, and the tax is reduced according to the percentage of containers which are recycled, up to 95 percent, at which level the container-type is exempt from the tax; and in Finland, refillable drinks packaging is not subject to the tax.

#### **5.3.4 Other Taxes/Charges**

The above three kinds of tax exist in all the four Nordic countries, and in terms of Finland, Norway and Sweden these three are the only taxes/charges that they employ in the waste area. However, as mentioned at the beginning of Section 5.3, Denmark’s green tax measures concerning waste issue, taking into account many particular types of waste, are far more comprehensive than those in other Nordic countries. Thus in this part, Denmark’s taxes/charges on other particular waste types are discussed.

##### **5.3.4.1 Tax on Heat from Waste**

Denmark introduced a tax on heat produced for district heating systems via waste incineration in 1999. The tax has been implemented to ensure that the incineration of waste is not favoured tax-wise over use of conventional fuels as waste incineration plants are exempt from the CO<sub>2</sub> tax.

#### **5.3.4.2 Tax on Carrier Bags**

Regarding the carrier bags, in Denmark there is not only a tax on plastic bags – as Hong Kong does - with a gradually increasing tax rate, but also there is a tax on paper bags with a lower tax rate. From 2001 the tax rate for paper bags remains unchanged at 10 DKK/kg, and the rate is 22 DKK/kg for the plastic bags.

#### **5.3.4.3 Tax on Batteries**

Used batteries are very environmentally-harmful when they are discarded. The Danish Government introduced a tax on nickel-cadmium batteries associated with a subsidy scheme on the collection of nickel-cadmium batteries for recycling. The tax applies to loose batteries as well as those sealed inside products, and the tax rates are 6 DKK per single battery or 36 DKK per pack for round cells joined in a unit. The revenue generated from the tax on batteries is earmarked to finance the subsidy scheme.

#### **5.3.4.5 Charges on Tyres**

The charges on new, retreaded and used tyres were introduced in 1995 and the rates have remained unchanged, ranging between 8 DKK for a new or used tyre (4 DKK if retreaded) for smaller passenger vehicles up to 180 DKK per tyre for the largest size category. Since 2001, subsidies have been given to scrap tyres for production of rubber granules at rates of 1.20 DKK per kg to 1.60 DKK per kg, according to the size of tyre. And now, attributing to the charges and subsidies, 90 percent of scrap tyres is recycled or re-used, with incineration only in cases where recycling or re-use is not possible.

#### **5.3.4.6 Tax on Chemical Waste**

Also there are taxes levied on the chemical pollutants contained in the waste. For

example, Denmark introduced tax on Polyvinylchloride (PVC) and phthalates, chlorinated solvents, Chloro-Fluoron-Carbon (CFCs) and other greenhouse gases.

### **5.3.5 Conclusion of Green Tax Measures Concerning Waste**

In conclusion, in Scandinavian countries, the green tax measures in their waste policy are very comprehensive. There are three common types of green taxes: Municipal Waste Charges, Waste Tax and Packaging Taxes. What's more, Denmark's green tax measures addressing waste issue are even more comprehensive. As shown in Section 5.3.4, they take into account a lot of particular types of waste. Except for the primary environmental taxes in selected countries discussed above, there is another concept worth to be paid attention to in particular – and also has been applied in Scandinavian countries for many years - that is, the Environmental Tax Reform (ETR). Thus, the next section introduces the ETR in the selected countries briefly.

### **5.4 Brief Overview of Environmental Tax Reform in Nordic Countries**

As shown in Chapter 1, green tax has the disadvantages of income regressiveness and its affect on industries' international competitiveness. For example, without the CO<sub>2</sub> tax rebates granted by the Danish government to heavy industrial processes, the competitive power of energy-intensive industries would have been significantly weakened. Therefore, it makes sense that at least part of the revenue for essential public purposes should be raised from socially undesirable activities that need to be discouraged, such as pollution and natural resource consumption. When the revenue from environmental taxes is used to lower taxes on socially valuable economic activities that are wished to be encouraged, such as employment or investment, this will refer to the environmental tax reform (ETR). ETR is typically designed to be

revenue-neutral, i.e., all the revenue from the environmental tax is returned to the economy through cuts in other taxes. However, this need not be the case, Depending on the fiscal needs of a nation, ETR can be designed to cut or raise the total tax burden.

Explicit ETR is a recent political phenomenon: all ETRs enacted have occurred in the past decade. Scandinavian countries are the pioneers of the ETR, and then larger economies in western and southern Europe have since followed suit. Eight nations have adopted such reform, including four Nordic countries, the Netherlands, Germany, Italy, and the United Kingdom (Hoerner and Bosquet, 2001, p.1). Below is a brief summary of the ETR packages that have been adopted in the four Scandinavian countries and a synopsis of these ETR packages is shown in the Table 2 hereafter.

ERT packages have tended to reduce the tax burden placed on labour, primarily by cutting non-wage labour costs in the form of social security contributions paid by employers.

ETR packages have tended to focus on the energy sector as the locus of new or higher green taxes. This is mainly owed to the need for curbing the risk of global climate change induced by greenhouse gases emitted upon combustion of fossil fuels, as well as the revenue potential of energy taxes compared to other green taxes.

The financial magnitude of ETR packages varies from small in Norway – around 0.2 percent of total tax revenue in 1999 – to significant in Denmark – over 6 percent of total tax revenue.<sup>50</sup>

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<sup>50</sup> European Environment Agency (2000). *Environmental Taxes: Recent Developments*. Copenhagen:

Country	Taxes cut or items funded	Taxes raised on	Magnitude
Sweden	PIT Energy taxes on agriculture Continuous education	CO <sub>2</sub> SO <sub>2</sub> Various	2.4% of total tax revenue
Denmark	PIT SSC	CO <sub>2</sub> SO <sub>2</sub> Various (gasoline, vehicles, electricity, water, waste) Capital gains	Around 3% of GDP by 2002, or over 6% of total tax revenue
Finland	PIT SSC	CO <sub>2</sub> Landfill Corporate profits	Around 0.5% of total tax revenue
Norway	PIT	CO <sub>2</sub> SO <sub>2</sub> Diesel oil	0.2% of total tax revenue in 1999

Abbreviations: PIT=Personal income tax; SSC=Social security contributions

Table 2: Synopsis of ETR Packages in Scandinavian Countries<sup>51</sup>

The economic impact of ETR is shown by a survey conducted by Hoerner and Bosquet (2001). The survey finds out that when the revenues of environmental taxes are used to reduce other distorting taxes, the economic outcome is better than if those revenues are not so distributed, in terms of impacts on both employment and GDP. Furthermore, the negative or positive impact of ETR also highly relies on the design of the ETR packages. A good design always includes a labour tax reduction, ideally targeted at lower-wage workers to maximize employment benefits and offset distributional problems; policies to protect the competitiveness of energy-intensive

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EEA.

<sup>51</sup> Source of data from Hoerner J. A. and Bosquet B. *ETR: The European Experience*. U.S.: Washington, DC, February 2001; and Speck S. Overview of ETR in EU member states. *Competitiveness effects of Environmental Tax Reforms*. Denmark: National Environmental Research Institute. December 2007.

industries; measures to prevent a wage-price inflationary spiral; policies to promote the development and diffusion of new cost-effective clean technologies; and policies to compensate low-income households outside of the workforce (Hoerner and Bosquet, 2001).

Finally, besides its intention of environmental protection, “ETR should also be regarded as fundamental tax reform” (Hoerner and Bosquet, 2001, p.75). It alters the system of incentives through cuts in taxes on economic goods, such as work and investment, financed by increased taxes on “bads”, such as pollution and natural resource consumption. Thus the ETR might be suitable for Hong Kong as an approach of broadening the tax base and valuable for the Hong Kong government to take into consideration in its future policy plan. In the next chapter, particular recommendations to enhance green tax measures in Hong Kong are provided.

## **5.5 Conclusions**

Concerning four types of environmental problems – climate change, air pollution, water pollution and waste - the primary elements included in green tax measures in the six selected countries are presented in this chapter.

To sum up, firstly, with regard to the tax measures levied for energy purpose, , the four Scandinavian countries all have Excise Duties on Fossil Fuels (including Energy Tax, CO<sub>2</sub> Tax, Sulphur Tax and Sweden also has NO<sub>x</sub> Tax), Excise Duties on Electricity, and specific Renewable Energy Sources Support Schemes, and because of different energy structures in the four countries, these taxes have some differences from each other (e.g. different level of tax rates and different exception provisions for specific energy use). In the Netherlands, the green taxes applied in energy use

sector is unique, two types of taxes exist, Fuel Tax - levied on all kinds of fossil fuels – even including the nuclear power and Regulatory Energy Tax – with the focus on small consumers of energy and with “degressive” tax rates (i.e., the tax rates decrease with higher levels of energy consumption, and very large consumption levels face a zero rate).

Secondly, with regard to measures concerning the transport sector, in Nordic nations, transportation fuels are subject to energy tax and CO<sub>2</sub> tax, and the acquisition and use of motor vehicles are charged with various vehicle taxes. In particular, the transport tax structure in Singapore is very innovative around the world and is very comprehensive as well, it broadly contains four parts: (1) VQS and COE, excise duties on vehicle importation, RF and ARF to control the vehicle population; (2) petrol duty and special tax to discourage burning of dirty fuels; (3) road taxes and ERP to regulate the road usage; (4) tax incentive and penalty measures.

Thirdly, with regard to measures concerning water pollution, in Nordic countries, there are water supply charges to restrict the water use and with a further purpose to encourage people to save water. In dealing with the wastewater problem, they all implemented the wastewater tax.

Fourthly, municipal waste charges, waste tax and packaging taxes are three common types of green taxes in dealing with waste problems in Scandinavian countries. In particular, among the four countries, Denmark has the most comprehensive green tax measures addressing the waste issue. The measures take into account a lot of particular types of waste, for example, heat from waste, paper bags, batteries, tyres and chemical waste.

Finally, with the purpose to counteract the negative effects that green tax might bring

about, until now, eight nations have adopted the ETR, including four Nordic countries, the Netherlands, Germany, Italy, and the United Kingdom, and Scandinavian countries are the pioneers. ERT packages tends to focus on the energy sector as the locus of new or higher green taxes and reduce the tax burden placed on labour.

After this discussion and analysis of the above advanced overseas experiences of green tax measures, , the next chapter summarize the experiences that are suitable for Hong Kong – using the findings in Chapter 3 and Chapter 4 for reference – and make policy recommendations for green tax measures in Hong Kong.

## **CHAPTER 6 RECOMMENDATIONS TO ENHANCE GREEN TAX MEASURES IN HONG KONG**

Given the need both to improve the environmental condition and broaden the tax base in Hong Kong, while minimizing the impact on Hong Kong industries' competitiveness, green tax measures currently existing in Hong Kong need to be revised and new measures need to be introduced. Based on earlier chapters' findings, this section discusses recommendations to Hong Kong concerning experiences from selected countries, concerning ways of using the revenue generated by green taxes, and concerning building the political and public acceptance of green tax in Hong Kong.

### **6.1 Recommendations Based on Experiences from Selected Countries**

This section is addressed from three major categories of environmental problems, they are, air pollution and climate change, water pollution, and waste.

#### **6.1.1. Green Tax Measures Addressing Air Pollution and Climate Change**

Air pollution is the most serious environmental problem in Hong Kong, and in comparison to the six selected countries mentioned in Chapter 5, it is also the area in which Hong Kong's green tax measures are the most deficient – in Hong Kong there are only FRT and VLF, Excise Duties on motor fuel, some tax incentive measures including depreciation allowances for environmentally-friendly vehicles. Below are some suggestions for Hong Kong government to put in force gradually, from two aspects: those concerning energy use<sup>52</sup> and those concerning the transport sector.

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<sup>52</sup> In Hong Kong, the issue of energy use is mostly concentrated on power station emissions.

### **6.1.1.1 Green Tax Measures Concerning Energy Use**

As mentioned in Chapter 4, the combustion of energy for heating and power generation makes up the largest source of emissions within Hong Kong, and the government's action of controlling the major cause of air pollution and climate change is currently insufficient. The energy used for heating and power generation is not subject to excise duties, and there is no direct tax or charge levied on power plants emissions. As a result, the government should pay closer attention to the major cause of air pollution and climate change. After learning from the four Scandinavian nations and The Netherland's advanced experiences, the proposal for Hong Kong is addressed below, including the suggestions of extending excise duties and introducing CO<sub>2</sub> tax and sulphur tax.

#### **6.1.1.1.1 Extending Excise Duties to Fossil Fuels**

Regarding the energy structure in Hong Kong, the predominate energy sources are coal, fuel oil, naphtha, and natural gas, while excise duties are only levied on transport fuels but not on any of the above-mentioned fossil fuels. By contrast, all the Scandinavian countries have excise duties on fossil fuels in order to regulate and restrict the use of energy. As a result, excise duties are advised to be extended to above mentioned fossil fuels in Hong Kong, According to the Nordic experience, the tax could adopt differentiated tax rates according to the energy content or the pollution intensity of each specific fuel type to provide consumers with financial incentives to save energy.

As discussed in Chapter 5, aimed at energy use, Scandinavian countries levy an energy tax, carbon tax and sulphur tax, and although The Netherlands' energy tax structure is different from Scandinavian ones in some respects, it has a similar

purpose and effects. In view of these taxes' effectiveness in controlling Green House Gas emissions and air pollution, it would be advisable for the Hong Kong government to introduce the CO<sub>2</sub> Tax and sulphur Tax gradually. Proposals for introducing these two taxes are presented below:

#### **6.1.1.1.2 CO<sub>2</sub> Tax**

Choice between an upstream and downstream tax base and choice between a specific and *ad valorem* tax rate are two crucial arguments involved in the design of a CO<sub>2</sub> tax.

First, an upstream CO<sub>2</sub> tax would be one that is levied early in the chain of production and processing, i.e. on raw energy sources at the point where they are mined or extracted (coal mines, oil wells, etc.), and if a country/region does not have its own raw energy sources and all the energy used by the country/region is imported, then the upstream carbon tax would be one levied at the time of importation. A downstream CO<sub>2</sub> tax, on the other hand, would not be levied until much later in the chain of energy production and processing, i.e., at the point where energy sources had been converted into final fuel products sold to business and domestic energy consumers (Pearson and Smith, 1992). According to Vollebergn (2008), an upstream CO<sub>2</sub> tax is better than the downstream tax, because the upstream CO<sub>2</sub> tax establishes the best linkage to (potential) emissions - it implicitly accounts for emissions in the production stage of the final fuel products by taxing the carbon content of the raw materials.

Second, with regard to CO<sub>2</sub> tax, specific rate is expressed as a fixed amount per ton of carbon, and *ad valorem* rate is expressed as a percentage of prices of energy products (Pearson and Smith, 1992). Specific tax rates are superior to *ad valorem*

rates if the aim is to use taxes as regulatory devices, because a specific tax on the carbon content of a fuel is the best-targeted (indirect) instrument in the case of climate change, whereas an *ad valorem* tax would also penalize characteristics that are responsible for the heating potential of energy products but not for climate change (Volleberg, 2008).

In all the four Scandinavian countries, CO<sub>2</sub> tax is upstream-charged, and at the same time, almost all the fossil fuels used in Hong Kong are imported, so the CO<sub>2</sub> tax in Hong Kong should be designed as an upstream tax, in other words, the CO<sub>2</sub> tax would be levied on the importer. The tax could be levied on the primary fossil fuels used in Hong Kong: coal, fuel oil, naphtha, and natural gas and could be charged basing on the carbon emission from combustion of fuels and adopt a fixed rate per tonne of CO<sub>2</sub> regardless of the fuel type – to increase the feasibility. The tax rate could be set at a low level at first and be increased gradually in the future – in other word, the less CO<sub>2</sub> emitted when the fuel is consumed, the lower the tax to be paid. As a result, economic incentives for usage of less CO<sub>2</sub> intensive energy are available to energy users. Currently, coal is the major source of heating and power generation in Hong Kong, and in order to promote the three main suppliers<sup>53</sup> of electricity and gas to use more natural gas which is less carbon intensive, the natural gas could be exempted from the CO<sub>2</sub> tax. At an appropriate time in the future, this exemption provision of CO<sub>2</sub> tax on natural gas should be removed.

#### **6.1.1.1.3 Sulphur Tax**

As mentioned in Chapter 3 and Chapter 4, SO<sub>2</sub> also is a major air pollutant in Hong

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<sup>53</sup> The three main suppliers are China Light and Power (CLP), Hong Kong Electric (HKE) and Hong Kong and China Gas (Towngas).

Kong and because the sulphur content varies, even within each overall fuel category, it is necessary to treat the sulphur tax separately from the CO<sub>2</sub> tax. According to the Nordic experience on energy taxation, a sulphur tax could also be introduced in Hong Kong in the future. Similar to the CO<sub>2</sub> tax, the sulphur tax can be first levied on fuel oil and coal and then be gradually extended to the combustion of natural gas, And the tax can be set at a fixed rate and be charged on the basis of the sulphur content in the energy product or on the basis of the SO<sub>2</sub> emissions generated by the combustion of the fuels.

To sum up, because excise duties on fossil fuels are basically extended from current excise duties on motor fuels, and the CO<sub>2</sub> tax is designed to be an easily collected upstream tax, the two duties can be relatively easy to be imposed in Hong Kong in the near future, and when the excise duty and CO<sub>2</sub> tax are both implemented, the two would be levied on the importer at the same time. In order to avoid fierce opposition to green taxes, the Hong Kong government could consider introducing sulphur tax in the future after the implementation of excise duty and CO<sub>2</sub> tax gets comparatively mature.

#### **6.1.1.2 Green Tax Measures Concerning the Transport Sector**

According to experiences of selected countries, environmental taxes on transportation are divided into two subcategories: taxes or fees levied on motor vehicles and energy related taxes levied on transportation fuels. In this section, the taxes and fees that are suggested to be revised or introduced also follow these two categories and the suggestions about tax incentives, reliefs and subsidies on green vehicles and clean energy are described in Section 6.2 below Recommendations for Revenue Use.

#### **6.1.1.2.1 Green Taxes Levied on Motor Vehicles**

According to the Singapore's experience, vehicle taxes should be designed with the following three objectives: keeping the cars in Hong Kong relatively new, controlling the vehicle population and encouraging the use of green vehicles.<sup>54</sup>

First, Hong Kong has the First Registration Tax (FRT) and Vehicle License Fee (VLF) to charge the purchase and use of motor vehicles. But as discussed in Chapter 4, until now these two charges have not had much effect on restricting the amount of motor vehicles in Hong Kong. As a result, there is still space for the FRT and VLF to be increased. Additionally, it is essential to notice that it is not true that the higher the tax level the fewer vehicles being bought and used. According to Singapore's experience, the too-high FRT will stimulate people to buy second-handed/used cars, resulting in an opposite effect. So an appropriate tax level for the FRT and VLF in Hong Kong needs to be figured out in the near future.

Second, as mentioned earlier in Singapore's transport tax in Chapter 5, the ERP System has many advantages and is operated successfully in Singapore. First, it is possible to make fine adjustments in the rates to account for differences in usage at different times and along different highways. Second, it is possible to charge road usage for frequently used roads, making the user/polluter pay. Third, the ERP is a move towards the optimal tariff structure which allows for each toll to equal the congestion externality. In Hong Kong, ERP has been under discussion on and off for almost twenty years and a good deal of work has been done by the government to

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<sup>54</sup> The new cars are more efficient and less polluting than the old ones. By reducing the vehicle population in Hong Kong, not only the road congestion can be reduced, but also can the air quality be improved. Promoting the use of green vehicles has the direct effect of reducing the harmful vehicle emissions.

test it,<sup>55</sup> but it was opposed when it was first put forward on the grounds of infringing privacy. Since the ERP system could help Hong Kong improve traffic management, e.g. in the Central District on Hong Kong Island, reduce air and noise pollution and traffic accidents in areas where there are many pedestrians and where many people work, and also reduce the need for further road construction (HKICPA, 2007a, p.26), Hong Kong is expected to put forward the Electric Road Pricing System in the near future. The fees could be set to reflect the externalities brought about by both the use of the car and the use of the road. The tax could be set with differentiated tax rates according to the road congestion level at different time and along different streets. For example, if the vehicles are driven during off-peak hours or on the congested-free roads, they will be charged at a lower rate.

#### **6.1.1.2.2 Taxes Levied on Motor Fuels**

First, excise duties on motor fuels are suggested to be revised and improved in Hong Kong. As discussed in Chapter 4, current excise duties on motor fuels have had little effect on reducing the number of vehicles on Hong Kong's roads and thus on reducing pollution levels. Thus it can be concluded that, as indicated by economic theory concerning green tax, excise duties in Hong Kong have not reflected the real negative externalities produced by the road travel and fuel use. As a result, it seems that a considerably higher rate of excise duties may be required here. Moreover, currently, the tax rates on petrol are differentiated according to the lead content, and the rates on diesel oil are differentiated according to the sulphur content. The differentiated tax rates have had a good effect in changing people's motor fuel using behaviour and encouraging people to choose more environmentally sound fuel types,

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<sup>55</sup> Transport Department (1997). *Feasibility Study on Electronic Road Pricing Final Report*. HKSAR: the HKSAR government.

but in order to more effectively control the air pollution caused by vehicle emissions and according to the Scandinavian and Singapore's experience, the differentiated tax rates on petrol should not only be designed by the lead content but also would better take the sulphur content into consideration. Additionally, the scope of excise duties should be extended to the fuels used by ships which are much dirtier than the fuels used by trucks.

Second, as mentioned in Chapter 3, automobile exhaust fumes are the second largest source of air pollution in Hong Kong, so when the CO<sub>2</sub> tax is introduced, it is also advisable to be levied on the combustion of motor fuels, in order to reduce the CO<sub>2</sub> emissions generated by motor vehicles effectively. At some point in the future, the Hong Kong government could also consider extending the sulphur tax to motor fuels to more effectively cut the local-street SO<sub>2</sub> pollution.

Finally, since there is more than one type of tax levied on motor fuels, the government should consider the total tax burden on fuels in order to keep the overall tax rates at an appropriate level.

### **6.1.2. Green Tax Measures Concerning Water Pollution**

Water pollution in Hong Kong is primarily caused by wastewater discharge. As mentioned in Chapter 4, until now the Hong Kong government's actions in dealing with water pollution have been effective in comparison with actions related to other types of pollutions. The current Sewage Charging Scheme has seen some of its achievement in improving the water quality, and the design of this scheme is quite similar to the wastewater tax in Nordic countries. But this charging scheme still needs to be enhanced.

### **6.1.2.1 Enhancing the Sewage Charging Scheme**

Learning from the Nordic countries' experience, efficient and effective taxes and charges related to water pollution need to comply with three objectives: covering the full costs of providing the water and sewage services, providing incentives for efficient water use and providing incentives for water quality protection. Below are suggestions for enhancing the Sewage Charging Scheme in Hong Kong:

First, as can be seen in Chapter 5, the wastewater charges in Nordic countries are all at a level that can cover their operating costs, so that the charges can allow governments to providing high-quality water services. However, the water supplies and drainage services are provided at a loss, in that the revenue from water charges and sewage charges is far less than the operating costs (VanderWolk, 2010). As a result, the level of both the Sewage Charge (SC) and the Trade Effluent Surcharge (TES) need a substantial increase. The government has a plan of increasing the SC by 9.3% per annum up to \$2.92 per cubic metre of water supplied in 2017, but even the revenue generated by the \$2.92 /m<sup>3</sup>-level charge will still be far less than the costs of providing the water and sewage services, so both the increasing speed and range need to be raised substantially in order to cover the full operating costs, ensuring that the government gives high-quality water and sewage services.

Second, the calculation base of the current SC and TES is suggested to be changed. At present, the SC and TES in Hong Kong are calculated based on the amount of water supplied. Although through this calculation way it is convenient for the government to collect the charges – the SC and TES can be collected together with water fee and showed to the payers in one water bill, this tax base is not reasonable, because it does not reflect the actual quantity of wastewater discharge. So according

to experiences from Denmark, the SC and TES are better to be levied on direct dischargers and water received at wastewater treatment plants, so that the charges can be more directed to the water discharge and can reduce the wastewater discharge more effectively.

Finally, in the current Sewage Charging Scheme, the TES is related to the pollution loads of wastewater, but under the TES it is the dischargers who are classified according to their wastewater's pollution level – measured by the Chemical Oxygen Demand (COD) values of the trades. However, as mentioned in Chapter 5, according to the experience of Scandinavian countries, when wastewater taxes/charges are related to pollution load of wastewater discharge, they could result in an increasing pollution reduction in wastewater. Thus, the TES in Hong Kong is recommended to be directly proportional to the pollution loads of wastewater discharge, and there could be different tax rates applying to different pollutants - such as BOD, nitrogen and phosphorous - in the wastewater.

### **6.1.3 Green Tax Measures in Waste Area**

As mentioned in Chapter 3, Hong Kong has seen its waste loads increase as its economy has grown. Municipal solid waste, construction waste and chemical waste are three primary types of waste in Hong Kong. The Hong Kong government has implemented two green tax measures to deal with waste problem: Construction Waste Disposal Charges and Plastic Bag Tax. These two measures have had significant effects on reducing the quantity of construction waste and the usage of plastic bags, but they still need to be improved, and these two measures alone are not sufficient in tackling the waste problem in Hong Kong. Thus, in order to decrease waste disposal, encourage waste recycling and prevent the deterioration and pollution

to land, some recommendations are proposed as follows:

#### **6.1.3.1 Municipal Waste Charges**

Construction waste disposal charges scheme has been very effective on reducing construction waste, but in dealing with the whole waste problem in Hong Kong, construction waste disposal charges alone are not enough. Thus, Municipal Waste Charges - the most common type of economic instrument applied in waste policy in Nordic countries - are suggested to be introduced in Hong Kong. According to the experiences of Nordic countries, the charges should be set to cover the costs associated with provision of waste management services, for example, transport, sorting, treatment, and so on. Moreover, as mentioned in Chapter 3, currently most of the municipal solid waste in Hong Kong is disposed of at landfills. This is a very heavy-polluting method to dispose of waste, causing serious land deterioration and generating harmful landfill gases. As a result, in order to promote incineration over landfill and also to promote recycle of waste, the Municipal Waste Charges could at first only be levied on waste disposed of at landfills. At some point in the future, the exemption on incineration should be removed, and the charges rates should be raised gradually.

#### **6.1.3.2 Tax on Carrier Bags**

First, the Plastic Bag Levy Scheme should be extended, and the tax should be levied on all retail outlets as soon as possible. As mentioned in Chapter 4, the current plastic bag tax has the following two disadvantages: increasing tax burden on low-income households and causing substantial financial burden on retailers who are subject to the tax. Consequently, the government is recommended to extend the levy scheme to tackle plastic bag problems and reduce the above two negative impacts generated by

the current scheme at the same time. Further, to facilitate small retailers who cannot afford a computerized or new cashier system to handle the levy, the HKRMA has suggested that small operators should be allowed to handle collected cash manually before submitting it to the EPD.

Second, the government is suggested to introduce a tax on paper bags in the future. Paper bags can be biodegraded and have a higher recycling rate than plastic. However, firstly, most paper comes from tree pulp, so the impact of paper bag production on forests is enormous; secondly, the subsequent manufacturing of paper bags produces greenhouse gases; thirdly, when disposed at landfills, paper requires extremely large space, so the disposal of paper bags also entails the issue of saving space in landfills. As a result, a paper bag tax in the future will help dealing with these environmental problems.

### **6.1.3.3 Waste Charges on Other Types of Waste**

At some point of the future, Hong Kong could gradually extending waste charges to other types of waste, just as the four Scandinavian countries do. For example, the Hong Kong government could also introduce packaging taxes on beverage containers. The tax can be charged differently on two types of beverage containers - refillable and non-refillable, with a lower tax rate on refillable containers. Additionally, regarding the refillable containers, the tax rates could be differentiated according to the percentage of containers which can be recycled, in order to promote the technology of recycling beverage containers. Furthermore, according to experiences from Denmark, some other types of environmentally-harmful waste, such as batteries, chemical wastes, tyres, etc. should also be taxed in the future.

## **6.2 Recommendations for Revenue Use**

As mentioned in The Introduction, one advantage of green tax is that it can be an important revenue generation source for the government, and the revenue can be used in the environmental protection related areas to further improve the environment. Accordingly, this section provides some recommendations for using the green tax revenue:

### **6.2.1 Recommendations for Revenue Use in Energy Related Areas**

As mentioned in Chapter 5, according to the experiences of selected countries, in the energy related areas, air pollution is reduced mainly through using clean energy, promoting energy efficiency and developing renewable energy sources. In light of this, green tax revenues are recommended to be used in the following ways:

#### **6.2.1.1 Assist the Promotion of Using Clean Energy and Energy Efficiency**

While encouraging the three main suppliers of electricity and gas to switch to using more natural gas, in order to assist this promotion action, the government could use the tax revenue to facilitate building more natural gas pipelines to transport natural gas to households and companies. Tax incentives on environmentally-friendly facilities in Hong Kong should be expanded. In particular, because energy efficiency is very important as it is a proven means of reducing greenhouse gas emissions and energy costs, allowing us to address climate change and increase our economic competitiveness at the same time, tax incentives should especially be given to machinery and power plants which could enhance energy efficiency.

### **6.2.1.2 Provide Incentives for Development of Renewable Energy Sources**

For example, the government could grant funds to wind energy projects<sup>56</sup>, solar energy projects and energy savings projects. Additionally, nuclear power is a comparatively clean energy source. As a near zero emission fuel source, it has significantly reduced emissions of sulphur dioxide, nitrogen oxides and particulates in Hong Kong. It has also saved more than 130 million tonnes of CO<sub>2</sub>, which is equal to about three times Hong Kong's annual CO<sub>2</sub> emissions.<sup>57</sup> CLP Power Hong Kong Limited has had a nuclear electricity supply contract since 1994, through which CLP receives 70 percent of the nuclear electricity supply generated from the Daya Bay Nuclear Power Station. In September 2009, the Hong Kong government approved an extension of this contract for another 20 years from 2014. As a result, the government should continue the tax exemption on nuclear-generated electricity importation. It is also suggested to use green tax revenue to grant funds for CLP to buy more nuclear electricity, thereby to increase the proportion of nuclear-generated electricity of Hong Kong's total electricity demand (the current proportion is 25%)<sup>58</sup>, so that emissions from burning environmentally-harmful fuel (e.g., coal) could be further reduced.

### **6.2.2 Recommendations for Revenue Use in Transport Related Areas**

Concerning the efficiency of the public transport system, and the use of clean vehicles and transport fuels, recommendations for revenue use in Transport Related

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<sup>56</sup> *Lamma Winds* on Lamma Island, Hong Kong's first commercial-scale wind power station, started operation in 2006.

<sup>57</sup> CLP Holdings Limited. CLP Welcomes Hong Kong SAR Government's Approval for an Extension of Nuclear Electricity Supply Contract, 22 Sep. 2009. Archived from [www.clpgroup.com/ourcompany/news/Pages/22092009.aspx](http://www.clpgroup.com/ourcompany/news/Pages/22092009.aspx).

<sup>58</sup> *ibid.*

Areas are made as follows:

#### **6.2.2.1 Assist the Implementation of ERP System**

While the ERP system has lots of advantages, its cost is very high. From the Singapore experience, the ERP technology costs taxpayers S\$197 million (HK\$ 1.09 billion) to install and S\$39 million (HK\$ 216 million) to operate in the first five years. Thus there is a need for financial support to the ERP system, and the tax revenue could be used to facilitate the implementation of ERP.

#### **6.2.2.2 Enhance the Efficiency of the Public Transport System**

The government could provide funds to, for example, the subway system, the light railway system and the bus service. Tax revenue could also be used to maintain the fees of using public transport at a relatively stable level or even lower the fees, encouraging citizens to choose public transport for their daily trip.

#### **6.2.2.3 Promote the Use of High-Technical Environmentally-Friendly Vehicles**

The encouragement of the use of electric cars could be continued by the government, meanwhile the tax revenue could also be used to make electric cars more convenient to use – building more recharging stations and maintenance stations, improving the feasibility of this electric car scheme.

#### **6.2.2.4 Encourage Technological Development**

The government could provide tax incentives for and also could directly invest in technological improvements in fuel efficient and cleaner engines as well as alternative fuelled vehicles. Especially in respect of public transport, smaller, lighter and high-technological buses should be introduced to gradually replace the existing

ones, meanwhile, the government could give subsidies to franchised bus companies for using the new buses, so that ticket fees could be kept at a reasonable level, helping to build the acceptance of the new buses among citizens.

#### **6.2.2.5 Encourage the Use of Cleaner Transport Fuels**

The use of cleaner transport fuels need to be further encouraged, and this is a good way to spend the green tax revenue. The current tax reduction and exemption provisions need to be improved in some respects. The tax rates should be differentiated between light diesel oil and ultra low sulphur diesel, and the government should give tax incentives to the use of ultra low sulphur diesel to encourage people to switch to using this less-pollutive fuel. In addition, as mentioned in Chapter 4, excise duties paid on light diesel oil for the use of vehicles operated by grantees of franchised bus service, by the Kowloon-Canton Railway Cooperation and by the MTR Corporation Limited are fully refunded to these companies. The refunds should gradually be removed, cooperating with tax exemptions on the use of LPG and Euro V diesel, inducing public transport to increase their use of cleaner motor fuels and decreasing the current problem of buses overrunning on the road.

#### **6.2.3 Recommendations for Revenue Use in Water Related Areas**

The Hong Kong government could use the tax revenue to assist the water and sewage services. Currently, the Water Supplies Department (WSD) and the Drainage Services Department (DSD) are responsible for the water and sewage services in Hong Kong, so the revenue could be used to subsidize the two departments to improve their service quality, for example, enhancing the wastewater disposal and recycling infrastructure.

#### **6.2.4 Recommendations for Revenue Use in Waste Related Areas**

The revenue could be used to build more waste incineration facilities. As mentioned in Chapter 5, incineration is a more environmentally-friendly way of disposing the waste than the landfills, so the revenue generated from green taxes could be investigate in building incineration facilities, in order to promote the incineration and to save the space of landfills.

### **6.3 Political and Public Acceptance**

As mentioned in Chapter 4, considering their theoretical advantages and at least partial success to date in Hong Kong, green tax measures have not been more widely applied, and it can be inferred that the above recommendations about green tax measures would be difficult for the Hong Kong government to put into practice. Besides the theoretical disadvantages of green tax, the reasons for this situation are discussed below, and then some approaches to build acceptance of green tax in Hong Kong are recommended.

#### **6.3.1 Obstacles to Imposing Green Tax Measures in Hong Kong**

In Hong Kong, as mentioned in Chapter 4, there are two major obstacles that hinder green taxes being widely used. First is the increasing gap between rich and poor. Because of the income regressive characteristic of some green taxes, poorer households pay a disproportionate share of their income in these taxes relative to richer households. The wide income disparities in Hong Kong mean that any broadening of the tax base is open to the criticism that it redistributes the tax burden onto those least able to afford it. Second, Hong Kong's political structure can make it difficult for the government to pursue policies in the face of vested interests. In

particular, functional constituencies give various groups influence in the legislature and thus over government. Thus it would be very difficult for the Government to take any action that may impact on these groups' interests. As a result, approaches are necessary to be worked out to enhance the political and public acceptance of green tax in Hong Kong. Some recommended approaches are addressed below:

### **6.3.2 Building Acceptance of Green Tax Measures**

It should be noticed that there has already been a supportive foundation, to some extent, for green tax in Hong Kong. Firstly, the public support for green taxes was proved by a public opinion survey conducted by Cullen and Simmons (2007). The survey's finding suggests that with a 7-point scale from 1 (strongly disagree) through 4 (neutral) to 7 (strongly agree), there was fairly strong support (4.75) for the proposition that the Government is not doing enough to address Hong Kong's serious environmental concerns through the use of green taxes. Secondly, in the interview conducted with the officials from EPD, they said that "Green tax measures will play a more and more important role in tackling environmental problems in the government's future environmental policies", showing the government support for green taxes.

The central government of China proposes to implement a carbon tax in 2012, so green tax measures – a kind of base-broadening tax measures in Hong Kong would be in line with national Chinese tax policy initiatives aimed at reducing carbon emissions.

In light of the above supportive foundation, below are the recommended ways to build acceptance of green tax in Hong Kong: First, the application of green tax measures could start with tax incentives. As mentioned in Section 6.2 above, current

tax incentives on environmentally-friendly vehicles and facilities should be continued, and new tax incentives could be provided to promote the use of renewable energy in Hong Kong, for example, wind power and solar energy.

Second, when introducing a new green tax, the tax could start with a low rate and with exemptions to specific industries – especially the manufacturing industry. Just as Scandinavian countries did, they all offered some exemption provisions to the energy-intensive industries to reduce the negative impacts on their international competitiveness. The tax rates then could be increased step by step, and other new green taxes could be introduced gradually over the years.

Third, relief should be provided to low-income households while introducing or increasing the tax. For example, as electricity and heating costs might increase due to the extension of excise duties and the introduction of CO<sub>2</sub> tax and sulphur tax, low-income households should be provided with relief. Furthermore, relief should also be offered to low-income households to guarantee their necessary water use would not be affected by the increased sewage charges. Additionally, all the above recommendations about revenue use Example here could help a lot in building acceptance too.

Fourth, as discussed in Chapter 5, Scandinavian nations adopted the “environmental tax reform” (ETR) – using revenue from green taxes to lower taxes on valuable economic activities, such as employment or investment. Moreover, as also mentioned in Chapter 5, when the revenues of environmental taxes are used to reduce other distorting taxes, the economic outcome is better than if those revenues are not so distributed. Thus, the ETR is a very good way to build the acceptance of green taxes, and the Hong Kong government could consider adopting the reform or some

elements of the reform in the future.

Finally, the government should enhance its communication with public and make the “green” purpose of the introduction of green taxes clearer to the public. “Public acceptance of noticeable increases in the cost of electricity, gas, public transportation and petrol would depend in large part on the government’s ability to communicate that Hong Kong’s continuing prosperity requires both that the revenue base be broadened (with appropriate relief for low-income households) and that more be done to improve the environment.” (VanderWolk, 2010, p. 14)

#### **6.4 Conclusions**

After learning from the six selected countries’ experiences of green tax measures, recommendations for green tax measures, in addressing energy use, transportation, water pollution and waste respectively, are made to Hong Kong in this chapter. Moreover, recommended ways for using the revenue generated by green taxes are also provided here.

Finally, with regard to the political and public acceptance of green tax measures, it is true that increasing the use of environmental taxes would, to some extent, affect the competitiveness of certain industries, especially energy-intensive ones, in Hong Kong through increasing their costs of production. It is also true that an increase in the use of green taxes would raise the prices of certain consumer goods, resulting in some resistance from the public. However, the government should not let these obstacles block the application of green tax measures in Hong Kong, and it might be helpful for the government, by doing the six steps mentioned above, to build the acceptance of green tax in Hong Kong.

## **CHAPTER 7 CONCLUSIONS AND FURTHER STUDY**

### **7.1 Conclusions**

Hong Kong, a compact city with a population of nearly seven million, has undergone remarkable economic growth over the past few decades. At the same time, however, the city has developed severe environmental problems. For example, Hong Kong's air pollution concentration has been unhealthily high and has given cause for alarm. Additionally, the waste problem is also very serious in Hong Kong. Hong Kong's landfills will be exhausted if the municipal solid waste continues to be disposed of at current rate - 1.36 kg per person per day in 2007. It is demonstrated that the need for strong and immediate action to address environmental problems in Hong Kong is urgent

In today's world, "green" taxes have been accepted and applied by more and more countries, especially those in the OECD, among which the Scandinavian nations are forerunners. Green tax has the advantages of static cost minimisation, dynamic efficiency, lower compliance and administrative costs and bringing about some positive behavioural effects.

In spite of these many advantages, Hong Kong, which has long been considered a developed economy, still has not adequately used the tax tool as an integral part of the government's anti-pollution strategy. The green tax measures in Hong Kong are very limited. Firstly, for air pollution, there are FRT and VLF to restrict the amount of motor vehicles, excise duties on motor fuels to regulate the use of transportation fuels and some tax incentives to encourage the use of energy-efficient vehicles and the investment in environmentally-friendly machinery, plant, or construction.

Secondly, the Sewage Charging Scheme was introduced to reduce the water pollution. Finally, for the waste, a Construction Waste Disposal Charging Scheme and a plastic bag tax have been introduced.

It can be seen that what the Hong Kong government has done so far does not seem to be enough, thus after learning from the six selected countries' experiences of green tax measures in addressing energy use, transportation, water pollution and waste respectively, recommendations for green tax measures are finally made to Hong Kong. First, concerning the energy use, it would be advisable for Hong Kong to extend its excise duties to fossil fuels, to impose an up-stream CO<sub>2</sub> tax basing on the carbon content of the fuels and also to introduce a SO<sub>2</sub> tax basing on the sulphur content of the fuels; second, concerning the transportation, it would be advisable to increase the level of FRT and VLF and introduce the ERP system in Hong Kong, and taxes on motor fuels are recommended to be enhanced; third, in dealing with the water pollution, the level of SC and TES is suggested to be increased and the TES rates would better to be differentiated according to the pollution loads of wastewater discharge; finally, concerning the waste issue, it would be advisable for Hong Kong to impose municipal waste charges and to extend current plastic bag tax to the next step and also to the use of paper bags, and waste charges on some other particular types of waste are recommended to be introduced gradually in the future.

Moreover, recommendations for using the revenue generated by green taxes are also provided here. The usage ways primarily include providing tax incentives for the development of renewable energy sources, assisting the water and sewage services provided by the government, building waste incineration facilities, providing relief to low-income households and using the revenue to reduce other taxes (e.g., salaries tax)

Finally, this study recommends that the Hong Kong government, by doing the following step by step, make green tax measures more acceptable to the citizens of Hong Kong: the application of green tax measures could start with tax incentives; when introducing a new green tax, the tax could start with a low rate and with exceptions to specific industries – especially the manufacturing industry; relief should be provided to low-income households to guarantee their necessary electricity/water use would not be affected by the increased charges, counteracting the income regressive disadvantage of green tax to some extent; the government could consider adopting the ETR or some elements of the reform in the future; and the government should enhance its communication with the public to make the “green” purpose of the introduction of green taxes clearer to the public.

Today, global environmental problems are becoming increasingly serious and are receiving more and more attention from governments and citizens. The 15th United Nations Climate Change Conference held recently in Copenhagen, although in many senses a failure, showed the world's concern over the problem of pollution and climate change. In consequence, it's time for Hong Kong to play its part, and take real action to boost the implementation of green taxes to build a sustainable future and a clean and green living environment for all the citizens of Hong Kong.

## **7.2 Further Study**

One characteristic of environmental problems is that they do not only result from polluting activities of a single city or region, and according to the interview with officials in EPD, most of air pollutants in Hong Kong come from neighbouring Guangdong province. Since this study does not consider the trans-boundary environmental issues, future study could concentrate on this trans-boundary issue,

study the cooperation of the Hong Kong government with Guangdong government and study the coordination of green tax measures between the two regions.

As mentioned in Chapter 2, for the limited time to do this study, only three interviews were undertaken. As a result, the confined number of interviews may not be able to represent public opinions as a whole. Therefore, in the future, a comprehensive survey of public attitudes towards green tax measures in Hong Kong could be undertaken; for example, the survey could study citizens' major concerns if the government introduced some specific green taxes.

As mentioned in Chapter 1, this study investigates green tax measures in the major pollution fields and takes a wide economic view. In the future, research on implementing specific green taxes could be conducted. For example, studies can be focus on how to actually design and introduce CO<sub>2</sub> Tax and SO<sub>2</sub> Tax in Hong Kong.

Moreover, as mentioned in Chapter 1, the negative effect on competitiveness is identified as an important obstacle for the widespread use of green taxes. Thus, further work could review and assess the empirical evidence for this competitiveness impact on Hong Kong and study the various policy options to reduce such impacts.

## **APPENDIX INTERVIEW QUESTIONS**

### **I. Questions for the Environmental Protection Department**

1. What are the most serious, and urgent to be solved, environmental problems in Hong Kong? What are the primary pollution sources?
2. Who/which groups do you think is/are potentially in opposition to green tax? What are their considerations? (and the current obstacles to the implementation of environmental protection policies – from who/which groups, and how do you intend to handle these obstacles)
3. What are the implementation effects of current green tax measures in Hong Kong? Including tax incentives for environmentally-friendly vehicles and electric cars, the tax concession scheme on environmental-friendly facilities, the sewage charging scheme, the construction waste disposal charging scheme.
4. Is there any proposal about green tax being discussed? Is there cooperation or a plan of cooperation among different Departments - for example between EPD and the Treasury - working on a project about environmental tax?
5. Regarding the good effect of the first stage of introducing plastic bag tax, when does the Government intend to move the tax on to the next stage – extending the tax and including all the rest of retailers?
6. What is the Government's attitude towards green tax? What do you think about green tax's future in Hong Kong?

### **II. Questions for Greenpeace**

1. What is the current level of public awareness of environmental protection in Hong Kong? (Are there any survey results showing the level?)
2. What is citizen's attitude towards the Hong Kong Government's environmental protection actions? (Are there any survey results showing the level?)
3. What is your evaluation towards the environmental protection work that has been done by the Hong Kong Government until present?
4. What do you think are the primary reasons that hinder the government's

environmental protection action?

5. What is your attitude towards environmental tax?
6. What do you think are the difficulties the government will face when implementing environmental taxes in Hong Kong?
7. What do you think about the future of green tax in Hong Kong? Why?
8. Who/which groups do you think is/are potentially in opposition to green tax?

### **III. Questions for the Hong Kong Retail Management Association**

1. What is your opinion towards the current plastic bag tax in Hong Kong?
2. What is your opinion towards the ways that the government implement the plastic bag tax? For example, before the introduction of the tax, did the government give a reasonable and clear explanation about the detailed information of the plastic bag tax and have adequate consultation and discussion with interested parties?
3. What do you think is a better way to implement the plastic bag tax? - Reducing the environmental damage caused by plastic bags while minimizing the negative impact on the benefits of this industry.
4. What is your attitude towards environmental tax?

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