February 2007

Beverage Producer Responsibility & Recycling

Michelle A. Ladouceur
Worcester Polytechnic Institute

Nathaniel Risler Rosso
Worcester Polytechnic Institute

Timothy David Ebner
Worcester Polytechnic Institute

TingFung Tsoi
Worcester Polytechnic Institute

Faculty code: CXP
Sequence #: 0701
IQP division: 44

Beverage Producer Responsibility and Recycling

An Interactive Qualifying Project Report
Submitted to the Faculty of
WORCESTER POLYTECHNIC INSTITUTE
in partial fulfillment of the requirements for the
Degree of Bachelor of Science

Submitted by:

Timothy Ebner

Michelle Ladouceur

Nathaniel Rosso

Ting Fung Tsoi

Submitted to:

Project Advisor: Creighton Peet, WPI Professor

Project Co-advisor: Karen Lemone, WPI Professor

On-Site Liaisons:
Edwin C. F. Lau, Acting Director

Hahn Chu,
Environmental Affairs Manager

Michelle Au,
Environmental Affairs Officer

Sponsored by: Friends of the Earth Hong Kong

Date: March 1, 2007

Abstract

The goal of this project was to recommend a framework for a producer responsibility system (PRS) to address the sustainable waste management of glass beverage containers in Hong Kong. The objectives we created to accomplish this goal were to identify the scale of beverage container waste; the mechanics, costs, and difficulties of recycling; and examples of PRS around the world. Results were obtained through interviews, tours, a focus group, and literary searches. From our conclusions, we generated a framework.

Acknowledgements

We would like to acknowledge and thank the following individuals for providing us with information and support that aided us in the completion of this project:

Hahn Chu, Environmental Affairs Manager, Friends of the Earth Hong Kong
Michelle Au, Environmental Affairs Officer, Friends of the Earth Hong Kong
Edwin C. F. Lau, Acting Director, Friends of the Earth Hong Kong
R. Creighton Peet, WPI professor and Hong Kong Project Center Director
Karen Lemone, WPI professor
The Hong Kong Environmental Protection Department
Zinc Lam of Laputa Eco-Construction Material Co., Ltd
SIN Kwok-hau, LAM Kang-fuk, YU Man-fung, and YEUNG Shun-kui of the Food and Environmental Hygiene Department

The following individuals provided us with invaluable support. A special thank you goes out to them:

The staff at Friends of the Earth Hong Kong
Felix F. S. Choi, Environment, Health & Safety Manager, Swire Coca-Cola HK
Tim Lucida Lo of the Tim Wai Group

Authorship

Timothy Ebner, Michelle Ladouceur, Nathaniel Rosso, and Ting Fung Tsoi all contributed to the writing of the project. Each section of the report contains the writing of multiple team members.

Table of Contents

List of Figures

List of Tables

List of Acronyms

DSD	Duales System Deutschland GmbH
EPD	Environmental Protection Department
EPR	Extended Producer Responsibility
EU	European Union
FEHD	Food and Environmental Hygiene Department
FoE	Friends of the Earth
HKD	Hong Kong dollars
JCPRA	Japan Container and Package Recycling Association
KELA	Korea Environmental Labeling Association
KRRRC	Korea Resources Recovery and Reutilization Corporation
MSW	municipal solid waste
NENT	North-East New Territories Landfill at Ta Kwu Ling
OECD	Organization for Economic Co-Operation and Development
PET	polyethylene terephthalate
PPP	Polluter Pays Principle
PRO	Producer Responsibility Organization
PRO-E	Packaging Recovery Organization Europe
PRS	Producer Responsibility Systems
RCP	refuse collection point
RTS	refuse transfer station
SENT	South-East New Territories landfill in Tseung Kwan O
TEPA	Taiwan Environmental Protection Association
WENT	West New Territories landfill at Nim Wan

Executive Summary

In line with global movements towards sustainable development, Hong Kong is currently seeking methods for sustainable waste management. The immediate need for sustainable waste management is evident due to decreasing landfill capacity. Within 6-10 years Hong Kong will run out of available landfill space. The Waste Reduction Framework Plan set forth by the Environmental Protection Department has determined a need for beverage producer responsibility legislation as a means to minimize waste.

The Hong Kong government has previously attempted to increase the recycling rate of drink containers by developing deposit-return systems and using public recycling systems. However, due to an increase in their rent, retailers discontinued collection services. Due of a lack of support from producers, these methods have failed. The Friends of the Earth (FoE), an environmental awareness and activist group, introduced the project "Producer Responsibility & Packaging Law" in order to develop an enforceable and appropriate plan to hold producers responsible for post-consumer beverage containers. Thus, the goal of this project was to recommend a framework for producer responsibility to address the sustainable waste management of beverage containers in Hong Kong.

The first objective in reaching this goal was to determine the scale of post-consumer beverage containers entering landfills. This objective was achieved through interviews with bars, restaurants, and a local glass recycler. Statistics obtained from the Environmental Protection Department (EPD) were used to arrive at a general picture of the scale of the problem.

The next objective was to identify the mechanics, costs, and difficulties faced by recyclers in Hong Kong. Interviews with bars and restaurants, Swire Coca-Cola Hong Kong, the Tim Wai Group, Laputa Eco-Construction Material Co., the Food and Environmental Hygiene Department, and the EPD identified difficulties at the retail, production, and government levels, respectively. These difficulties include limited space for collection sites, transportation costs, limited space for recycling facilities, and differing priorities amongst government departments.

The team completed the third objective, identification of beverage producer responsibility systems used in other countries, through research on methods used in Japan, Korea, Taiwan, and Germany. Results showed strategies that might be applicable to Hong Kong. These strategies include the following: deposit-refund system, eco-labeling, formation of a producer responsibility organization (PRO), and funding of local business and recycling technologies.

The last objective was to identify examples of producer responsibility systems currently used in Hong Kong. We interviewed individuals from three companies: Swire Coca-Cola, the Tim Wai Group, and Laputa Eco-Construction Material Co. Results determined the existence of financial and physical producer responsibility systems for beverage containers in Hong Kong.

Through analysis of the results, we determined that any extended producer responsibility (EPR) framework for beverage containers must accomplish the following: engage the cooperation of producers, empower consumers, stimulate local business and recycling technology, maintain the ideals of a free-market economy, and maximize feasibility. We considered these parameters in the construction of our recommended

framework. The framework discusses specific strategies that would be effective in Hong Kong to limit beverage container waste.

1. Introduction

The movement towards sustainable waste management is a growing priority across the globe. Many countries now face the problem of landfills quickly reaching capacity in conjunction with growing populations. Although not as apparent in areas with ample space for landfills, there are small island regions that presently face this crisis. These regions do not have sufficient strategies for the recovery and recycling of post-consumer packaging.

Hong Kong is such a region. Its dense population produces a constant stream of waste. Current waste management techniques have led to a crisis; all three landfills are expected to reach capacity within six to ten years (Environmental Protection Department, 2005). Hong Kong has not made sufficient progress towards sustainable waste management. One large waste stream in Hong Kong is packaging material. This includes any material used for the containment, protection, safety, or sterility of a product. Included in the 'packaging material' category are plastic, glass, and tetra pak beverage containers.

The idea of extended producer responsibility (EPR) is guided by the 'producer pays' principal and stresses that producers must take responsibility for the waste they create. Many countries implement EPR by designing producer responsibility systems (PRS). This approach makes the industry physically and/or financially responsible for the collection, reuse, and recycling of post-consumer waste containers and is a step towards sustainable waste management. Countries such as Japan, Taiwan, Korea, and many EU nations employ PRS legislation to force producers to take responsibility for their beverage packaging. In Hong Kong, the Waste Reduction Framework Plan (WRFP)

outlines the steps that will be taken to decrease waste production and promote EPR across many industries over the next several years. One of its initial applications was the introduction of three-bin collection points for paper, plastic, and aluminum containers. The WRFP has set 2008 as the year to introduce PRS for beverage containers.

Unfortunately, glass bottles have been neglected by the WRFP. Little has been done to reduce glass waste, despite the infinite reusability of the material. Public recycling bins do not accept glass bottles. Additionally, waste disposal charges are nonexistent, giving consumers no incentive to recycle. According to Hong Kong's Environmental Protection Department, only 2.2% of glass bottles were recovered in 2005, compared to nearly half of all polyethylene terephthalate (PET) plastic bottles. The problem is made more complicated due to the fact that approximately 98% of all beverages in Hong Kong are imported (EPD, 2005). There is presently no EPR policy for glass beverage producers.

The goal of this project was to recommend a framework for producer responsibility to address the sustainable waste management of beverage containers in Hong Kong. We established four objectives to fulfill this goal. Our first objective was to determine the scale of beverage container waste in Hong Kong. The second objective was to identify the mechanics, cost and difficulties of recycling beverage containers in Hong Kong. Objective three involved identification of beverage producer responsibility systems used in other countries. Our fourth and final objective was to identify examples of beverage producer responsibility in Hong Kong. Glass was chosen as the focus material because of its very low recycling rate and availability to local recyclers. By compiling all the data gathered from our objectives, we developed a framework for EPR policy to target glass beverage producers in Hong Kong.

2. Background

In recent years, regions of the globe with limited landfill space have been adopting sustainable waste management, in the form of a policy called EPR (Extended Producer Responsibility). The Organization for Economic Cooperation and Development (OECD) (2001) explained that "the packaging waste stream is a well-known application of EPR, and increasingly, more products, waste stream [sic] and sectors are being addressed to identify the feasibility of EPR" (p. 30). The OECD defines EPR as a system in which manufacturers consider the entire life cycle of their products, from 'cradle' to 'grave'. This ensures that responsibility for the waste created by these products is balanced between producers, consumers, and government departments. This chapter defines EPR, outlines successful cases around the world, and documents the need for legislation in Hong Kong. This project focused on recommendations for beverage producers, with the goal of developing an EPR framework for glass bottles.

2.1 Definition of EPR

This section describes the concept of EPR (Extended Producer Responsibility). EPR may also be referred to as PRS (Producer Responsibility Systems), which involve the implementation of EPR, rather than the concept. We will first define EPR in detail. Then, we will provide a set of criteria to consider when establishing an EPR policy. We have included a definition of responsibility under EPR and answer the question: "Who is the producer?" Finally, we will explain the characteristics of voluntary and mandatory systems.

2.1.1 Overview and Advantages of EPR

In the influential *Extended Producer Responsibility: A Guidance Manual for Governments*, the OECD (2001) defined EPR as:

> …a policy approach that can assist governments in their efforts toward sustainable development. EPR can help minimise environmental impacts over the life cycle of a product by providing producers with incentives to design products with less (or different) material input and which are also easier and more economical to reuse, recycle, and recover. (p. 16)

According to the organization, the two related features of EPR policy are the shifting of responsibility upstream to the producer, away from municipalities, and the provision of incentives to producers to incorporate environmental considerations in the design of their products. The OECD explained that using this policy, producers design products considering the entire life cycle of the product to minimize their environmental impact. In this way, environmental costs of treatment and disposal of waste will be the burden of the producer (OECD, 2001).

The OECD further explained that a growing number of countries within its membership are refusing the solutions of landfill expansion and incineration. According to the organization, EPR effectively addresses these concerns and also relieves some financial responsibility from municipalities and taxpayers. With EPR in place, producers can be 'sent signals' to change how products are treated during the post-consumer phase and re-consider the selection of materials and design process of the product (OECD,

2001). The system can effectively be used to pressure producers into designing eco-friendly products and disposing of these products in environmentally friendly ways.

The OECD stressed that although EPR is primarily aimed at producers, a delicate balance of responsibility is important to make the policy effective. Cooperation among all players in the product chain is imperative, and careful planning and communication is required. The organization explained that governments must consider what EPR is appropriate for their region and must find ways to incorporate and educate the consumer. According to the OECD (2001), the consumer must follow the law and should support those producers that show environmental responsibility.

According to the OECD (2001), the operation costs and incentives of a given EPR strategy will change from region to region, as no one EPR policy is guaranteed to be more effective than any others. The strategy of setting recovery/recycling goals can be effective in providing incentives to producers. Careful consideration of recovery levels is a must so that all involved understand the purpose and level of the selected recovery goals. These goals should be carefully chosen after consideration of market capacity of the given material.

As opposed to the 'polluter pays principle' (PPP), which has been the guide for environmental reform in the past, EPR disburses financial responsibility higher in the product chain (OECD, 2001). The OECD argues that this method places pressure on producers to reduce waste from the source by applying recovery rates and incentives to decrease the environmental impact of their products' lifecycle. This strategy attacks waste before it becomes a problem and thus reduces the need for landfill expansion or reliance on incineration.

2.1.2 Criteria for Establishing EPR

In its EPR manual for governments, the Organization for Economic Co-Operation and Development (2001) outlined a list of principles to aid policymakers in the construction of an extended producer responsibility system. The full text of these criteria may be viewed in Appendix E. The OECD (2001) stressed the importance of a number of factors in designing an EPR system. Importance is placed on giving producers incentives to comply with the policy. The organization argued that innovation in product design should be encouraged. Product characteristics should be considered when constructing the policy, and policy aspects should be chosen on a 'case-by-case' basis, so that differences between and unique properties of products are covered by the EPR system (OECD, 2001). The OECD recommended that a system for communication be devised to encourage the cooperation of all members along the 'product chain', including consumers. The responsibilities of these members should be clearly defined. Furthermore, the organization stressed the consideration of both voluntary and mandatory approaches to EPR. Finally, the policy should be analyzed before being put in place and periodically evaluated after implementation. It is critical that the system avoid causing economic disturbances.

2.1.3 Responsibility Defined

In their influential guidance manual, the OECD (2001) described responsibility under EPR as taking two main forms. According to the OECD:

> Physical responsibility… refers to direct or indirect responsibility for the physical management of products at the end of their useful life (post-consumer stage). Financial responsibility is the second type of responsibility, and it refers to the responsibility of the producer for paying all or part of the cost for managing the waste at the end of the product's useful life. (p. 53)

The OECD described three other types of responsibility, which were originally defined by Thomas Lindhqvist in 1998. These include informative responsibility, liability, and ownership. The guidance manual explained that, under informative responsibility, eco-labeling or another form of communication must be adopted to inform the public of the environmental impact of a product. Liability dictates responsibility taken by a manufacturer concerning a known impact of a product (OECD, 2001). Finally, the OECD referred to Lindhqvist's definition of ownership as the idea that the manufacturer of a product is always its owner, throughout its lifespan.

2.1.4 Who Should Be Held Responsible?

The Organization for Economic Co-Operation and Development (2001) stressed that, "Under EPR, *leadership of the producer is critical* to the success of the policy" (p. 54). According to Timonen (1997) and Ryden and Lindhqvist (1998), "Studies in Finland and Sweden indicate that the actors in the product chain surprisingly agreed that it is the producer in the product chain who should be responsible for the environmental issues related to products" (as cited in OECD, 2001, p. 54). The studies argued that one reason for this is the possession of specific product information by the producer. This information is not readily available to others who handle the product over the duration of

its life cycle (OECD, 2001). The OECD argued that because of this knowledge, the producer is the most appropriate player in the product chain to make changes and take responsibility for the effects of the product in response to EPR legislation. However, the organization also clarified that: "Assigning ultimate responsibility to the producer…does not change the need for others to participate to ensure that the programme is carried out" (p. 55).

The OECD (2001) identified the producer as being the manufacturer, or the company whose name appears on packaging. However, the organization clarified that in some cases, it becomes more difficult to identify the *producer* of a product. The OECD cited cases where a product is not directly packaged by the manufacturer, but is distributed by a company that fills the packaging. The organization deemed the filler/distributor to be the responsible producer, when packaging is the main EPR priority.

2.1.5 Mandatory vs. Voluntary EPR

In its manual for governments, the OECD (2001) explained that there are many techniques available for the implementation of producer responsibility systems. Approaches can range from completely voluntary to entirely mandatory. The manual emphasized that the decision to use one of these two approaches, or to use a combination of the two, must be made early on.

Mandatory EPR systems generally employ legislation in the form of regulations or ordinances (OECD, 2001). The OECD cautions, when developing a mandatory EPR framework, governments should decide whether a body currently exists that will be able to implement, manage and enforce the EPR framework. If such a body does not already

operate in the region, some form of overseer must be created to carry out this task. Furthermore, the creation of new legislation must be considered (OECD, 2001). According to the OECD, the motivation behind mandatory EPR is to force producers to be environmentally conscious in product design and management when they will not do so on their own. Howes, Skea, and Whelan (1997) argued in defense of mandatory EPR systems, "At the very least some form of legislative framework is required to support such initiatives and to overcome the problem of free riders" (p. 121).

The OECD (2001) described voluntary approaches to EPR as being diverse, ranging from systems created by the industry to those developed by governing bodies. These approaches can involve commitment by all players in the industry, agreements between those who create wasteful products and those who are affected by this waste production, negotiations between producers and public authorities, and voluntary programs into which producers are invited (OECD, 2001). The OECD explained that voluntary EPR is often considered in order to recover material of high value, for public relations reasons, in an effort to avoid the involvement of governing agencies, and as a way to expand market shares. The organization noted that, "Often such programmes result in reduced resource and energy consumption, reduced operational costs, and increased credibility with shareholders and the public" (p. 33).

2.2 Notable EPR in Other Regions

In order to develop a 'database' of potential EPR techniques for use in Hong Kong, the team examined successful cases from around the globe. Special attention was paid to Japan, Taiwan, and Korea. These nations are more similar to Hong Kong in geographic size and population density, and are already employing a number of different producer responsibility systems, outlined in the following sections. Another notable country included in the examination was Germany. This nation was the first to introduce packaging responsibility and recovery for manufacturers, and thus possesses a high level of experience with EPR policy.

2.2.1 Japan

In a 2002 EPR article, Lease explains that before the 1990s, Japanese communities sold collected materials to recyclers. In turn, recyclers would receive reasonable payment for the material sold. According to Lease, the price received for these goods dropped dramatically in the early 1990s. Some communities were even forced to pay recyclers to take their collected material. As a result, the 1997 Law for the Promotion of Sorted Collection and Recycling of Containers and Packaging came into effect (Lease, 2002). The goal of this legislation was to shift the costs of recycling from the consumer to the industry. The new law required different responsibilities from consumers, municipalities and manufacturers/industry.

Lease stated that although producers and municipalities absorbed costs, Japanese consumers were forced to adopt a new complicated waste separation protocol. Most

communities currently employ a curbside collection system that requires many levels of separation and sorting of recyclables. For example, Nagoya released a 31 page booklet to explain the collection system for trash and recyclables: "The system requires residents to deliver some recyclables to special collection stations weekly, put other materials in special bags the city collects twice a month, and deliver still other recyclables to retail outlets" (Lease, 2002, p. 2).

Each municipality must establish a collection and separation area in its jurisdiction (Lease, 2002). Additionally, each jurisdiction is responsible for preparing the collected materials for future recycling. According to Lease, this process can include removing caps, washing, removing contaminants, and even bailing. The cost of these operations is absorbed by the municipality. In fact, for every $0.25 used in the recycling process, industry covers less than $0.01 (Lease, 2002). As a result, many regions have requested additional support and funding from industry. According to Lease, once the recyclables are prepared by municipalities, industry should assume responsibility for the following: covering the cost of recycling collected materials, fulfilling recycling targets set by the government, making efforts to establish recycling plants, and eventually taking back and reusing all the collected materials from their products.

Many producers, manufacturers, bottlers, and importers have chosen to participate in a third-party organization known as the Japan Container and Package Recycling Association (JCPRA) (Lease, 2002). As explained by Lease, membership in the JCPRA requires payment of recycling fees based on the number of containers produced in the last year and the capacity of recycling facilities available. Municipalities may deliver material or arrange for the JCPRA to pick up material from collection centers. Using the

fees collected from member industries, the JCPRA then pays recycling companies to process the material, thereby fulfilling its members' obligations required by law.

2.2.2 Taiwan

In her comprehensive article, Lease outlined the strategies being taken by Taiwan to promote producer responsibility. At the core of the Taiwan EPR strategy lies the deposit refund system. In this system, PET manufacturers and importers pay a fee according to the number of containers produced (Lease, 2002). According to Lease, consumers can return bottles to supermarket and chain stores for a refund. These bottle collectors then receive a refund for returning the bottles to a recycler. Although this strategy was extremely effective in recovering PET bottles, the deposit fund soon went bankrupt. Due to under-reporting of production figures, many producers were in essence 'free riders.' Taiwan was recovering 120% of all PET bottles reportedly on the market (Lease, 2002). Lease explained that Taiwan has been forced to decrease refunds awarded for returned bottles and is considering eliminating the program altogether, due to the presence of free riders. In 1997, the Taiwan Environmental Protection Association (TEPA) was formed in order to manage the Reuse Recycling and Management Fund.

Lease stated that in addition to the deposit-refund system for PET bottles, Taiwan instituted mandatory product take-backs for any non-PET containers. As with the PET scheme, producers pay based upon production levels. However, in the take-back system, independent groups hired by TEPA conduct bi-monthly audits to help eliminate under-reporting of production numbers (Lease, 2002). Fees are based upon material value and recovery levels of the previous year and are used to reimburse auditing and recycling

costs. Any extra funds are transferred to the government. Lease explained that in regard to non-PET beverage containers, supermarkets and chain stores are required to set up take-back stations which bear an official recycling logo. A recent change has been made so that companies currently employing a recovery system may have reduced fees or may even be exempt from charges.

Taiwan also employs the use of 'Green Mark' or eco-labeling in order to empower the consumer (Lease, 2002). The first labeling system is mandatory and requires all containers covered in the Waste Disposal Act to carry an official seal. The second system is voluntary and requires producers to apply based upon the eco-friendliness of their product. As Lease pointed out, consumers then see that a given company has practiced environmental awareness. At the same time, consumers are encouraged to support the actions of those companies that bear the Green Mark seal by buying their product. In this way, eco-labeling enables the consumer to buy with discretion and reward environmentally friendly manufacturers.

2.2.3 Korea

Lease (2002) provided details on EPR methods in Korea, explaining the Act Relating to the Promotion of Resource Saving and Reutilization, passed by the Korean government on December 8, 2002. As a result of this act, the federal government was given the power to implement programs related to extended producer responsibility in support of developing sustainable waste management (Lease, 2002). The methods directed at beverage containers were a deposit-refund system, disposable goods restrictions, and eco-labeling.

Unlike systems used in other areas, Korea's deposit-refund system required producers to pay deposits on their products. All deposits were collected in the "Special Account for Environment Improvement" and used to support the recycling industry. Companies were refunded based upon the recovery rate achieved (Lease, 2002). Initially, the government had no requirements for how goods were collected and industry was left to develop its own methods. However, in 1993, the Ministry of the Environment created the Korea Resources Recovery and Reutilization Corporation (KRRRC) (Lease, 2002). This corporation was responsible for the collection and sorting of containers, enforcing all recycling laws, and managing the "Special Account for Environment Improvement." The corporation also used those funds for the construction of new recycling facilities and the financial and technical support of private recycling industries.

Lease (2002) cited some successes after the introduction of a deposit-refund system. For example, metal can manufacturers shifted from using removable tabs to push down tabs in order to decrease deposits from five to two Korean won per container (Lease 2002). Additional industry-led efforts in the recovery of metal cans resulted in an increase in recovery rate from 13.7% in 1995 to 29.3% in 1996. In general, however, the system has not resulted in a high percentage of returned containers (Lease, 2002).

According to Lease, for most manufacturers it was more economical to forfeit deposits than explore recycling options. The deposits did not prompt producers to manage their waste. As a result, deposits were rarely refunded and the KRRRC collected an excess of funds. For example, in 1996, a total of 516 million won was given as grants to schools, military units, and community organizations to sponsor collection programs (Lease, 2002). Although the funds were used to improve collection, their excess was an

indicator of a poor collection rate. Lease states that the Korean Ministry of Environment has made plans to increase the deposits in order to encourage manufacturers to increase recycling and collection efforts.

Another method, disposable goods restrictions, was used to limit excessive distribution of disposable goods on the market (Lease, 2002). As part of the 1992 Act Relating to Promotion of Resources Saving and Reutilization, limitations were placed on the number of disposable goods distributed in the service sector as defined by total weight produced. This strategy was meant to force producers to limit not only excessive distribution but also excessive packaging of their products.

The third strategy discussed by Lease (2002) was the introduction of eco-labeling. Eco-labeling is used to influence manufacturers to reduce their environmental impact by giving consumers the power to choose. In order to qualify for the label, producers must meet certain criteria set forth by the Ministry of Environment and the Korea Environmental Labeling Association (KELA). As stated by the KELA: "[t]he environmental label is awarded to products, which distinguish themselves from other products serving the same purpose by reducing pollution, or by saving resource during the all phases of the life span [sic]" (Lease, 2002, p.9). This tactic allows consumers to support manufacturers that reduce pollution and encourages non-qualifying manufacturers to adopt extended responsibility.

2.2.4 Germany

The Packaging Recovery Organization Europe (PRO-E) (2006) outlined measures taken in Germany to implement EPR. According to PRO-E, the Packing Ordinance and the Amendment to the Ordinance are two legal systems that require beverage producers to recycle. The Packing Ordinance (GPO) introduced the "take back" idea (PRO-E, 2006). Producers and distributors are required to take back their products and ensure that they are being recycled or reused. Failure to comply with the system results in fines. The Amendment to the Ordinance came into effect in 1998. According to PRO-E, targets were set for recovery and recycling, 65% and 45% respectively. A compliance scheme, Der Grüne Punkt (The Green Dot) - Duales System Deutschland GmbH (DSD), was created to help meet these targets (PRO-E, 2006). DSD organizes the collection and recycling of packaging waste in Germany. The business is financed through contracts with producers and importers. A Green Dot trademark can be placed on registered containers to let consumers know that the product is part of the organization and that donations are being provided towards recycling. This increases the appeal of Grüne Punkt ordained products to consumers (PRO-E, 2006).

According to the Packaging Recovery Organization Europe (PRO-E) (2006), German industry is very devoted to recycling as many products as possible. Lee (2003) stated that beverage producers must utilize at least 72% environmentally friendly material in their containers. This promotes using refillable bottles. According to Lee, recycling targets set for soft drink containers were: glass – 90%, aluminum – 90%, and plastic – 80%. A deposit refund system exists for non-refillable containers, because the targets were not being met (Lee, 2003). A €0.25 deposit for drink beverages such as mineral

water, beer, and soft drinks was created to increase the recycling habits. Fruit juice, milk, spirits, wine, and champagne are exempt from this. This has led to many companies bottling their drinks in plastic containers (Lease, 2003).

2.3 Waste Management in Hong Kong

In this section, we outline the structure of Hong Kong's municipal solid waste (MSW) management system. Following this is a description of the Waste Reduction Framework Plan, which details future waste handling strategies. We have also included a discussion of glass recycling.

2.3.1 Management of Municipal Solid Waste

Hong Kong's current waste management strategy is not a sustainable system. In the pivotal *A Policy Framework for the Management of Municipal Solid Waste (2005-2014)*, Hong Kong's Environmental Protection Department (2005) explained that there are three operational landfills in Hong Kong: WENT (the West New Territories landfill at Nim Wan), SENT (the South-East New Territories landfill in Tseung Kwan O), and NENT (the North-East New Territories Landfill at Ta Kwu Ling). The locations of these three landfills are shown in Figure 1.

Figure 1. As shown in *A Policy Framework for the Management of Municipal Solid Waste (2005-2014)*, the layout of landfills in Hong Kong (EPD, 2006).

According to the EPD, thirteen retired landfills and several incinerators were phased out of service in 1997, after an eight-year transition period. The three currently operating landfills, constructed between 1993 and 1995, occupy 271 hectares of land. Having drawn HKD $6 billion to build, the landfills presently cost HKD $400 million to operate each year (EPD, 2005).

Based on current EPD estimates, all three are expected to be full within six to ten years. The department argued that this is due to increased municipal solid waste (MSW):

"At the time the three-landfill strategy was implemented, it was forecast that the daily amount of waste to be disposed of at landfills would rise from 12,500 tonnes in 1989, to 14,000 tonnes in 1997 and 16,700 tonnes by 2001. But by 1997 the three strategic landfills were already taking in 16,000 tonnes of waste every day" (EPD, 2005, 16).

The EPD stated that annual refuse collection totals HKD $435 million and refuse transfer amounts to another HKD $355 million per year. In combination with WENT, SENT, and NENT, Hong Kong employs a system of seven refuse transfer stations (RTSs), occupying a total of over one hectare of urban space. Several more RTSs are located on outlying islands (EPD, 2005). Approximately 1,000 refuse collection points (RCPs) serve as temporary storage facilities from which refuse is collected and delivered to RTSs before being delivered to landfills for permanent storage (EPD, 2005).

According to the EPD (2005), despite the already high cost estimates of Hong Kong's waste management system, several factors are left out of cost calculations, including refuse removal costs and the land value of the RCPs and RTSs. As stated by the department: "The greatest significance is that the costs of dealing with MSW are mostly not borne by those who produce the waste" (p.19). The EPD continued:

> Most of the costs of MSW disposal are being paid for out of the public revenue and the costs appear insignificant or even non-existent for most waste producers. There are virtually no incentives for anyone to recycle or reuse waste that they produce, or to reduce the volume of material, because they are not being made to pay directly for what they are throwing away. The free waste management service in Hong Kong not only provides no incentives for the general public to avoid waste, but also affects the growing costs for disposal. (p.20)

For this reason, EPD has concluded that EPR is needed to support the 'producer pays' principle.

2.3.2 Waste Reduction Framework Plan

The ultimate goal of the Environmental Protection Department's WRFP (Waste Reduction Framework Plan) (2006) is to change the current attitude towards waste management in the attempt to promote increased recovery. Three programs are being implemented, targeting waste prevention, reduction, and management technology, respectively. The Waste Reduction Framework Plan (2006) listed the following goals:

(a) to extend the useful life of our strategic landfills;

(b) to minimize the amount of waste produced that requires disposal;

(c) to help conserve the earth's non-renewable resources;

(d) to increase the waste recycling rate;

(e) to show the administration, the Provisional Municipal Councils, commerce, industry and the public the true costs of waste management so that we can review how these costs are met; and

(f) to encourage maximum efficiency in waste management operations and minimization of the costs associated with collection, treatment and disposal of wastes. (ch. 2)

The government's goal is to decrease the amount of municipal solid waste (MSW) 58% by 2007, from 4.57 million tons to 2.75 million tons per year (WRFP, 2006). The government intends to make use of producer responsibility systems, in part, to help

achieve waste reduction and recovery targets. In order to accomplish this, the EPD advised that the Polluter Pays Principle must be adopted.

The Polluter Pays Principle (PPP) described by the Waste Reduction Framework Plan (WRFP, 2006) "requires that those who cause pollution should pay for the cost of treatment or cleaning up" (ch. 2). This results in a reduction of waste at the source. The Environmental Protection Department revealed that costs for taxpayers are increasing to support the resistance to adopt the policy. According to the EPD, past utilization of the PPP has resulted in cost savings and waste reduction, so the plan will strive to embrace the idea in future years (WRFP, 2006). Charging schemes for private Refuse Transfer Stations already exist in limited form and will be expanded.

An important topic discussed by the WRFP (2006) was legislation. While the WRFP seeks to support the principle that polluters are responsible for the waste they create, the government aims to keep legislation to a minimum. As stated by the EPD, legislation will not result in increased consumption of recycled products. Any regulations introduced must be 'in line' with global standards, so as not to deter business. Thus, legislation will be used "only where necessary and clearly beneficial, or where a market-driven approach has not or cannot succeed" (ch. 2). Additionally, any legislation introduced by the EPD must be enforceable, in order to keep illegal cost-cutting and disposal to a minimum.

2.3.3 Glass Recycling

Based on EPD estimates (*Waste Reduction and Recovery Factsheet No.6,* 2005), in 2005, a total of 89,000 tons of glass bottles were disposed of in landfills; only 2,000

were recovered. Of the 1.6% of glass bottles recovered, most were recycled or reused locally.

Quantities of waste glass recovered and disposed of in 2005		
	Recovered	Disposal
	('000 tonnes per year)	
Glass bottles	2	89
Other glass	0	38
Total	2	127

Figure 2. EPD waste recovery statistics for glass in 2005 (Waste Reduction Recovery Fact Sheet no. 6, p.1)

The EPD explained that typical glass reprocessing in Hong Kong includes the following steps: Initial separation by size shape and color bottle; removal of caps, straws or contaminants; soaking in an alkaline solution and label removal; rinsing, drying, and packing. The bottles are then ready to be ground into raw glass or reused as a drink container.

According to the EPD, major constraints on waste glass bottle recycling and re-use in Hong Kong are as follows:

a) Absence of a local glass manufacturing industry which otherwise will serve as a vital recycling outlet.

b) Lack of outlets and markets for the used glass bottles collected.

c) Absence of a cost-effective way for exporting waste glass bottles for recycling overseas.
d) Lack of deposit-refund system that is not difficulty for local beverage manufacturers and beverage importers to implement or maintain for their glass bottles.
e) Lack of relevant mandatory product responsibility schemes to facilitate the collection and recovery of used glass beverage bottles.

The EPD (2005) stated: "If Hong Kong cannot first secure reliable outlets for waste glass, there will be little point to set up any extensive collection system to gather the glass bottles."

2.4 Administration

Development of an EPR framework for glass bottles involves the government agencies in Hong Kong that deal with waste management and reduction. Two government departments are directly responsible for waste management in Hong Kong: the Environmental Protection Department (EPD) and the Food and Environmental Hygiene Department (FEHD). While each agency is concerned with the management of municipal solid waste, their goals and methods differ somewhat. We describe their responsibilities below. Another important body in Hong Kong is the Legislative Council. Any policies, dealing with waste reduction or not, must go through the council. We have also provided an explanation of this department's duties as they relate to our project.

2.4.1 Food and Environmental Hygiene Department

According to the FEHD (2006) in *Cleansing Services*, their workforce totals around 3,500, over half of which is outsourced through private contractors. The department services refuse containers and recycling collection points around Hong Kong. Approximately 5,453 tons of household refuse are collected daily (FEHD, 2006). Once collected, this waste is usually taken to recycling collection points (RCP) for storage. These vary in size, from single bins to full-scale facilities. A refuse collection point in the Sheung Wan district is shown below, in Figure 3. After temporary storage in RCPs (up to a day), the household refuse is taken to refuse transfer stations (RTSs), which are managed by the Environmental Protection Department (FEHD, 2006).

Figure 3. The interior of an RCP in Sheung Wan

Clusters of colored recycling bins are provided by the FEHD at nearly 2,000 locations across Hong Kong (FEHD, 2006). The bins are situated at refuse collection points (RCPs), markets, bus terminals, MTR exits, sitting-out areas, and other public places. The distribution of these bins for each district in Hong Kong may be viewed in Appendix M. The three bins present at each collection point accept waste paper (blue), metal containers (yellow), and plastic containers (brown), respectively (FEHD, 2006). From 2003 to 2005, the bins brought in a total of just 2,128 tons of material. The complete year-by-year data can be found in Appendix M. Glass is not included in this system. An example of a 'three-bin' cluster is shown below.

Figure 4. Recycling collection bins at a secondary school.

2.4.2 Environmental Protection Department

The EPD (2006) described their waste management responsibilities: "The EPD is responsible for...providing collection, transfer, treatment and disposal facilities for many types of waste..." (Responsibilities). The mission of the department's waste program is

to ensure proper handling of waste, providing facilities and legislation to do so. The department developed the Waste Reduction Framework Plan, which is described in section 2.3.2. Unlike the FEHD, the EPD possesses considerable legislative power (EPD, 2006). The department is responsible for advising town planning and policymaking. In addition to creating waste management legislation, the EPD has the power to enforce it.

The EPD runs Hong Kong's landfills and refuse transfer stations (EPD, 2006). While the main concern of the FEHD is efficiency in waste management, the EPD is more focused on waste reduction. The department is taking many steps to target this issue. In *A Policy Framework for the Management of Municipal Solid Waste (2005-2014)*, the EPD (2006) described these methods. Policies are being developed to manage the disposal of electronic devices and appliances, vehicle tires, plastic shopping bags, packaging materials, rechargeable batteries, and beverage containers (EPD, 2006). Importance is placed on waste avoidance and minimization, wherever possible. The department plans to use tools such as waste charging and producer responsibility systems to reduce waste.

2.4.3 Legislative Council and the Waste Disposal Ordinance

Hong Kong's Legislative Council (LegCo) is Hong Kong's legislative body. According to the Council (2004), its responsibilities include the enactment, amendment, and repeal of laws; the approval of government budgets; and the examination and criticism of government work. In *Sustainable Development*, LegCo (2006) demonstrated that beginning in 1998, increasing concern was expressed by the council about Hong Kong's dwindling landfill space. LegCo urged the government to consider the concept of

"sustainable development" in public policies. LegCo spawned the Council for Sustainable Development to oversee this, eventually establishing the Sustainable Development Fund, endowing it with HKD $100 million.

In *Legislation for the Management of Wastes*, the Environmental Protection Department (2006) states that the Disposal Ordinance is to be used to control the disposal, import, and export of waste. Over the years, the bill has been amended to support the growing acceptance of the Producer Pays Principle. Charges for the disposal of chemical waste were introduced in 1995. Service charges were enacted for refuse transfer stations in 1998. In 2004, a charging system was added to the Ordinance to limit the amount of construction waste entering landfills. Finally, in 2005, an amendment was added to control the disposal of clinical waste using a charging scheme (WRFP, 2006). The theme within the Waste Disposal Ordinance is waste reduction by minimization at the source. With the Legislative Council conscious of the growing waste problem Hong Kong now faces, and open to legislation to reduce the amount of waste going into landfills, the way is paved for an EPR policy dealing with glass beverage containers.

3. Methodology

The goal of this project was to recommend a framework for producer responsibility to address the sustainable waste management of beverage containers in Hong Kong. This project has been completed under the guidance of the non-profit organization Friends of the Earth. The team's goal coincides with the goal of the Environmental Protection Department (EPD) as part of the Waste Reduction Framework Plan (WRFP) to reduce the amount of recyclable material entering landfills. The team has gathered data using the methods outlined in this chapter in order to make suggestions toward achieving this goal. Glass was chosen as the focus material because of its very low recycling rate and availability to local recyclers. We have broken down our goal into four objectives, shown below:

- Identify the scale of beverage container waste in Hong Kong.
- Identify the mechanics, costs, and difficulties of glass beverage container recycling in Hong Kong.
- Identify beverage producer responsibility systems used in other countries.
- Identify examples of beverage producer responsibility in Hong Kong.

3.1 Identify the scale of beverage container waste in Hong Kong.

The team took this step in order to determine the number of drink containers being disposed of as waste in Hong Kong. The methods employed to accomplish this objective included: interviews with local bar and restaurant managers, observation of the

'three-bin' recycling system, research into EPD waste composition statistics, and an interview with the Tim Wai Group.

3.1.1 Bar and Restaurant Interviews

Interviews were conducted at local bars and restaurants in order to obtain information about the disposal of beverage containers at these establishments. Data were gathered from restaurant and bar managers in the Sham Shui Po, Central, and Wan Chai districts of the city regarding the rate of container glass bottle consumption and recycling at the retail level. The standard protocol used for these interviews can be viewed in Appendix E of the report.

3.1.2 Tim Wai Group

The team interviewed the owner of a local recycling company mainly involved with glass: Tim Lo of the Tim Wai Group. We chose to interview Tim Lo in order to collect data concerning the amount of glass drink container material being disposed of and recycled in Hong Kong. The Tim Wai Group is one of the main collectors of the glass baby bottles in Hong Kong from hospitals. These baby bottles are only used once and then disposed of. Without this company many glass bottles would be entering the landfills. We visited Tim Wai's recycling plant in the New Territories and conducted our interview there. We obtained photographic evidence of the volume of recyclable material being handled by the company. The standard interview protocol can be viewed in Appendix H.

3.1.3 EPD Waste Data

Statistics regarding the tonnage of glass and plastic bottles were obtained via the *Monitoring of Solid Waste in Hong Kong- Waste Statistics for 2005* published on the EPD website. Statistics included total tonnage deposited in landfills as well as percentage of glass and plastics recycled. These data described the differences in glass and plastic recycling in 2005.

3.1.4 Correspondence with Felix Choi

Following the tour at Swire Coca-Cola Felix Choi provided continued support and knowledge regarding the scale of recycling in Hong Kong. Mr. Choi's assistance was vital in interpreting statistics published by the Environmental Protection Department. Statistics included estimates of the current recycling rates for glass bottles, plastic PET bottles and aluminum cans.

3.2 Identify the mechanics, costs, and difficulties of glass beverage container recycling in Hong Kong.

Data were gathered concerning the logistics, costs, mechanics, and difficulties associated with recycling glass containers. The methods chosen to accomplish this objective were interviews with the bars/restaurants, Tim Wai, Swire Coca-Cola, Laputa Eco-Construction, the FEHD and the EPD, and a focus group held with five students of Hong

Kong University. These interviews identified costs, mechanics and difficulties of glass beverage recycling at the retail, producer, recycler and municipal levels of responsibility.

3.2.1 Interviews with Bars and Restaurants

Interviews with bar and restaurant managers were conducted in order to determine the current recycling practices of retailers as well as any difficulties or costs associated with said practices. A total of eight pubs and restaurants were interviewed. It was difficult to find places willing and able to communicate with the team. Locations that had time to share information were chosen. As previously stated, the standard protocol used for these interviews can be viewed in Appendix E of the report.

3.2.2 Tim Wai Group

The aforementioned interview with the Tim Wai Group was also conducted to study the process of recycling drink containers. We asked Tim Wai about the mechanics and logistics associated with obtaining, processing, and transporting post-consumer containers. The team structured the interview questions in order to determine the financial aspects of recycling in Hong Kong. We also wished to identify the advantages and disadvantages of using third party companies to outsource the recycling of post-consumer beverage containers. This information served as a valuable example for the final recommendations because Tim Wai Group recycling model could be implemented for the high percentage of importers who dominate the beverage market in Hong Kong. As previously stated, the standard interview protocol can be viewed in Appendix H.

3.2.3 Swire Coca-Cola

We selected Coca-Cola of Swire Pacific for an interview to obtain data from the perspective of a large and influential beverage producer in Hong Kong. Coca-Cola has a wide range of beverages that it provides Hong Kong such as numerous soft drinks, water, energy drinks and juices. With the largest share in the Hong Kong soft drink market, over 80% (Swire, 2006), the company has great influence in the region. Additionally, as an international corporation, Swire has market shares (and therefore influence) all over the world. We asked our contact, Felix Choi, about the difficulties and costs of recycling their post-consumer drink containers. We also gained a better understanding of the process of cleansing and reusing glass drink bottles. The standard interview protocol can be viewed in Appendix I.

3.2.4 Laputa Eco-Construction Material Co., Ltd.

An interview with Laputa Eco-Construction was conducted to collect data about uses for recycled glass from another recycler in Hong Kong. Laputa uses broken glass to create glass bricks which absorb air pollutants. Laputa provided data about the difficulties and costs associated with using recycled material in construction applications. Data were also obtained regarding the life cycle of glass bottles and other recycled material. We also determined Laputa's collection methods and glass donors/suppliers. The standard interview protocol can be viewed in Appendix L.

3.2.5 Food and Environmental Hygiene Department

The team interviewed Hong Kong's FEHD in order to understand the measures currently being taken to recycle. The FEHD, as explained in chapter 2 of the report, is responsible for waste collection and street cleaning in Hong Kong. They are responsible for managing Refuse Collection Points (RCPs) around the city. The team identified difficulties the FEHD faces in sorting, storing, and collecting recyclable material from RCPs. The team also obtained information regarding recycling pilot schemes currently operated by the FEHD. Specifics about the communication between the FEHD and the EPD were also collected. The two departments must work together to manage Hong Kong waste so this was an important part of the interview. The standard interview protocol can be viewed in Appendix J.

3.2.6 Environmental Protection Department

Despite many attempts at securing an interview with the EPD, the department was unable to meet with the team. The results listed below were determined through email correspondence (W. Tam, personal communication, February 5, 2007.) As previously stated, the standard interview protocol can be viewed in Appendix K.

3.2.7 Students of Hong Kong University

The team held a focus group with five students of Hong Kong University to obtain knowledge on what consumers thought made recycling difficult and if the current system was effective for them. Ideas of how the system may be improved were acquired.

A questionnaire was given to the students to see where they were from and what kind of background they had. A copy of the questionnaire can be viewed in Appendix G and a copy of the standard focus group protocol can be viewed in Appendix F.

3.3 Identify beverage producer responsibility systems used in other countries.

This phase of our research dealt with gathering examples of notable PRS used in other countries. The majority of this data gathering was performed as a literature search via internet research and databases. Germany was chosen as a case study because of the nation's effort to pioneer extended producer responsibility in the early 1990s. Research was also conducted on PRS in Japan, Taiwan, and Korea because of the similarity and proximity of these nations to Hong Kong. This information is described in detail in the background section of the report and will be discussed and analyzed in the results section.

3.4 Identify examples of beverage producer responsibility in Hong Kong.

The team identified existing methods employed by beverage producers in Hong Kong to assume responsibility for the post-consumer waste from their products. Interviews were conducted with the Tim Wai Group, Swire Coca-Cola, and Laputa Eco-Construction Material Co., Ltd to identify existing PRS.

3.4.1 Tim Wai Group

Tim Wai Group was contacted for an interview after obtaining their contact information from the EPD website. Tim Wai Group supplied raw glass for the research of glass bricks. This work led to the formation of Laputa Eco-Construction and thus Tim Wai Group has largely contributed to the advance of glass recycling in Hong Kong. The Tim Wai Group served as an excellent model for PRS in Hong Kong because it is the collector and recycler in a successful local baby bottle producer responsibility scheme. As previously stated, the standard interview protocol can be viewed in Appendix H.

3.4.2 Swire Coca-Cola

By interviewing Felix Choi at Swire Coca Cola, the team identified the methods used by the franchise to collect and reuse or recycle post-consumer drink containers. In addition, we determined financial aspects of transportation, sterilizing and refilling bottles. Finally, we identified legal and economic barriers to increased producer responsibility. As previously stated, the standard interview protocol can be viewed in Appendix I.

3.4.3 Laputa Eco-Construction Material Co., Ltd.

The interview with Laputa supplied details on the company's relationship with local beverage producers. We obtained financial details and other operational arrangements, such as the costs associated with transporting recyclable material, and

sources of raw glass. As previously stated, the standard interview protocol can be viewed in Appendix L.

3.5 Summary

In this chapter, we reviewed the methods employed to achieve the goal of developing a framework for producer responsibility of beverage containers in Hong Kong. The four objectives identified above were accomplished to reach this goal.

4. Results and Analysis

In this chapter we will present the results of our research with the goal of developing a framework for the sustainable waste management of beverage containers in Hong Kong, under a producer responsibility system. Glass was chosen as the focus material because of its very low recycling rate and availability to local recyclers.
We first determined the amount of waste being generated by glass containers. The team also identified the mechanics and difficulties of glass recycling in Hong Kong. In order to develop a foundation of potential EPR systems for beverage producers, we identified notable techniques used in other countries. Finally, the team identified existing examples of EPR systems in Hong Kong dealing with glass bottles.

4.1 Determine the scale of beverage container waste in Hong Kong

According to the EPD (*Waste Reduction and Recovery Factsheet,* 2006) 3,422,605 tons of municipal solid waste (MSW) were received at disposal facilities 2005. This year 89,000 tons of glass bottles, 73,000 common PET and other plastic bottles, 8,030 aluminum cans were received. Of the total MSW generated daily, glass and plastic bottles and aluminum cans accounted for 5%, 3.7% and 0.7% respectively. We have organized the data in the table below:

Table 1. Waste container contribution to municipal solid waste, EPD (2006).

Waste Type	Domestic Waste		Construction & Industrial Waste		Total waste in 2005
	Quantity (tpd)	% by weight	Quantity (tpd)	% by weight	qty / %
Glass Bottles	183	(2.6%)	61	(2.4%)	244 / 5.0%
Plastic Bottles	168	(2.5%)	32	(1.2%)	200 / 3.7%
Aluminum Cans	17	(0.5%)	5	(0.2%)	22 / 0.7%

*(tpd) = Tons per day

According to Table 1, it may appear as if glass and plastic bottles are used in near equal proportions and aluminum cans used the least. However production levels at Swire Coca-Cola in Sha Tin suggest otherwise. About 60% of their production is sold in aluminum cans, 30% in plastic bottles and 10% in glass bottles. Due to the fact that Swire owns much of the beverage industry, its production levels are a good indicator of actual bottling statistics. This indicates that glass bottles, even though they are used the least of these materials, causes the greatest amount of post-consumer waste.

Felix Choi of Swire Coca-Cola, who is currently preparing his Master's thesis on producer responsibility systems of Hong Kong, estimated that the glass recovery rate is about 2%, PET plastic bottles about 50% and nearly all aluminum cans are recycled. As seen in Table 2, a total of 2,000 tons of glass were recycled while 89,000 of glass were disposed of in landfills (EPD, 2006). This clearly indicates a need for increased glass bottle recycling in Hong Kong. Table 2 also shows the low percentage of recycling occurring in Hong Kong. Of the total 2,491 thousand tons recovered, only 5% was recycled locally.

Table 2. Quantity of recovered recyclable materials in 2005 (EPD, 2006).

Waste Type	Quantity of recovered recyclable materials (thousand tonnes)		
	Exported for Recycling (a)	Recycled Locally (b)	Total recovered for recycling (c) = (a) + (b)
Ferrous metals	829	0	829
Glass	0	2[1]	2
Non-ferrous metals	102	6	108
Paper	792	116	908
Plastics	637	8	644

Most of the restaurants we visited use at least 500 glass bottles per week. Approximately one third are capable of using over 2000 bottles weekly. One restaurant the team interviewed sometimes sells over 500 bottles of beer in a single night. Thus, districts populated with bars appear to contribute a great deal to the consumption of glass bottles.

We determined that all the pubs and restaurants we interviewed discard bottles rather than recycling them. This is partially due to a lack of disposal fees. There are no extra charges affecting waste disposal. As a result, there is no penalty for throwing away these bottles. Furthermore, the Food and Environmental Hygiene Department (FEHD) is not responsible for collecting waste from commercial sectors. Therefore, all businesses must hire their own contractor for waste collection. These private contractors bring waste directly to landfills or to refuse transfer stations which lead to landfills.

Figure 5. Bottles collected by Laputa's pilot scheme in Tsim Sha Tsui.

Another example of the scale of waste was seen on a tour at Laputa Eco-Construction Material Co. Laputa was conducting a trial to collect used glass bottles from bars and pubs in the Tsim Sha Tsui district. Figure 5, taken at Laputa's processing facility in Fanling, shows only one quarter of the total glass bottles produced by pubs and restaurants on a single street in Tsim Sha Tsui in one day.

4.2 Identify the mechanics, costs, and difficulties of recycling glass beverage containers in Hong Kong

In this section, we will describe our examination of the glass recycling process in detail. We have identified the constraints faced by glass recyclers, including costs and other difficulties. The team took transportation, location, available space, financial aid, and publicity into consideration during research.

4.2.1 Collection, Transportation, and Processing Problems

The processing facilities of both Laputa Eco-Construction and the Tim Wai group are located deep within the New Territories of Hong Kong. While recyclers must locate themselves far from residential areas to avoid unwanted noise pollution, this results in high transportation costs. Recyclers in the suburban New Territories must collect from busier districts further south.

As transportation of glass is expensive, Lam of Laputa Eco-Cosntruction admitted that the company is at times unable to collect all available glass. Some material is simply donated, but most of the time collection involves transportation fees. He mentioned a pilot scheme Laputa conducted, wherein empty bottles were collected from bars and restaurants in Tsim Sha Tsui. The pilot was abandoned as a result of transportation costs. The company does not own any trucks, so a 5-ton vehicle and workers had to be hired, costing Laputa between HKD $1000 and $2000 per trip. Another factor that thwarted this scheme was the amount of space available in Tsim Sha Tsui. Buildings are close together and streets are crowded. There was difficulty in providing trucks with access to collection points.

The Tim Wai Group has contracts with four hospitals for the collection and recycling of glass baby formula bottles. All collection points are visited daily. The costs required to transport and reprocess the bottles is high compared to the return rate on the raw glass obtained afterward. Collecting, transporting, cleaning, and preparing one ton of glass for shipping costs Tim Wai approximately HKD $1200. Meanwhile, the company only receives between HKD $240 and $280 per ton of raw glass.

After the company collects bottles, they are put into barrels of solution containing a cleaning agent that helps to remove labels. Labels come in two types: paper and plastic. The paper labels are easily removed after soaking, but the plastic ones are not. They must be removed one by one (by hand), as shown in Figure 6. These labels are then sent elsewhere to be recycled. Following the cleansing process, the bottles are dried and either crushed into aggregate or shipped out as-is, depending on the application for the clean glass and the demands of the client.

Figure 6. Removing the plastic label from a baby formula bottle.

4.2.2 Spatial Limitations

Another difficulty for the Tim Wai Group is the size of their facility. It is rather small in size when taking into account the amount of collecting and processing that is being done. Glass bottles covered the grounds of the facility in storage bags and heaping piles. The factory suffers from its location. It must be far from residential areas to avoid noise pollution.

In addition, there are limitations to the modification of Tim Wai's processing facility. The plant is located on the grounds of an old farm. An old shed houses a glass crushing machine. Shipping containers are piled everywhere and are used as makeshift rooms and offices. For undetermined reasons, government regulations do not allow the company to make changes to the existing structures, so operations suffer from the layout of the facility due to lack of usable space.

4.2.3 Publicity for Recyclers

Mr. Lam of Laputa Eco-Construction also discussed the problem of publicity with us. In order to establish a large enough market for recycled products, a recycler needs to advertise itself to the right people. One method Laputa is using to do this is a partnership with secondary schools. Ten secondary schools will be contacted, with the hope that five will ultimately participate in a pilot scheme. Students will be asked to collect glass bottles for Laputa. Then, glass bricks will be made using the collected material and will be used to pave areas around the schools. Time will be provided for the schools to ask for aid from the government to fund the program. This is a completely publicity-based endeavor because there will be no profit for Laputa.

4.2.4 Convenience

From our interviews with pub and restaurant managers, we determined that managers' recycling habits play an important role in determining the ability of their businesses to recycle glass bottles. Please see *Appendix E* for more detailed information.

We were able to learn about some of the managers' personal recycling habits. For example, some of the mangers recycle at home, even if there are no recycling facilities or collection points nearby. While some seemed more indifferent than others, most people we interviewed agreed that recycling is not convenient. One manager brought up the point that recyclables often have to be washed before being returned. He also commented on the small sizes of openings in the 3-color bins.

Nearly ¾ (71%) of the interviewed managers agreed that they would have the ability to separate glass beverage bottles during business hours. Of these, all but one claimed to recycle personally. A pub manager in Wan Chai mentioned that most of the waste generated by his business is glass, and there is only a small amount of other waste, such as food and plastic bottles, which would need to be separated from the bottles. Therefore, instead of using a large bin to collect the post-consumer bottles, they would just need to use a small bin to collect other waste.

Pub managers in many of our interviews agreed that efficiency and convenience are the most important constraints for pubs and restaurants when considering recycling. These businesses are fast-paced. One manager explained that workers may not be able to take extra time to separate recyclables from other waste. Any collection system introduced to these establishments would have to be very easy and efficient. This way, business would not suffer. Presently, these businesses do not recycle their waste bottles because the repercussions for disposing of them are not significant. There are no charges for glass disposal.

Students in the team's focus group stressed the importance of convenience. All of them considered the government's 3-color bin recycling collection system to be highly

inconvenient. They cited the lack of collection points in residences and in public places. The students brought up the point that most homes do not have the storage space for recyclables. They reinforced the sentiment of the FEHD that Hong Kong's climate does not allow for long-term storage of waste.

4.2.5 Material Selection: Glass vs. PET

Our contact at Swire Coca-Cola Hong Kong – environment, health & safety manager Felix Choi – broke down the details of production for two types of containers: Polyethylene terephthalate **(**PET) and glass bottles. He explained the difference between using PET and using glass in terms of life cycle analysis.

According to Mr. Choi, based upon life cycle analysis the 'environmental friendliness' of glass and PET bottles is about the same. It is cheap to produce beverages contained in PET bottles. The initial process involves expanding pre-forms into containers. Then, the product to be distributed is heated and poured into the bottles, sterilizing the PET. Caps are put on, and the product is ready to go. Filling these bottles is a less energy consuming process than for glass bottles.

Recycling PET is more complicated. The material has to be re-sterilized and ground down into chips. The chips are separated from the pieces of label and eventually melted down into pellets. Then, they can be made into new bottles. However, unlike glass, PET cannot be infinitely recycled. Color is lost each time. Furthermore, when recycled plastic is used in new bottles, the recycled plastic must be situated in a layer between the inside of the bottle and the outside, so as not to come in contact with either the product or the consumer.

Producing and reusing glass bottles is a resource and labor-intensive process, which takes considerably more energy than producing PET bottles. Once formed, the bottles must be continually monitored for damage throughout the production process. The recycling process relies on computers as well as human workers. If the rigorous inspection system identifies a damaged container, the bottle must be removed from production.

A disadvantage to reusing glass bottles is cleaning them. They must be heated and cooled gradually during washing and rinsing, in order to avoid damage due to thermal stress. Overall, it takes approximately 4-5 bottles of water to clean each individual bottle. The equipment used to perform this process is bulky and is specific to the container shape. Furthermore, the bottles are costly to transport due to their density.

The advantage of using glass is that it is endlessly recyclable. Coca-Cola reuses its glass bottles up to thirty times each, limited only due to high product specifications. Damaged bottles and those at the end of their lifespan as Coca-Cola containers are donated to Laputa Eco-Construction Material Co., Ltd., to be broken down and reused in construction material. The "glass" bricks (see the following section) created by Laputa are infinitely recyclable themselves. Once glass is formed, they can be continually reused in a growing number of applications.

4.2.6 Construction Value of Glass

Laputa Eco-Construction is responsible for the creation of the "glass" paving block, shown in Figure 7. This block uses fly ash from power plants, recycled aggregates from crushed paving blocks, and crushed glass. A flow chart of the process is also

provided below. The paving blocks use 20%-50% recycled material. Laputa hopes to increase this to 80% in the future. Combining all the ingredients, a special brick is formed with the ability to be infinitely reused. Some of these are coated with titanium dioxide, giving them the ability to neutralize air pollution from vehicles by reacting with emissions. Once glass bricks need to be replaced, they are crushed and reused as completely new blocks.

The team asked Laputa if there are any limitations on the types of glass the company can accept for recycling. He explained that reinforced glass of any kind, such as bulletproof glass, cannot be used. However, glass beverage bottles from bars and restaurants are definitely acceptable for recycling.

Figure 7. Laputa's glass paving block on display at Coca-Cola's Sha Tin Bottling Plant.

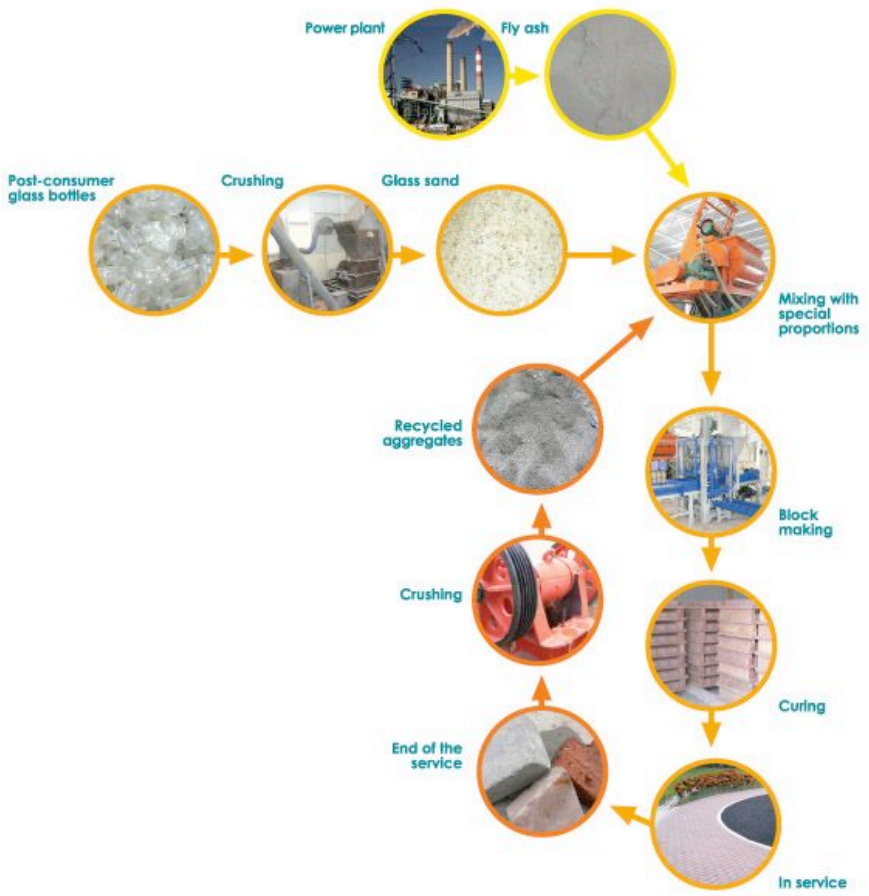


Figure 8. From Laputa's website: the process of creating and recycling glass paving blocks (*Flow Chart*, 2006).

4.2.7 Government Support

Government involvement in producer responsibility and recycling is very limited. Our interviewees from the FEHD stated that the department has no connection to producer responsibility. They are responsible for collecting waste and transporting it to landfills. Mr. Sin, senior superintendent of the FEHD, declared that one of the main difficulties for source separation – the separation of recyclable material from waste – by the FEHD is the space it would require. Refuse Collection Points (RCP's) are small and do not have enough room for sorting or storage of extra material. The FEHD lacks the

manpower to conduct sorting. Furthermore, the climate in Hong Kong would also affect sorting efforts. Waste can only be stored temporarily because of heat and humidity. The FEHD representatives stated that for recycling to be successful and sorting to occur, it will need to be done privately by consumers.

Hong Kong's government has begun to institute aid for recyclers by constructing an industrial park – called the Eco-Park – in Tuen Mun. However, recyclers like Laputa have not considered moving into a facility there because of the restrictions and enormous startup costs involved. The area is located closer to residential areas, which increases noise level restrictions. According to Mr. Lo of Tim Wai, tenancy in the Eco-Park requires an initial investment of at least HKD $6 million up front. In addition, new recycling facilities must be built on the site by each tenant, which significantly increases startup costs.

According to the EPD, the Lands Department has located and leased 36 sites across Hong Kong with a total area of 7.4 hectares. These areas are currently being leased for recovery and recycling efforts. Previous consideration has been given to land under flyover zones at airfields. However, the EPD has determined that this land is required as a buffer zone for aircraft. Construction of recycling facilities would require barricades for structural columns and would result in small, scattered, and irregular sections of available land.

The Environmental Protection Department also stressed that enforcement of legislation is a priority to ensure successful PRS. As a supplement to PRS legislation, the EPD plans to authorize the Department of Environmental Protection (DEP) for

enforcement of PRS legislation. The DEP would have the power to conduct investigations, collect evidence and issue fines for non-compliance.

Mr. Lam of Laputa Eco-Construction strongly suggested that the government implement a policy to charge producers HKD $1 for each glass bottle they produce. The money could be used to fund recycling. At the moment, Laputa has no government aid. Lam explained that the process of asking for and receiving aid is lengthy. The company has also been deterred from asking for aid by the fact that profits would undoubtedly have to be returned to the government in the end. Tim Wai has no aid from the government whatsoever, which seems to be a common difficulty shared by glass recyclers in Hong Kong. Without contracts from manufacturers, the Tim Wai Group would go bankrupt very quickly.

Friends of the Earth (FoE) acting director Edwin Lau informed the team that the FEHD is involved in a number of pilot schemes for recycling. Several RCP's have been selected to participate. At some of these locations, polystyrene is set aside by workers to be collected by private contractors. The scheme involves little change to existing waste collection systems. It also results in less material needing to be stored in collection facilities. FEHD frontline workers simply need to set the polystyrene aside, and the private sector takes care of the rest. In fact, Friends of the Earth hires these collectors.

4.2.8 Past Recycling Attempts

Hong Kong once had a well-established deposit-return system for beverage containers. This system operated at the retail level with bottle collection banks at local stores. Due to increased rent and limited, indirect profits for retailers, the system was

eventually abandoned. The EPD stated in an e-mail to the team that "when the quantity of bottles drops below a certain level the deposit-return system fails to be cost-effective."

This problem was made worse when more manufacturers moved out of Hong Kong, which made refilling/reuse of glass bottles difficult and not economical for producers. The large percentage of importers in Hong Kong leads to other difficulties. The "main vein" of the Waste Reduction Framework Plan is the 'Producer Pays Principal.' According to the EPD, the fact that the Hong Kong beverage industry relies largely on imported goods could increase the need for cooperation between importers, distributors, retailers and consumers.

4.2.9 Support from NGO's

Mr. Lau of Friends of the Earth explained that non-government organizations have considerably more flexibility than government departments. FoE is a perfect example. In 2003, the NGO launched a campaign against one of Hong Kong's largest distilled water producers. In the first phase of the campaign, negotiated was attempted with the company. When this produced no results, FoE went public. They piled truckloads of waste plastic in front of the company's factory. Embarrassed, the bottled water producer agreed to negotiate with FoE. Since the incident, the manufacturer has continually taken more responsibility for recycling its post-consumer bottles.

Another example of this was "Operation Moonkick", which was also initiated in 2003. Moon cakes are a high-selling product during the mid-Autumn festival in Hong Kong, as they are part of traditional celebration of the holiday. These cakes are notorious for excessive packaging. To combat this, FoE negotiated with moon cake producers

privately and in public, ultimately embarrassing them. The manufacturers agreed to cut down on their packaging.

Finally, Friends of the Earth is responsible for arranging a number of pilot schemes with the FEHD and producers all over Hong Kong. One of these involves the separation and collection of polystyrene. FoE took a number of steps to ensure the success of this pilot. They liaised with producers in need of polystyrene material and helped these producers hire vehicles and compacting equipment to aid in collection. They also worked with the FEHD to arrange separation and collection points. Overall, Friends of the Earth has demonstrated the power non-government organizations can have in recycling efforts.

4.2.10 EPD vs. FEHD: Conflicting Goals

Communications between the FEHD and the EPD are very limited and the goals of these two departments are different. The number one priority of the FEHD is to collect waste from the city and dispose of it before it can become a health concern, while the EPD aims to protect the environment. The FEHD cooperates with the EPD to work on pilot schemes, but beyond this, there is little cooperation between the two departments.

4.3 Identify successful and unsuccessful beverage producer responsibility systems used in other countries

Table 3 indicates EPR methods implemented in Japan, Taiwan, Korea, and Germany. We have summarized the advantages and disadvantages of these systems in last column on the right.

Table 3. PRS Used in Japan, Taiwan, Korea, and Germany.

Country	Techniques Used	Advantages and Disadvantages
Taiwan	Deposit-Refund System	• **Recycling rates very high** • **Free riders**
	Mandatory Take Back	• **Targets large importers** • **Provides cash back** • **Bi-monthly reviews**
	Eco-labeling	• **Encourages use of green products** • **Consumers must use green products**
Japan	Extensive Separation Collection System	• **Increased amount of recycling** • **Costly** • **Time consuming** • **Space consuming**
Korea	Deposit-Refund System	• **Stress on producers** • **Poor producer cooperation** • **Many free-riders**
	Disposable Goods Restrictions	• **Limits disposable goods** • **Does not include EPR (simply switch materials)**
	Eco-labeling	• **Encourages use of green products** • **Consumers must use green products**
Germany	Beverage Producer Law	• **Promotes refillable bottles** • **Targets were not met**
	Deposit-Refund System	• **Increased recycling habits** • **Many companies turned to plastic containers**

Taiwan has used a deposit-refund system, mandatory product take back system, and eco-labeling. A deposit-refund system seemed to increase the rate of recycling. However, some producers were dishonest about the number of bottles that were being produced, resulting in more bottle refunds than deposits. It is mandatory to eliminate such 'free-riders' and establish some method to ensure accurate reporting of production.

The mandatory take back system required companies to have bi-monthly reviews, in order to help with the deceitfully producers. Through eco-labeling, consumers were made aware of what products were eco-friendly. It is essential that consumers and educated and made aware of this system in order to maximize its benefit.

Japan created a law for the promotion of sorted collection and recycling of containers and packaging. It was an extensive system that required consumers to separate multiple types of materials for collection on different days. This raised the recycling rate of many different materials. Arrangements for recycling at many manufacturers were also adapted. This may take more time and space than Hong Kong would be able to supply. Also the detail of recycling procedure is likely not convenient enough for Hong Kong residents. Furthermore there is not enough producer payment for recycling and municipalities ended up paying almost all collection and recycling costs. Financial assistance would be needed from bottling companies if implemented in Hong Kong.

Korea uses three different methods: deposit-refund system, disposable goods restrictions and eco-labeling. An organization was created to manage the funds of the deposit-refund system, a producer responsibility organization (PRO). By using this organization, pressure was put on manufacturers to pay deposits on all bottles. Rewards are given to manufacturers with good recycling records. Excess money was donated to schools, collection programs and other related organizations. This worked in theory, but as mentioned in chapter 2, many bottlers forfeited their deposits and threw away their containers instead of recycling them. Government restrictions were generated to restrict the amount of disposable goods that were served in service sections such as restaurants

and stores. This addressed the proliferation of disposable goods. Manufacturers simply switched from individual containers to large ones.

Eco-labeling encouraged companies to think green and contribute money towards recycling and is very promising for Hong Kong. This caters to and encouraged green-thinking consumers. Consumers, however, must want to buy these products in order to keep producers manufacturing such products.

Germany's beverage producer law and deposit-refund system was used to promote recycling. Targets were set for the recycling of soft drink containers. Constraints were put on manufacturers on the amount of non-eco-friendly materials that they were able to use. This promoted refillable bottles. Targets were not being met, which prompted the establishment of a deposit-refund system. This helped to increase the recycling habits of the people, although many companies just began bottling drinks in plastic containers.

4.4 Identify examples of beverage producer responsibility in Hong Kong

Presently, there are few producers and manufacturers in Hong Kong taking responsibility for their post-consumer bottles. Because there are no laws demanding producers to assume this kind of responsibility, many companies choose to disregard the waste created by their post-consumer beverage containers. However, there are a few exceptions. Swire Coca-Cola Hong Kong, Kowloon Dairy, and the Tim Wai Group are all involved in producer responsibility systems for glass bottles. By analyzing the systems employed by these companies, it was possible to determine guidelines for all producers distributing products in glass containers in Hong Kong.

4.4.1 Financial Responsibility

The idea of financial responsibility is that producers and importers hire a third party contractor to collect post-consumer glass bottles. The contractor will recycle the collected waste glass bottles and avoid their being sent to a landfill. Two companies in Hong Kong that are part of financial responsibility are the Tim Wai Group and Laputa Eco-Construction Material Co.

The Tim Wai Collection and Reprocessing Facility is involved in many producer responsibility systems. However, Tim Wai is a collector and recycler, not a producer. Producers pay Tim Wai Group to collect their bottles. The bottles are then broken down and sold as raw glass to manufacturers. ExxonMobil has used Tim Wai to help them recycle many tons of material. Mattel has hired Tim Wai to destroy and recycle large amounts of confidential documents. Most importantly, baby formula producers supplying local hospitals continue to rely on the help of Tim Wai to collect and recycle their glass bottles. The suppliers produce one-time-use bottles for feeding new infants. Tim Wai has set up a collection system to gather these bottles from hospitals. This is the idea of financial responsibility. Producers are not involved in the collection or recycling process. Instead, private collectors are paid to collect and recycle glass.

Tim Wai's profits are not from the recycling and resale of the glass, but rather from the contracts the company establishes with producers. Mr. Lo of Tim Wai clarified that glass recycling alone is not a profitable business. In fact, his company loses HKD $900 on each ton of recycled glass. Contracts are required to cover the deficit and

generate a profit for the group. The forces that keep Tim Wai's business afloat are the producers that take financial responsibility for their post-consumer glass containers.

The team interview with Mr. Lam of Laputa Eco-Construction Material Co., Ltd. provided information to help achieve the fourth and final objective. The team discovered that Swire Coca-Cola Hong Kong supplies Laputa with its broken unusable glass bottles. After reusing the bottles twenty to thirty times, they are transported and donated to Laputa for recycling purposes.

Mr. Lam confirmed the information given to us by Coca-Cola. The company does indeed supply them with post-consumer glass bottles. While in some cases, Laputa is forced to deal with transportation costs involved with picking up post-consumer glass, Coca-Cola delivers its bottles directly to Laputa, free of charge. This greatly eases the difficulties of glass collection for Laputa.

Mr. Lam also verified information gained from our interview at Tim Wai; there is no money to be made by simply recycling glass and selling it. This alone is a money-losing business. Tim Wai gets around this barrier by making money from contracts which pay him for collecting empty glass bottles. Laputa Eco-Construction – in addition to making arrangements with producers and suppliers – has taken advantage of the viable application of glass paving blocks. The business of selling these glass bricks has proven to be very successful.

As stated by Mr. Lam, about 70% of Laputa's profits come from the government. The reason for this is simple: Government housing authorities use "gimmicks" to sell property. One such gimmick used by these authorities is to sell property which has utilized environmentally friendly construction. This is where Laputa comes in. Glass

paving blocks are used to increase the "environmental value" of the property. This is not the only benefit of using the glass bricks, however. In addition, the paving blocks can be made in custom shapes and colors for each client. They are considered aesthetically pleasing, in part because of the way they sparkle due to their glass content.

According to Mr. Lam, Laputa has increased the overall recycling rate of glass in Hong Kong by a percent or two, since they began in 2005. The company is still looking for more glass to use in their bricks. They are also exploring other construction applications for glass. Mr. Lam told our team that the use of glass paving blocks could easily absorb all of Hong Kong's waste glass; that was 89,000 tons in 2005 (EPD, 2006). They hope to continue to form partnerships with importers and suppliers in order to increase the quantity of collected glass bottles. Importers could practice financial responsibility by funding collection and transportation of waste bottles from retailers to Laputa Eco-Construction.

4.4.2 Physical Responsibility

The team's interview with Felix Choi of Coca-Cola informed us of the steps the franchise is taking to bear more responsibility for its waste containers. During a tour of the plant, Choi demonstrated a pilot program on the verge of being introduced to the public. The machine shown to us can be seen below in Figure 9.

Figure 9. Coca-Cola's PET (polyethylene terephthalate) bottle "reverse" vending machine.

The machine operates in a similar fashion to the bottle and can collection machines in United States supermarkets, but with a few upgrades. It is activated via a touch screen. The user may then feed a PET (polyethylene terephthalate) bottle through the black and yellow opening. Scanners identify the bottle, classifying it either as a Coca-Cola product or an unknown brand. At this point, one of the following occurs: If there is no label present on the bottle, or the product cannot be identified, the bottle is returned to the user via the gray receptacle on the front of the machine. If in fact the bottle is labeled and identified, it is crushed and dropped into the machine for temporary storage.

If the container returned was a Coca-Cola product, the user will be offered a HKD $0.10 reward. That user may then choose to accept the reward or to donate it towards an

environmental fund. This is aimed at provided recycling incentives to consumers. If the bottle given to the machine was not a Coca-Cola product, the user will be informed and no reward will be offered. In this way Swire practices producer responsibility and also encourages the purchasing of its products while not excluding other PET bottles. Finally, when the user is finished with the machine, she is asked to scan her Octopus Card to accept her refund. The amount will be immediately credited to the card.

The first eight of these machines were installed on February 13, 2007: three at Ocean Park in Aberdeen and five in secondary schools and housing estates. Coca-Cola plans to launch 60 "reverse vending" machines in all during their pilot program. They will be installed mainly in schools, shopping malls, and housing estates. Based on the data received after the initial phase of introduction, the program may be expanded. One of the deciding factors in the success of the "reverse vending" system is the cooperation of other beverage producers. Choi stressed to us the importance of having a 'level playing field', meaning an environment where all beverage producers in Hong Kong contribute equally to extended responsibility efforts.

In addition to the experimental system for PET bottles, Swire Coca-Cola HK uses a deposit-refund system for their glass bottles as well. This system has been in use much longer. Glass bottles of Coca-Cola are delivered to retail locations across Hong Kong. Every retailer pays the deposit on the bottles directly to the franchise, so the deposit-refund interaction is between the store and the customer only. When a consumer purchases one of these beverages and drinks it, the bottle can be returned to the retailer for a HKD $1.00 refund. The bottle is placed in a reusable tray. Then, the trays are picked up by Coca-Cola delivery trucks.

Coca-Cola takes physical responsibility for reusing their glass bottles, often cleaning them and refilling them 20-30 times before taking them off the shelves. These "retired" bottles and damaged bottles that do not pass the rigorous inspection process are donated to Laputa Eco-Construction Material Co., Ltd, where they are used to make "glass" bricks (see section 4.2.6). This is to ensure that all glass bottles created by Coca-Cola continue their useful life elsewhere, rather than being put into landfills.

In summary, we made the following observations concerning EPR from our interview at Swire Coca-Cola Hong Kong:

- The deposit and refund system with glass bottles is an example of *physical responsibility*. Coca-Cola physically washes and reuses their bottles 20-30 times.
- Coca-Cola has begun a deposit-refund pilot program for PET bottles that uses the Octopus Card. A total of sixty machines will be put into use.
- Spent glass bottles are donated to Laputa Eco-Construction Material Co., Ltd. for recycling.
- Producers need a 'level playing field' for EPR to work.

4.4.3 Conclusions

After the interview with Tim Wai, Swire Coca-Cola, and Laputa, the team realized that recycling and selling raw glass is not profitable. However, Laputa has been a successful example, demonstrating that turning waste glass into eco-products can open a new market and make recycling glass become a profitable industry. About 98% of beverages are imported in Hong Kong, which means that financial responsibility may be

easier to implement in Hong Kong. Collecting waste glass is a very costly process for any recycler, especially because of transportation costs. The glass recycling business can be boosted if these costs can be shared with producers.

4.5 Summary

To review the material in this chapter, we have highlighted the important points discussed:

- Glass bottles generate a massive amount of municipal solid waste each year. This waste arises from sources such as bars, restaurants, convenience stores and hospitals.
- Glass is expensive to recycle and transport. As a result, the recycling rate of glass in Hong Kong is extremely low.
- A few producers, such as Swire Coca-Cola and baby formula suppliers, are taking responsibility for their post-consumer glass bottles. Most, however, are not. A 'level playing field' where all producers contribute to recycling efforts is needed.

5. Conclusions

In any design process, one of the first steps towards an effective design is to understand parameters. In order to make recommendations for a PRS for glass beverage containers, the team identified the details surrounding glass recycling in Hong Kong. The parameters listed below represent the conclusions derived from our results. We will identify and discuss each parameter. The framework in the following chapter has taken into account all of the parameters, in order to maximize its potential for application and success in Hong Kong.

Currently almost all glass beverage containers in Hong Kong exist as 'one way' products. After they are sold, they are deposited in landfills. This practice fails to utilize the material value of glass and its nearly inexhaustible recyclable properties. It is important that any EPR framework suggested for Hong Kong closes the loop and introduces a continuous life-cycle for glass bottles, while at the same time engaging the cooperation of producers, empowering the voice of the consumer, stimulating local business and recycling technology, and maintaining the ideals of Hong Kong's free-market economy. In addition to these parameters, in order to maximize its feasibility, the framework should utilize existing institutions, facilities, and systems as much as possible; require a minimum amount of space for collection points and recycling facilities; and be convenient for consumers and municipalities.

5.1 Engage the Cooperation of Producers

The cooperation of beverage producers and importers is the most critical consideration for the implementation of a producer responsibility system (PRS) in Hong Kong. In order to have the participation of beverage producers and importers, the PRS must provide some incentives that appeal to them. Voluntary participation in a Producer Responsibility Organization (PRO) could help to maintain a sustainable waste management system and development of PRS. The PRO is a major tool in engaging cooperation of the producers and can benefit the member beverage producers and importers in many different ways.

The image of a brand name is essential to sell any product on the market. Hong Kong's government is educating residents about environmental protection and should continue to do so. An eco-labeling system is a good example of engaging producer cooperation because it relies on the choices of consumers, rather than pressure from government. By applying an eco-label system, importers and producers will be motivated to obtain an eco-label to save face in the market. To qualify, producers must meet recycling standards. Eco-labeling does not directly interfere with production in any way. However, it engages the producer to act in a responsible and environmentally friendly way by applying a subtle yet powerful pressure: consumer demand.

One major function of the PRO is to create a pool of resources for its members. As shown in case studies found in the background, the PRO could provide technical and financial assistance to industry in order to maintain a "level playing field" for producers of all sizes. This ensures that all importers and manufacturers pay depending upon their rate of production. According to Felix Choi of Swire Coca-Cola Hong Kong, one major

barrier in pursuing further recycling efforts at Swire Coca-Cola is the fact that other producers are not contributing equally or at all. When Swire contributes to recycling efforts but competitors do not, it results in a direct loss in profits for Swire.

PROs can also provide centralized transportation to collect empty bottles and deliver the collected bottles to appropriate recycling centers. This can lower the high transportation cost for its members and increase the willingness of a given importer to comply with the PRS.

Another way a PRO can engage producer cooperation is to act as a voice for the beverage industry. It becomes the bridge between government, producers, and importers. This facilitated communication is imperative for long-term success of PRS in Hong Kong. As shown in case studies in the background, success requires producer cooperation and participation. We determined that the formation of a PRO in Hong Kong would make it easier for producers and importers to practice EPR, would organize and simplify communication between beverage industry and government, and would increase the likelihood of engaging producer cooperation.

5.2 Empower the Consumer

Although EPR directly targets producers, consumers must be aware of how they can participate for sustainable waste management to be adopted to the fullest extent. Production is market-driven. Products that experience better sales remain on the market. Having said this, consumers need to be educated about the benefits of buying environmentally friendly products. Preference towards these types of products will force producers to show more responsibility for the waste created by their products.

Education should be provided to inform consumers about recycling, eco-friendly materials, and Hong Kong's landfill crisis. Curriculum is already being introduced to teach children at a young age about the "4 R's": Reduce, Reuse, Recycle, and Responsibility. Children are the future generation of Hong Kong. They are impressionable, so they will more readily adopt newer habits. Television, radio, and other media should be used to educate the older generations. Consumers in Hong Kong already have a tendency to lean towards eco-friendly products, such as biodegradable plastic bags. This tendency simply needs to be spread throughout Hong Kong's population.

A PRO could be the communication bridge between consumers, producers, and other players in product chains. This PRO would be able to unify the opinions of consumers, reinforcing the market-driven approach to EPR. One important regulation that should be enforced by the PRO is the publishing of product information, such as recycling statistics, on product packaging. This puts power in the hands of consumers, allowing them to make more educated choices. It also serves as a way for manufacturers to demonstrate their environmental responsibility to the public. This kind of system is already in use for products such as notebooks that use recycled paper. The percentage of recycled content is clearly printed on the cover of the notebook.

5.3 Stimulate Local Business & Recycling Technology

The financial backing from producers can lead to the formation of new recycling companies (such as the Tim Wai Group) and glass recycling/eco-construction technology. Conversely, limited or withdrawn support from producers reduces the

capital available for recyclers, ultimately leading to bankruptcy or limited growth. One of the greatest difficulties faced by glass recyclers in Hong Kong is the cost of transporting glass. If this cost could be covered in part by producers, it would allow recyclers to greatly expand their intake of glass. Laputa believes it alone could absorb all of Hong Kong's waste glass, should producers provide aid for transportation costs.

An important source of development for recycling technology is academia. As mentioned previously, research at Hong Kong Polytechnic University led to the formation of Laputa Eco-Construction Material Co. Although brought to life with the help of the Tim Wai Group, Laputa is currently an independent and successful business. The products Laputa manufactures target three different waste streams: automobile emissions, construction waste, and glass waste. The company is a thriving testament to the power of university research.

5.4 Maintain Free-Market Ideals

One of the most important constraints we considered was the economic structure in Hong Kong. As the city embraces the 'free-market' philosophy, the government avoids involvement in business affairs. This poses the question of whether legislation would be the correct approach to dealing with beverage producer responsibility. Requirements for recycling could be considered unfair and could even deter producers from distributing in Hong Kong.

EPR regulations must be in line with practices in use on a global level. The system should take into account producer responsibility systems being used in surrounding regions and EU nations, especially. Maintaining economic freedom and

considering global EPR standards will keep producers invested in Hong Kong's market. Although the idea of imposing a PRS is in itself against free-market, it is our goal to minimize government involvement and build means of easy communication between industry and government.

5.5. Maximize Feasibility

Just as any other large city, Hong Kong has certain characteristics that make it unique. The following is a discussion on maximizing the feasibility of a PRS in Hong Kong. Three criteria were identified as key aspects of designing a feasible framework: First, the framework must utilize existing institutions, facilities and recycling practices. Second, limited space in Hong Kong is an issue everywhere, from small convenience stores, to large collection facilities, to apartments. As a result, the space needed for collection points and transfer stations should be minimized. Finally, the framework must maximize convenience for retailers and consumers. Ultimately, producers must collect bottles from consumers and retailers. In order to achieve high recovery rates, it must be easy and convenient for consumers and retailers to recycle. The easier it is to recycle, the more likely a consumer is to contribute.

Part of designing a successful framework for Hong Kong includes utilizing existing waste management facilities, institutions, and systems. Division of goals between the EPD and FEHD has already resulted in complications. The creation of new institutions should be avoided unless it serves to organize operations and/or facilitate communication among members. The more our framework can be built upon existing institutions, the more likely it will thrive.

Secondly, the collection and recycling system should maximize convenience for retailers and consumers. As mentioned in chapter 4, one point of failure of the three-bin system has been the lack of bins in convenient locations. Also, as indicated by the EPD, the last deposit-refund system failed in part to due inconvenience and a non-profitable collection and refund system. In the framework, we propose that producers be responsible to collect their own waste bottles.

The area taken up by collection points should be kept to a minimum. If too much space is required for collection and recycling, it is likely that many will not recycle. This is confirmed by the EPD (see chapter 4). As we will discuss in greater detail in chapter 6, this will be the responsibility of the producers. Because they are responsible for collection methods and are ultimately trying to make a profit, producers will most likely limit the size of collection facilities.

6. Recommendations: Framework

This section describes a framework for a producer responsibility system for glass beverage containers. The parameters in the preceding chapter were used as guidelines for the distribution of responsibilities in the framework. Major points of the framework include:

- a deposit/refund system,
- eco-labeling to empower the consumer and encourage recycling by the producer,
- support of local business and recycling technology research, as well as
- the formation of a producer responsibility organization to assist and organize producers.

We encourage the formation of a producer responsibility organization (PRO) to manage deposits, refunds, collection, recycling, technical support and assistance for all beverage producers and importers in Hong Kong. This body can also act as a strong united voice for producers to communicate and cooperate with the government and municipalities. The PRO should use membership fees and un-refunded deposits to support local recycling business, technology, education and university research. To ensure that production numbers are accurate and companies do not under-report their production, the PRO will be responsible for conducting bi-monthly audits at production facilities. Taiwan fell victim to underreporting and 'free riders', which resulted in inaccurate numbers. More containers were awarded refunds than reportedly existed on the market, and the system went bankrupt. By instituting bi-monthly audits, as in Korea, the framework will be made more resilient to free riders.

Although membership should not be required, the benefits of joining (such as positive publicity) will result in a high percentage of membership. A diagram of the PRO assisted framework is shown below:

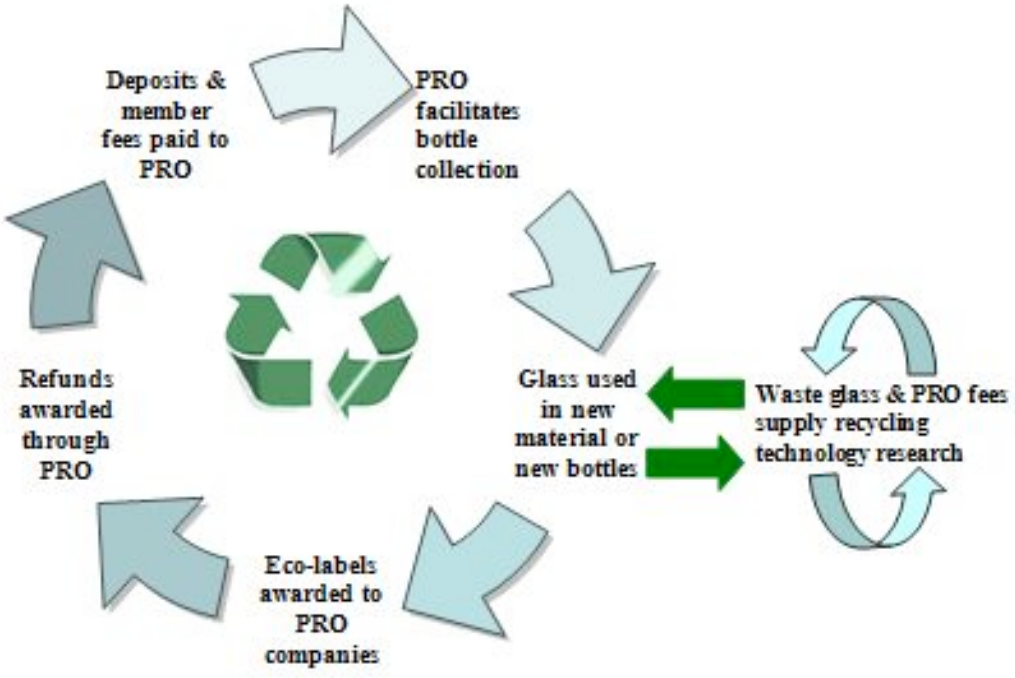


Figure 10. Recommendations for a PRO assisted producer responsibility system.

The framework includes a deposit-refund system. Producers pay according to the tonnage of packaging material used in production, much like the system used in Korea. They are then entitled to a refund depending on percentage of material recovered and recycled. As explained in chapter 2, Korea once implemented a similar deposit-refund system. However, the costs for producers to recover and recycle their waste were greater than the price producers paid for deposits. As a result, producers chose to forfeit their deposits and forego any recycling efforts. To combat this, deposits should be set at a

level that forces producers to recycle in order to receive a refund. Furthermore, the formation of a PRO as suggested above could make it easier for importers to allocate means for collection and recycling in Hong Kong.

Another way to encourage producers to recycle is through the use of eco-labeling. Eco-labeling would be especially useful in Hong Kong because it would utilize the large consumer base. By awarding an eco-label to products that apply for and meet the criteria for an eco-friendly product determined by the PRO, consumers would have the responsibility to support the manufacturers of such products. With an ever-growing educated consumer population and younger generations being more eco-conscious, this strategy could bring sweeping changes to production. Education for schools and communities should be funded through the deposit refund system and PRO membership fees. If the demand for eco-friendly products is strong enough, producers will be forced to meet demand and maintain an environmentally responsible policy. This strategy would bypass any legislation, would be completely market-driven, and would not violate free-market ideals.

The next suggestion for this framework is to fund local business and recycling technology. Uncollected deposits, as well as membership fees collected by the PRO, should be used to support these causes. This is a major staple for the framework because it reinforces the entire producer responsibility system and acts as a fail-safe mechanism. By supporting local recycling technology and business, the efficiency of recycling efforts should increase and the costs for producers should decrease. Second, even if producers do not cooperate in recycling efforts, directing funds at local recycling technology will still have a positive impact on waste beverage container recycling. Laputa Eco-

Construction and the Tim Wai Group contribute towards local recovery of glass containers. However, financial aid from producers could enable larger collection efforts for similar companies and dramatically increase recovery rates in Hong Kong. Universities should be considered for research into recycling technology. The highly successful Laputa Eco-Construction Material Co. and the glass paving block were developed via academic research.

As discussed in the Background section, collection efforts are almost always determined by and implemented by industry around the globe. Instead of specifying collection methods, it has proven more efficient and effective for industry to establish its own systems. Forcing industry to develop its own means of bottle collection also limits the disturbance of the free-market system and encourages innovative new efforts from producers. In this way, producers must determine collection methods that are easy for its retailers to comply with in order maximize collection. By holding producers responsible for collection efforts and making it profitable for them to collect as many waste bottles as possible, new and successful collection methods will arise to better meet the needs of consumers and retailers. It is expected that producers and retailers will work together to develop a convenient collection system that takes up a minimum amount of space.

Many successful examples studied in chapter 2 included the formation of a PRO through which deposits, refunds, eco-labeling are awarded and bi-monthly audits are conducted. The formation of a producer responsibility organization could be especially useful in Hong Kong due to the high percentage of imported beverages. Importers from all over the globe could use the PRO as a way to cooperate with each other and coordinate recovery and recycling efforts.

The framework described above was constructed with the considerations that it must engage producer cooperation, empower the consumers, stimulate local business and recycling technology, maintain Hong Kong's free-market ideals, and maximize feasibility for implementation in Hong Kong. The proposed framework, or any other producer responsibility system designed for Hong Kong with adherence to the same parameters takes into account the political, economic, technological, and socio-cultural characteristics of Hong Kong.

Bibliography

Andela Products, L. (2006). *The Andela Pulverizer System.* Retrieved January 13, 2007, 2007, from http://www.andelaproducts.com/index.html

Binder, C. R., & Mosler, H.(2002). Waste-resource Flows of Short-lived Goods in Households of Santiago de Cuba. [Electronic version]. *Resources, Conservation and Recycling*, In Press, Corrected Proof.

Corral-Verdugo, V. (2003). *Situational and Personal Determinants of Waste Control Practices in Northern Mexico: A study of Reuse and Recycling Behaviors.* [Electronic version]. *Resources, Conservation and Recycling*, *39*(3), 265-281.

Egan, K. (1997). *WasteWi$e Partners Quadruple Waste Reduction in Second Year. Waste Age's Recycling Times,* January 13, 2007. Retrieved 15 Jan 2007, from http://www.epd.gov.hk/epd/english/environmentinhk/waste/prob_solutions/wpp_wastewise.html#ws

Friends of the Earth Hong Kong (2006). *Friends of the Earth Hong Kong homepage*. Retrieved November 1, 2006, from http://www.foe.org.hk

Germany's Packaging Law Too Strict. (2003). *Edie News Center*, January 15, 2007 . Retrieved January 15, 2007, from http://www.edie.net/news/news_story.asp?id=7670&channel=0

Green Power. (2005). *Green power homepage.* Retrieved November 1, 2006, from http://www.greenpower.org.hk

Henstock, M. E. (1975). *The Recycling and Disposal of Solid Waste*. New York: Pergamon Press.

Heron, L., & Chan, Q. (2007, February 11). Greener bags finding their way into more shops. *South China Morning Post*, p. 13.

Howes, R., Skea, J., & Whelan, B. (1997). *Clean & Competitive?: Motivating Environmental Performance in Industry*. London: Earthscan Publications Ltd.

Japan Containers and Packaging Recycling Association. (2006). *Containers and Packaging Recycling Law*. Retrieved December 11, 2006, from http://www.jcpra.or.jp/eng/index.html

Jenkins, R. R., Martinez, S. A., Palmer, K., & Podolsky, M. J. (2003). The Determinants of Household Recycling: A material-specific Analysis of Recycling Program Features and Unit Pricing. [Electronic version]. *Journal of Environmental Economics and Management*, *45*(2), 294-318.

Kasakura, T., Noda, R., & Hashiudo, K. (2004). *Trends in Waste Plastics and Recycling*. *Journal of Material Cycles and Waste Management*, *1*(1), 33-37.

Kim, J.C., Freyberger, J.E., & Beardsley, N.A. (2002). Critical Review of Hong Kong's Construction and Demolition Waste Management Program. Unpublished IQP report, Worcester, MA: WPI.

Laputa Eco-Construction Material Co., Ltd. (2006). *Laputa Eco-Construction Material Co. Homepage*. Retrieved February 2, 2007, from http://www.laputa-eco.com/

Lease, K. (2002). *Asian Countries Jump on the EPR Bandwagon (41st ed.)*. Washington, DC: Institute for Local Self Reliance.

Lee, H. (2003). Drinks Packaging Law Hits Sales in Germany. *Euromonitor Archive*. Retrieved 15 Jan 2007, from http://www.euromonitor.com/Drinks_packaging_law_hits_sales_in_Germany

Leung J., & Lam T.H. (2001). Implementing Ecological Improvement in Hong Kong. Unpublished IQP report. Worcester, MA: WPI.

McDonald, S., & Ball, R. (1998). Public Participation in Plastics Recycling Schemes. [Electronic version]. *Resources, Conservation and Recycling, 22*(3-4), 123-141.

Nemerow, N. (1995). *Zero Pollution for Industry: Waste Minimization through Industrial Complexes*. New York: Wiley.

Okuwaki, A. (2004). Feedstock Recycling of Plastics in Japan. [Electronic version]. *Polymer Degradation and Stability*, *85*(3), 981.

Organisation for Economic Co-operation and Development. (2001). *Extended Producer Responsibility: A Guidance Manual For Governments*. France: OECD Publications.

Recycle Now. (2003). Stats and Facts--Recycling Information. Retrieved December 11, 2006, from http://www.recyclenow.com/facts/interesting_facts/index.html

Staudt, E., & Schroll, M. (2004). The German Packaging Ordinance: The Questionable Effects of a Fragmentary Solid Waste Management Approach. [Electronic version]. *Journal of Material Cycles and Waste Management*. *1*(1), 17-24.

Swire Pacific Limited (2006). *Swire Pacific Limited Homepage*. Retrieved January 17, 2007, from http://www.swirepacific.com/

Tonglet, M., Phillips, P. S., & Bates, M. P. (2004). Determining the Drivers for Householder Pro-environmental Behaviour: Waste Minimisation Compared to Recycling. [Electronic version]. *Resources, Conservation and Recycling*, *42*(1), 27-48.

Waste Prevention World Home. (2004). Don't Make the Holidays "the Haulidays". Retrieved November 1, 2006, from http://www.ciwmb.ca.gov/WPW/Coordinator/Articles/Holidays.htm

Weinberg, A. S., Pellow, D. N., & & Schnaiberg, A. (2000). *Urban Recycling and the Search for Sustainable Community Development*. Princeton, N.J: Princeton University Press.

Wheeler, K., Carter, C., Elizabeth Anne, A., Janelle, C., & Pietroforte, R. (2000). Recycling Post-consumer Plastics in Santa Ana, Costa Rica. Unpublished IQP report. Worcester, MA: WPI.

Wong, M. (2007, January 31). Certificates to increase green awareness by companies. *South China Morning Post*, p. A3.

Wong, T.C., Lu, L.S., & Lin, B.H. (2006). Air Pollution in Asia. Unpublished IQP report, Worcester, MA: WPI.

Appendix A

Sponsor description

Friends of the Earth is a public, non-profit organization. It is an international group with chapters in 70 different countries. Friends of the Earth (FOE) also works with Bluewater Network, and together strive to help develop international environmental awareness. Friends of the Earth was founded in Hong Kong in1983, and it has become one of the most influential environmental organizations in Hong Kong. Friends of the Earth is funded by charitable donations, and most of their staff is comprised of volunteers. Currently it has more than 1000 members, over 140 schools and non-government organization. The mission of Friends of the Earth is to work towards a healthier and just world. Efforts include protecting human and environmental rights, protecting the planet and its disappearing biodiversity and working towards the repayment of ecological debt owed by rich countries to those they have exploited for their own economic benefit.

There are a number of resources available to our sponsor. One of their greatest resources is the physical population of Hong Kong. People of Hong Kong experience pollution throughout their life in part due to the high population density. They are going to be the ones to listen and help out by recycling or assisting FOE in any way they can. Many younger individuals are inspired to work towards a healthier earth, but they do not know what they can do. Friends of the Earth gives these people opportunities and combines their efforts as many individuals into one powerful movement. To acquire money to fuel this movement, FOE accepts donations via their website. Additional funding is acquired by special donations, such as those from celebrities, philanthropists,

and politicians. This funding helps to bring about the desired changes to Hong Kong's waste disposal system.

There are wonderful solutions available in which to recycle material. We see recycled paper every day as Americans, and may not even know it most of the time. Tire rubber and old shoes can be turned into running track or playground surface material. Plastic bottles can be used to make polar fleece, fabrics, and other synthetic clothing and. Metal can be melted down and reused. These are a few of the older recycling technologies. Many new processes are becoming available on a daily basis. Our sponsor has worked to publicize Hong Kong's situation in order to reach the public. Many media are available in Hong Kong, such as television, periodicals, radio, and internet; it is only a matter of cost.

There are many organizations doing similar work as Friends of the Earth; however, there are only two other organizations which have stressed producer responsibility—*Green Power* and *Civic Exchange*. Although all three organizations are working on the same environmental problems of Hong Kong, they rarely work as a partnership. Should the three organizations combine forces they could combine resources and knowledge to have an impact that is greater than the sum of their parts.

INFORMATION NOTE

Landfills in Hong Kong

1. Introduction

1.1 There are 16 landfills in Hong Kong, with 13 closed and three operating to serve the public for final waste disposal. The purpose of this information note is to provide Members of the Panel on Environmental Affairs with background information on the closed and operating landfills in Hong Kong.

2. Closed landfills in Hong Kong

2.1 Hong Kong has 13 closed landfills which were phased out between 1975 and 1996. A summary of these closed landfills is given in Table 1.

Table 1 — Closed landfills in Hong Kong by commission date

Landfill	Location	Area (hectares)	Commission date	Total waste received (million tonnes)	Closure date
Gin Drinkers Bay Landfill	Kwai Tsing District	29	1960	3.5	1979
Ngau Tam Mei Landfill	Yuen Long District	2	1973	0.15	1975
Shuen Wan Landfill	Tai Po District	50	1973	15	1995
Ma Tso Lung Landfill	North District	2	1976	0.2	1979
Ngau Chi Wan Landfill	Wong Tai Sin District	8	1976	0.7	1977
Sai Tso Wan Landfill	Kwun Tong District	9	1978	1.6	1981
Siu Lang Shui Landfill	Tuen Mun District	12	1978	1.2	1983
Tseung Kwan O Stage I Landfill	Sai Kung District	68	1978	15.2	1995
Ma Yau Tong West Landfill	Kwun Tong District	6	1979	0.6	1981
Ma Yau Tong Central Landfill	Kwun Tong District	11	1981	1.0	1986
Pillar Point Valley Landfill	Tuen Mun District	38	1983	13	1996
Jordan Valley Landfill	Kwun Tong District	11	1986	1.5	1990
Tseung Kwan O Stage II/III Landfill	Sai Kung District	42	1988	12.6	1994

Source: Environmental Protection Department.

2.2 All landfills produce landfill gas and leachate as products of refuse decomposition.[1] However, all the closed landfills did not have proper landfill gas and leachate management systems installed at the time when they were in operation. As such, the Environmental Protection Department (EPD) has implemented a restoration programme since 1996 to reduce the potential safety hazards and health risks of the closed landfills on the surrounding areas.[2] The last restoration project was completed in mid-2006. The restored landfill sites are landscaped to provide green zones and can be further developed into various public recreational facilities, such as golf driving ranges and courses, multi-purpose grass pitches, recreational parks and ecological parks. Table 2 summarizes the current and/or planned usage of the restored landfills.

Table 2 — Current/planned usage of restored landfills

Landfill	Commission date	Restoration works period	Planned/current usage(1)
Gin Drinkers Bay Landfill	1960	1999-2000	The site has been designated for Kwai Chung Park development.
Ngau Tam Mei Landfill	1973	1999-2000	General landscaping provided. The whole site at Ngau Tam Mei is zoned "Green Belt". Given the small size of the site with limited access, the Government is of the view that it should remain as local green scenery.
Shuen Wan Landfill	1973	1996-1997	It is currently used as a golf driving range which is a profit-sharing self-financed project. EPD is discussing with a national sports association the feasibility of replacing the driving range by a golf course on a self-financing basis.
Ma Tso Lung Landfill	1976	1999-2000	The site was returned to the Tung Wah Group of Hospitals in August 2000 for recreational use.
Ngau Chi Wan Landfill	1976	1997-1998	The current plan is to develop the site as recreation ground with an archery field, gateball courts, a fitness corner, a children's play area, a 7-a-side soccer pitch, basketball courts, landscaped and sitting out areas, etc.

Note: (1) The above information is based on a paper entitled "Restoration of Northwest New Territories Landfill and Gin Drinkers Bay Landfill – Aftercare Work" issued by the Environment, Transport and Works Bureau in February 2006. In the paper, the Bureau sets out the status of the planned/current usage of the restored landfills as at November 2005.

1 Landfill gas is malodorous and potentially asphyxiating, flammable and explosive, whereas leachate is highly polluting if not properly controlled. Leachate is the liquid produced when water permeates through the waste mass in the landfills.

2 The restoration facilities include (a) landfill gas and leachate management systems, (b) a capping layer (with low permeability) and a surface water drainage system to reduce infiltration of water into the waste mass, and (c) other ancillary engineering works.

Table 2 — Current/planned usage of restored landfills (cont'd)

Landfill	Commission date	Restoration works period	Planned/current usage[1]
Sai Tso Wan Landfill	1978	1997-1998	The recreation facilities, opened to the public since April 2004, include a multi-purpose grass pitch for football and baseball, a children's playing area, a jogging trail and two baseball batting cages.
Siu Lang Shui Landfill	1978	1999-2000	It is part of the Green Belt of the area with the existing green landscaping. EPD is considering suitable afteruse in consultation with relevant departments and interested parties.
Tseung Kwan O Stage I Landfill	1978	1997-1999	The proposed uses of the site include a Football Academy, a golf driving range, and open space including a kite-flying area, a jogging trail and a cycle track.
Ma Yau Tong West Landfill	1979	1997-1998	The Leisure and Cultural Services Department (LCSD) has planned to develop the site as a rest park. EPD will discuss with LCSD on suitable afteruse of the site.
Ma Yau Tong Central Landfill	1981	1997-1998	LCSD has planned to develop the site as part of Lam Tin Park. EPD will discuss with LCSD on suitable afteruse of the site.
Pillar Point Valley Landfill	1983	2004-2006	Information not available.[2]
Jordan Valley Landfill	1986	1997-1998	The current plan is to develop the site as recreation ground with a jogging track, an outdoor fitness station, a children's playground, landscaped features, a radio-controlled motor car circuit, a horticultural education centre, etc. LCSD is carrying out planning work with relevant departments. The Architectural Services Department is designing the layout plans. The construction of the above facilities is scheduled to commence in early 2008 with a view to commissioning them by end-2010.
Tseung Kwan O Stage II/III Landfill	1988	1997-1999	The Hong Kong Air Cadet Corps has been given permission since August 2004 to use the upper platform temporarily as a model aeroplane training field during Saturdays, Sundays and public holidays. Due to the geotechnical constraint of the site, there is no long-term committed use.

Notes: (1) The above information is based on a paper entitled "Restoration of Northwest New Territories Landfills and Gin Drinkers Bay Landfill – Aftercare Work" issued by the Environment, Transport and Works Bureau in February 2006. In the paper, the Bureau set out the status of the planned/current usage of the restored landfills as at November 2005.

(2) The Pillar Point Valley Landfill was the last closed landfill restored by EPD and the restoration work of which was just completed in mid-2006. The site is currently landscaped as a green zone.

Sources: Environment, Transport and Works Bureau and Environmental Protection Department.

3. Operating landfills in Hong Kong

3.1 All municipal solid waste is disposed of at three large landfills in the New Territories, namely the West New Territories Landfill, the South East New Territories Landfill and the North East New Territories Landfill. These three landfills occupy a total land area of 271 hectares, costing HK$6 billion to build and over HK$400 million a year to operate. In addition, they have installed leachate collection and treatment systems, landfill gas management systems, and surface and ground water management systems to control air and water pollution. A summary of these operating landfills is given in Table 3.

Table 3 — Operating landfills in Hong Kong by commission date

Landfill	Location	Area (hectares)	Commission date	Capacity (million cubic metres)	Approximate daily waste intake	Operation life
West New Territories Landfill	Nim Wan, Tuen Mun	110	1993	61	6 356 tonnes	25 years until 2018
South East New Territories Landfill	Tai Chik Sha, Tseung Kwan O	100	1994	43	8 202 tonnes	13 years until 2007
North East New Territories Landfill	Ta Kwu Ling, New Territories	61	1995	35	2 794 tonnes	15 years until 2010

Source: Environmental Protection Department.

Prepared by Michael YU
1 August 2006
Tel: 2869 9695

References

1. Environmental Protection Department. (1989) *Waste Disposal Plan for Hong Kong*. Hong Kong, the Government Printer.

2. *Environmental Protection Department.* (2006) Available from: http://www.epd.gov.hk/epd/ [Accessed 25 July 2006].

3. Environmental Protection Department. (2006a) *Environment Hong Kong 2006.* Available from: http://www.epd.gov.hk/epd/misc/ehk06/eng/text/e00.04.html [Accessed 25 July 2006].

4. Environmental Protection Department. (2006b) *Hong Kong's Environment – Waste*. Available from: http://www.epd.gov.hk/epd/english/environmentinhk/waste/waste_maincontent.html [Accessed 25 July 2006].

5. Environment, Transport and Works Bureau. (2003a) *Restoration of Pillar Point Valley Landfill.* LC Paper No. PWSC(2003-04)29. Available from: http://www.legco.gov.hk/yr02-03/english/fc/pwsc/papers/p03-29e.pdf. [Accessed 25 July 2006].

6. Environment, Transport and Works Bureau. (2003b) *Restoration of Shuen Wan Landfill – Post-completion Environmental Monitoring Work.* LC Paper No. PWSC(2003-04)57. Available from: http://www.legco.gov.hk/yr03-04/english/fc/pwsc/papers/p03-57e.pdf [Accessed 25 July 2006].

7. Environment, Transport and Works Bureau. (2004a) *Restoration of Five Urban Landfills – Post-completion Environmental Monitoring Work.* LC Paper No. CB(1)846/03-04(03). Available from: http://www.legco.gov.hk/yr03-04/english/panels/ea/papers/ea0129cb1-846-3-e.pdf [Accessed 25 July 2006].

8. Environment, Transport and Works Bureau. (2004b) *Restoration of Tseung Kwan O Landfills – Post-completion Environmental Monitoring Work.* LC Paper No. CB(1)79/04-05(03). Available from: http://www.legco.gov.hk/yr04-05/english/panels/ea/papers/ea1025cb1-79-3-e.pdf [Accessed 25 July 2006].

9. Environment, Transport and Works Bureau. (2006) *Restoration of Northwest New Territories Landfills and Gin Drinkers Bay Landfill – Aftercare Work.* LC Paper No. PWSC(2005-06)46. Available from: http://www.legco.gov.hk/yr05-06/english/fc/pwsc/papers/p05-46e.pdf [Accessed 25 July 2006].

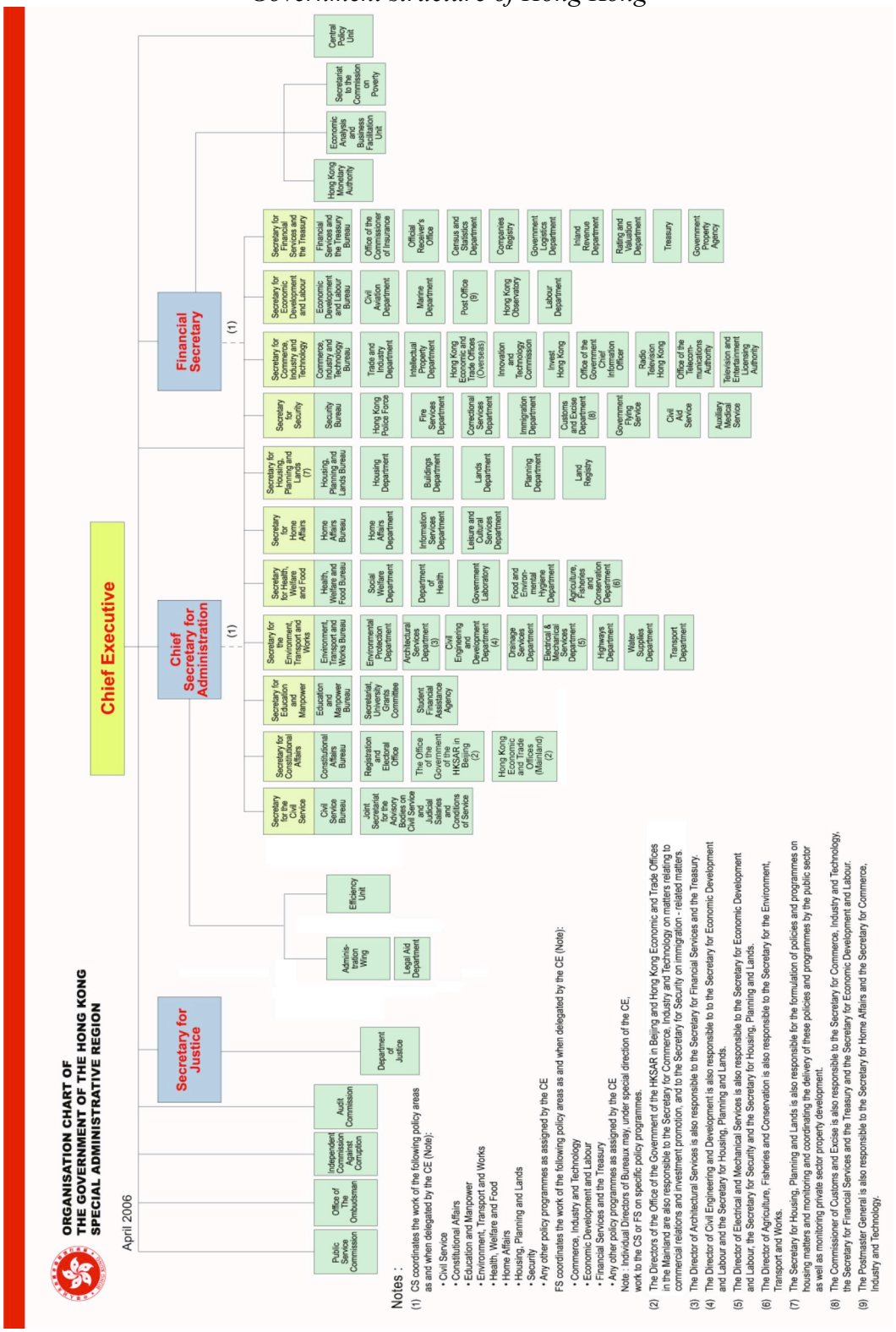
10. Hong Kong Special Administrative Region Government. (2004) *Press Release: Contract Signing for Pillar Point Valley Landfill Restoration.* Available from: http://www.info.gov.hk/gia/general/200410/14/1014129.htm [Accessed 25 July 2006].

11. Hong Kong Special Administrative Region Government. (2006a) *Hong Kong: The Facts – Environmental Protection.* Available from: http://www.info.gov.hk/hkfacts/enviprot.pdf [Accessed 25 July 2006].

12. Hong Kong Special Administrative Region Government. (2006b) *Hong Kong Yearbook 2005.* Hong Kong, Government Logistics Department.

Appendix C

Government structure of Hong Kong



Appendix D

Global producer responsibility systems

Country	Techniques Used	Advantages and Disadvantages
Taiwan	Deposit-Refund System	• **Recycling rates very high** • **Free riders**
	Mandatory Take Back	• **Targets large importers** • **Provides cash back** • **Bi-monthly reviews**
	Eco-labeling	• **Encourages use of green products** • **Consumers must use green products**
Japan	Extensive Separation Collection System	• **Increased amount of recycling** • **Costly** • **Time consuming** • **Space consuming**
Korea	Deposit-Refund System	• **Stress on producers** • **Poor producer cooperation** • **Many free-riders**
	Disposable Goods Restrictions	• **Limits disposable goods** • **Does not include EPR (simply switch materials)**
	Eco-labeling	• **Encourages use of green products** • **Consumers must use green products**
Germany	Beverage Producer Law	• **Promotes refillable bottles** • **Targets were not met**
	Deposit-Refund System	• **Increased recycling habits** • **Many companies turned to plastic containers**

Appendix E

Restaurant/Bar Information

Restaurant/Bar Information

Restaurant Name: ____Café O_____
Restaurant Location: __Queen's Rd, Central___

1. **Knowledge of landfill situation?**

   Had a vague knowledge of the landfill situation in HK

2. **Rate of bottle consumption per day?**

   Unknown

3. **Disposal Method for the used bottles?**

   Bottles are thrown away

4. **Ability to separate bottles for collection during business?**

   Feels that bottle collection would be a good system

5. **Feeling about government disposal law**

   Agrees with the "producer pays" concept, would follow the law

6. **Opinion on public awareness**

   Unknown

7. **Personal recycling habits**

   Lives in an apartment, where there are no recycling bins or collection centers nearby. She does not recycle.

Note:

This was the first establishment in the area willing to provide information. The woman interviewed did not speak the best English, but she was able to understand the questions.

Restaurant/Bar Information

Restaurant Name: ____Mangrove_____
Restaurant Location: ___Queen's Rd, Central_____

1. **Knowledge of landfill situation?**
   Unknown

2. **Rate of bottle consumption per day?**
   Under 50 glass bottles per day are consumes, most drinks are draft

3. **Disposal Method for the used bottles?**
   Bottles are thrown away. There are no disposal fees associated with this.

4. **Ability to separate bottles for collection during business?**
   Said that he would gladly participate in a deposit/refund system. He agrees with the idea of government-sponsored collection company

5. **Feeling about government disposal law**
   Demonstrated concern when government disposal laws are mentioned

6. **Opinion on public awareness**
   Feels that the government should provide more education or information to the public about the landfill situation. He believes that people do not care about recycling. They won't use recycling bins unless there's some sort of legislation to promote it

7. **Personal recycling habits**
   Lives in a house, but there is no curbside collection. He may be interested in recycling if household disposal fees were initiated.

Note: Manager was busy when first addressed but actually made an appointment to talk later in the day. Was very helpful to the cause and interested in participating in the Wastewi$e program.

Restaurant/Bar Information

Restaurant Name: ____ The Bridge_____
Restaurant Location: __ Wan Chai_____

1. **Knowledge of landfill situation?**
   No knowledge at all

2. **Rate of bottle consumption per day?**
   4 cases per day (24 bottles per case)

3. **Disposal Method for the used bottles?**
   Bottles thrown away, collector separates; "responsibility" is just to throw bottles in the trash

4. **Ability to separate bottles for collection during business?**
   Separation would not be too much work for bars. Collection might prevent people from going through the trash, looking for valuable material. Collection company is a good idea.

5. **Feeling about government disposal law**
   Willing to cooperate with government law

6. **Opinion on public awareness**
   Unknown

7. **Personal recycling habits**
   Unknown

Note: Difficult to communicate because the manager's native language was Thai. She believed at first that we wanted to know about the bar operations, rather than recycling. This confusion prevented us from asking too many questions.

Restaurant/Bar Information

Restaurant Name: _____Mes Amis_____
Restaurant Location: __Wan Chai_____

1. **Knowledge of landfill situation?**
   Had no idea of the landfill situation, but agreed that the government should make more of an effort to inform people

2. **Rate of bottle consumption per day?**
   Weekdays: 10 bottles of wine, 5 cases of beer per day
   Weekends: 10 cases of wine, 15-20 cases of beer per day

3. **Disposal Method for the used bottles?**
   Bottles thrown away; no disposal fees

4. **Ability to separate bottles for collection during business?**
   Agrees with the idea of collection of recyclables. Would not warrant too much effort on the part of the bar.

5. **Feeling about government disposal law**
   Unknown

6. **Opinion on public awareness**
   Feels that people need to be educated

7. **Personal recycling habits**
   Unknown

Note: Again, we were somewhat limited in communication because the bartender did not speak Cantonese and spoke poor English.

Restaurant/Bar Information

Restaurant Name: ___Carnegie's_____
Restaurant Location: __Wan Chai_____

1. **Knowledge of landfill situation?**
   Unknown

2. **Rate of bottle consumption per day?**
   100 bottles per day; sometimes up to 500 per day during weekend promotions

3. **Disposal Method for the used bottles?**
   Bottles are thrown away; no charge for disposal, but contractor hired to remove garbage.

4. **Ability to separate bottles for collection during business?**
   Not enough time for separation of recyclables, even if a simple bin collection system is used

5. **Feeling about government disposal law**
   Will follow the law the government creates. No real oppositions to disposal fees. Cancelled previous opposition to recycling.

6. **Opinion on public awareness**
   Unknown

7. **Personal recycling habits**
   Unknown

Note: Another situation in which poor English was the best available form of communication. Bartender was rather concerned about wasting time. Her attitude change about recycling was definitely noticeable when the idea of government legislation was introduced.

Restaurant/Bar Information

Restaurant Name: ___Devil's Advocate___
Restaurant Location: __Wan Chai_____

1. **Knowledge of landfill situation?**
   Immediately knew about the landfill situation, claimed not to know exact figures, but she understood that the situation is desperate

2. **Rate of bottle consumption per day?**
   15-20 cases of beer per week easily (24 bottles per case)

3. **Disposal Method for the used bottles?**
   Bottles are throw away; no recycling. Building manager responsible for waste disposal

4. **Ability to separate bottles for collection during business?**
   No room for collection bins in main bar area. Very little time available to dedicate to separation.

5. **Feeling about government disposal law**
   Unknown

6. **Opinion on public awareness**
   Feels that very little people know about recycling or the landfill situation. Believes that education of the people will help recycling rates. Stressed that fact that convenience and awareness are the two key issues to be targeted.

7. **Personal recycling habits**
   Uses recycling bins in her apartment building occasionally. Tries to do her part.

Note: Bar seemed to cater to an international crowd. The manager was a white British woman, which offered a different perspective. Communication was easy for Martin and me, so we were able to get good information. She referred us to the building manager, should we need more information.

Restaurant/Bar Information

Restaurant Name: ____Unknown_____
Restaurant Location: __Wan Chai_____

1. **Knowledge of landfill situation?**
   Had "no idea" about the landfill situation. Otherwise seemed to be an educated individual

2. **Rate of bottle consumption per day?**
   Normal day: 6 cases (24 bottles per case)
   Wednesday, Friday, and Saturday: 15-20 cases

3. **Disposal Method for the used bottles?**
   Bottles are thrown away and collected by a contractor. Need to pay extra for garbage collector.

4. **Ability to separate bottles for collection during business?**
   Not too difficult to separate recyclables. Most of the waste is glass, and only a small percentage is plastic. Recycling collection bin are a good idea

5. **Feeling about government disposal law**
   Opposed to the idea of disposal charges. However, believes that passing a law is the only way to make people care. If rules are made, people will follow

6. **Opinion on public awareness**
   Feels that people are not educated about recycling as children. They need to be educated.

7. **Personal recycling habits**
   Does do some recycling. Uses bins, especially for magazines. However, feels that they are now very inconvenient. He does not want to have to wash things before recycling them, and is annoyed by the fact that the openings to the bins are too small. Emphasizes convenience over and over. He feels that a better recycling bin design would help

Note: The manager was rather aggressive in his views. Seemed to have low confidence in the government.

Appendix F

Focus Group with HKU students

Date: 19 January, 2007
Time: 11:00 am
Location: Friends of the Earth headquarters
Attendees: WPI team and five university students from Hong Kong
Moderators: Martin and Nate
Secretaries: Michelle and Tim

Introduction
MODERATOR: "Hello to everyone, and thank you for volunteering for this focus group. Our topic today is glass bottle and container recycling in Hong Kong. We are going to begin by passing out a simple questionnaire. Then, we will ask you a few questions. Following the question-and-answer session, we will provide some time for discussion. Feel free to express your opinion and provide responses. Remember that there is no right or wrong answer. We are all here to learn from one another. With that said, let's get started."

Discussion
NOTE: Background information provided by the interviewers when necessary.

- **What do you know about the landfill situation?**
  - For the most part the students felt that people do not know much, other than the general idea of not much space.
  - One knew there are 3 landfills in Hong Kong and cited that there are only 8 years left until they are completely full.
  - The point was brought up that construction creates a lot of waste.

- **Should the government do anything to help? What?**
  - Two years ago, a document was published on how to manage waste over next 10 years (WRFP).
  - Maybe the government could make use of incineration, but that would create more air pollution. Also, there is little room for incinerators.
  - Most people do not want to find more/new room for landfills.
  - Hong Kong people do not always follow laws.
    - Laws will not be effective if they are difficult to physically enforce.
    - Hong Kong is anti-government.
    - The media probably wouldn't help.
      - The media in Hong Kong likes to stir up the people with sensationalism, causing them to rebel against the government

        - Most elected officials do not make changes when in office, because they are afraid of doing something to make a bad name for themselves
            - They would rather do nothing than cause problems.

- **How do you feel about the great amounts of waste being shipped to Mainland China?**
    - One student did not care because he dislikes mainland China.
    - Exporting could be a good solution.
    - The company for waste treatment needs to do a better job.
    - Maybe waste could be dumped into the ocean.
    - Hong Kong labor is very expensive, but in mainland China it is cheap.
    - People should do whatever they need to do to manage their own waste.
    - Maybe Hong Kong could have a partnership with mainland China.
    - Current system is only an end-of-the-pipe solution.
        - Producers should use less material.
        - There is need for a long term solution.
        - People must be educated for efforts to be effective.
            - Education needs to come first
                - Through media/school
                - May take awhile to get through to people
                - One student brought up the idea that people could be educated to buy more environmentally friendly products. This would force producers to shift their efforts to developing more of these types of products.
    - The government could try using Taiwan as an example.
        - They take recycling very seriously.

- **What kind of materials are the beverages you buy?**
    - The students explained that they buy drinks in tetra pak and plastic containers, for the most part.

- **Do you recycle these containers?**
    - Occasionally.
        - Most of the students explained that they did not recycle much when on the streets because recycling bins are too far apart.
            - Not convenient
        - One student carries empty drink containers with him (while on the street) until he can find a place to recycle them.
            - Always recycles
        - Some of the students like to use reusable bottles (e.g. Nalgene).
        - One student went away and recycled while out of China, but upon return gave up because it is not practiced here nearly as much as it is where she was.

- **How could recycling be made easier for you at home?**
  - One method could be to put bins on every floor, if there is enough room.
    - Maybe every other floor
  - A student commented that the government suggests that new buildings consider space for recycling bins.

- **What if a system like the one in Japan was implemented in Hong Kong? (Each day, different materials are collected)**
  - This would probably be very inconvenient.
  - Storage would be a problem.
  - The climate is not appropriate.

- **What if you had to pay to dispose of your waste?**
  - This would probably help to make people recycle more.
  - The idea may work in theory, but still requires space for bins.
  - It may be very impractical.
  - People will probably put trash in recycling bins to save money.

- **Have you used the refund system?**
  - Some students claimed to have used it with milk bottles.
  - Glass is usually returned, as drinks bottled in this type of container are finished in the store and returned right away.
  - The students were somewhat surprised that restaurants just throw away their glass bottles at the end of the night.
    - They assumed there would be some recycling going on.

- **Would you try to store your recyclables if you could get money back for them?**
  - Yes, if it were made more convenient to return them.
  - There would need to be more places to return, such as supermarkets and convenience stores.
  - A deposit of $.50 would be appropriate.
  - This still might be difficult because of space limitations.

Appendix G

Focus Group with HK University Students: Survey Responses

Student 1
Please fill out each line accordingly. All of the information you provide will be kept confidential.

1. In what area of Hong Kong do you live?

   Wan Chai.
2. What kind of home do you live in (e.g. apartment, house, dormitory)?

   Apartment.
3. Have you been taught to recycle in school?

   Yes.
4. Where did you grow up? Hong Kong, China, or other places?

   Hong Kong / London.

Student 2
Please fill out each line accordingly. All of the information you provide will be kept confidential.

5. In what area of Hong Kong do you live?

   Kowloon, Hung Hom.
6. What kind of home do you live in (e.g. apartment, house, dormitory)?

   Private apartment.
7. Have you been taught to recycle in school?

   Primary: a little; secondary: a little; university: none.
8. Where did you grow up? Hong Kong, China, or other places?

   Mainly HK and 3 years in Canada when I was young.

Student 3
Please fill out each line accordingly. All of the information you provide will be kept confidential.

9. In what area of Hong Kong do you live?

   Kennedy Town.

10. What kind of home do you live in (e.g. apartment, house, dormitory)?

    Private housing.

11. Have you been taught to recycle in school?

    Secondary school.

12. Where did you grow up? Hong Kong, China, or other places?

    Hong Kong.

Student 4
Please fill out each line accordingly. All of the information you provide will be kept confidential.

13. In what area of Hong Kong do you live?

    Kowloon, public housing area.

14. What kind of home do you live in (e.g. apartment, house, dormitory)?

    Apartment.

15. Have you been taught to recycle in school?

    Primary school: No; secondary school: Yes, some campaigns; University: Yes.

16. Where did you grow up? Hong Kong, China, or other places?

    Hong Kong.

Student 5
Please fill out each line accordingly. All of the information you provide will be kept confidential.

17. In what area of Hong Kong do you live?

    Southern District.

18. What kind of home do you live in (e.g. apartment, house, dormitory)?

    Apartment.

19. Have you been taught to recycle in school?

    Yes, but very little knowledge in primary education. Secondary school: Nil; University: Nil.

20. Where did you grow up? Hong Kong, China, or other places?

    HK.

Appendix H

Interview with Tim Lo of the Tim Wai Group

Date: 17 January, 2007
Time: 3:00 pm
Location: Fanling, N.T.
Attendees: Tim Lucida Lo and the WPI team

---

1. Give us some background about the Tim Wai Group.

   Mr. Lo's initial business was designing recycling bins. After this, he became a collector of recyclable material. Now, he promotes green energy.

   Mr. Lo and Dr. C.S. Poon of HKPU worked together to develop 'glass bricks', which are bricks with an additive of glass shards. These shards help to absorb 40% more the emissions of cars and other pollution than regular bricks. TW provided 300 kg of glass to HKPU for the research.

---

2. What are the difficulties of recycling glass in Hong Kong?
   a. Is transportation costly?
   b. Does the government provide aid?

   The downside of the glass bottle recycling/reprocessing industry is that it takes a great deal of effort to clean bottles. Additionally, there is no government aid or support. The FEHD claims that the government will not back glass recycling because of expenses. The government simply wants consumers to purchase less glass.

   Monthly rent for the land used by TW is approximately HK$50,000. Collection, cleaning, and transportation of glass bottles costs around HK$1200/ton, while the return on each ton is only about HK$300. Mr. Lo was unable to say which part of the business is the most expensive.

   TW is also limited by the rate at which it can process glass. A company called Glass Aggregate Systems manufactures sorting/label-removing/cap-removing machines to break down bottles into very small pieces. However, the volume limitation on these machines is 2 tons/day, which is not enough for TW to justify buying the machines. There are better, higher-volume machines available from Japan, but this costs quite a bit more money.

---

3. Has Tim Wai been part of any pilot schemes or producer responsibility systems?

The EPD gave TW an award of tender for glass bottle collection in Lan Kwai Fong and Soho for the study of 'glassphalt' and 'glass bricks'. However, the cost of making these bricks has increased by 20%, so there is no current market for them.

The company has permission (contracts) to collect and reprocess ExxonMobil products of various types. This corporation hires TW to process 110 tons of waste material each year.

Another contract TW had was to destroy and recycle confidential documents produced by a major toy manufacturer.

TW's profits come mostly from contracts. In 2005, TW began a contract with a baby bottle supplier to deal with waste bottles. Currently, the company has contracts with 4 baby bottle suppliers, and these keep getting renewed annually. The contracts allow Tim Wai to collect the waste bottles from hospitals. TW has contracts with a few other suppliers as well.

---

4. Where does TW get its material?

   99% of Tim Wai's material comes from hospitals in the form of glass baby bottles. Only 1% arises from other sources. Some of this other material is from bars and restaurants that pay for the glass to be processed, while some is from households. Tim Wai does not charge for the removal of household recyclables.

   The company also uses tetra pak containers to make stationery and other products. TW is exploring the process of recycling electronics.

---

5. Would Tim Wai consider moving into the government-sponsored EcoPark in Tuen Muen?

   The government eco-industrial park has very high tenancy requirements. It requires an initial investment of HK$6 million, and there are requirements for the amount of material that needs to be processed each year.

---

6. Why have other countries been successful with PRS?
   a. What can Hong Kong learn from this?

   There is a balance between the government and producers. The two cooperate and share responsibility.

Mr. Lo feels that producer responsibility has been slow to develop in HK because of a lack of enforcement. The Hong Kong government is very closed-minded, and laws for producer regulations are very outdated. Some of these laws date back to the 1970s.

---

7. Is there a sufficient market for recycled glass in Hong Kong?
    a. Is there a market in surrounding areas?

One glass bottle company in Mainland China pays HK$240-260 per ton of recycled bottles depends on the color of the glass. Colorless is more expensive than colored. The bottles are cleaned, broken down into pieces, and shipped. This particular company asks for 80,000 tons of glass per year. This is only 1 company, and there are approximately 2300 bottle manufacturers in Mainland China.

Approximately 120,000 tons of glass are thrown away in Hong Kong each year, while only 2,000 tons are recycled, according to 2006 figures.

Appendix I

Interview with Swire Coca-Cola Hong Kong

Location: Swire Coca-Cola headquarters, Sha Tin, N.T.
Time: 9:30am-12:00pm
Attendees: Felix Choi and the WPI team

---

1. How does the cost of using glass bottles in production compare to using other materials?
    a. Are glass bottles considered more environmentally friendly because of their ability to be reused infinitely?
    b. What are the costs associated with transporting and reprocessing drink containers?
    c. What dictates material selection for Coca-Cola's drink containers?

- Manufacturing products in glass bottles is more costly than using PET bottles.
- Reusing glass bottles is also more expensive and labor-intensive. They have to be checked numerous times for imperfections. Bottles that do not pass checkpoints are set aside and donated to Laputa Eco-Construction Material Co.
    - It takes between 4 and 5 bottles of water to properly clean glass bottles. Washing stages slowly heat the bottles (put energy in) and then cool them down (remove energy).
    - Using life cycle analysis, the environmental friendliness of glass and PET bottles is about the same.
- It is cheaper to produce drinks in PET containers. Less labor, water, and resources are required. Bottles are produced from small vials that are expanded.
- The reason that Coke is still produced in glass bottles is because of its market value. Consumers often prefer Coke in a glass bottle because of aesthetics and taste. Also, Coke producers in other neighboring countries do not have Coke in glass.
- Furthermore, the machinery used to deal with the production of the glass-contained Coca-Cola has no value. It is outdated. Changing the production line would mean costs for new equipment.
- Many products can be produced from recycled tetra pak containers, but the market for these products is very limited. Costs of using this material are slightly higher.
- Vitasoy introduced the 'one-way' glass bottle.
- Container material selection is market- and purpose- driven. Carbonated beverages cannot be put into tetra pak containers. At stadiums, outside soft drinks are not allowed (in glass bottles) because they can be used as weapons. Thus, materials must be chosen to reflect the needs of the target market and the properties of the container.

---

2. How many of Coca-Cola's glass beverage containers reach the market each year?
    a. How does this number compare to the amount of plastic and aluminum containers being produced?

- Less than 10% of coke's bottles are refillable glass bottles. Nevertheless, Coke will continue to supply glass bottles.
- Beverage containers account for about 2% of municipal solid waste, while packaging material accounts for about 30% of MSW.
    - It is not efficient to have many different systems for EPR targeting small percentages of MSW.

---

3. Would Coca-Cola consider a return system for its bottles, due to the landfill situation in Hong Kong?

- A high percentage of Coke in glass bottles returns to the factory. This is because of the deposit-refund system for these bottles. The refund is $1/bottle. Coke has an arrangement with retailers to pick up used containers when replacing supplies. Retailers pay a deposit to Coke, and are able to refund consumers directly for returned empty bottles.

---

4. We understand that Coca-Cola operates a recycling program in a number of residential areas around Hong Kong. Is the company considering extending or broadening this program?

- Coca-Cola is beginning a pilot program to implement collection ("reverse vending") machines for PET bottles.
    - Machines hold up to 500 bottles each. There are two versions: standard and extended (larger).
    - 12 machines will be introduced this month, with a total of 60 machines being put into service. They will be installed in shopping areas, schools, housing estates, and supermarkets with available space.
    - Machines will accept any labeled PET bottle. However, bottles without a label will be rejected.
    - Consumers receive a reward for each returned Coca-Cola product. They can choose to collect the reward via octopus card or defer the reward and donate it toward Coke's environmental program. No reward is received for non-Coke products, but bottles are still accepted.
    - The pilot scheme is expensive. However, information gathered from the pilot program will be shared with the EPD after its introduction.

---

5. What dictates Coca-Cola's concept of a responsible producer and what is it doing to fulfill that role?

- ISO 9001
    - producer actions/operations need to mirror written programs
    - what is written is what needs to be done, and vise-versa
    - good documentation standard
- ISO 14001
    - activity, aspect, and impact
    - all environmental aspects and impacts need to be identified
    - legislation related to activities needs to be identified
    - improvement goals need to be set
- Swire's environmental policy dictates what Coca-Cola's EPR should be. Coca-cola's standards are often stricter than government standards (e.g. waste water).
- Coca-Cola provides various educational resources and events for children to learn about the 4R principle.
- All recyclable waste material produced by Coca-Cola is sold to waste collectors. For example, tetra pak containers are donated to paper mills.

---

6. Why has EPR been so slow to develop in Hong Kong?
    a. What are the barriers for this process?

- The idea of EPR is to transfer costs from the government to producers, and then from producers to consumers.
- Technology is a major barrier for recycling. Currently, companies can only generate low technology products. Recycling also involves significant capital investments.
- Incineration is in fact safe. Present technology can control the pollution/emissions. The temperature is the main thing that needs to be controlled.
- Few producers are joining in with EPR systems. Right now, most of the costs are being absorbed by these few producers (like Coca-Cola).
- It takes a very long time to introduce legislation. Proposals must be read. Then, an analysis is conducted and the best solution is chosen and developed. The idea is brought up to a legislative council. Finally, the idea is implemented.
    - There must be a transition period (maybe 1 or 2 years) for producers to adjust to the new system.
    - EPR for beverage producers will finally be enforced in 2008.
- Regulations are needed to get other producers to join in the "reverse vending machine" operation. Otherwise, money will continue to be lost by Coke.

---

7. Should Hong Kong adopt legislation to enforce EPR?

- Legislation is not always the most effective way to implement EPR.
    - Producer responsibility organizations (PROs) can lobby and liaise with the government. They are financed by producers.

    - Extensive education of the people is also important.
    - Convenience needs to be considered.
- Austria uses a PRO without a deposit-refund system.
- Norway uses a deposit-refund system.
- PRO empowerment is the key to handle imported products. This will give the government the power to remove non-compliant products from the shelves of supermarkets. The organization will be able to conduct audits.
- A deposit-refund system needs some sort of accounting system needed to keep track of free riders. Imported beverages must be tracked.

Summary

- Government needs to set a level playing field for all producers
    - Audits need to be conducted to ensure compliance
    - Freeriders need to be eliminated from the system
    - More producers need to join the effort
- Consumers drive production; education and awareness is needed for long-term success
- Material selection for containers is dependent upon the market
- The best way to ensure eco-friendliness in HK is to make it profitable
- When constructing an EPR system, there are many factors in need of consideration
    - The more all-inclusive an EPR system is, the more efficient and effective it will be
    - Costs must be considered
    - Consumer compliance is important
- PRO need legislation to be empowered

Appendix J

Interview with the Food and Environmental Hygiene Dept.

Location: Food and Environmental Hygiene Department (FEHD) office, Admiralty
Time: 2:30 pm
Attendees: FEHD officers (SIN Kwok-hau, YEUNG, LAM Kang-fuk, YU Man-fung) and the WPI team (Michelle Ladouceur, Martin Tsoi, Tim Ebner, Nathaniel Rosso)
Chair: Tim Ebner
Secretary: Nathaniel Rosso

"I am the keyboard. They are the CPU." – K. H. Sin, in reference to himself and his associates, respectively

- Tim – Gave intro to our project and goal. Explained our understanding that the FEHD is not responsible for producer responsibility (PR), in response to a clarification made by Sin.
- Sin – Overall waste reduction (WR) is managed by the Environmental Protection Department (EPD).
    - The Waste Reduction Framework Plan (WRFP) is outdated.
    - The FEHD supports the "4R" principle and is responsible for street cleansing and waste collection.
    - The waste transport bureau dictates what the department does.
    - EPD manages refuse transfer stations and the final disposal of waste.
    - All departments, however, work with the EPD under the WRFP.
    - The FEHD's role changed in 2000 with the centralization of district management. There was a reorganization of the department.
    - *In response to our first question:* Yes. Waste collection strategies between political districts are more or less the same.
    - Final disposal is carried out by the EPD
- Martin – But is waste managed differently from region to region?
- Sin – The only difference is transportation. Landfills are strategically placed, however.
    - *In response to questions:* There is no source separation being carried out by the FEHD other than pilot programs.
    - The waste separation is "far from satisfactory" in Hong Kong. This may be due to the background of the Chinese people. There is also a lack of space available for sorting and storage, both privately and in refuse collection points (RCPs).
    - The EPD may try to introduce waste sorting to refuse transfer stations (RTSs).
- Nate – So the responsibility would be on consumers to sort waste?
- Sin – Yes. The amount of waste at RTSs should decrease with the introduction of source separation.
    - Current contractors are not currently required to provide sorting facilities.

- Tim – What percentage of waste collection is private?
- Sin – The FEHD has the responsibility to collect waste unless they cannot access waste collection areas (of housing estates, etc.).
- Tim – Is there a polystyrene separation program being carried out by the FEHD?
- Sin – Yes, but its scope and effectiveness are limited. There are 7 or 8 RCPs under that pilot scheme. It has been running for nearly 2 years, since 2005. Our staff are asked to set aside polystyrene for collection by FoE contractors. The program will continue for another 12 months. Then, it will be reviewed and analyzed for effectiveness.
- Nate – Any other separation pilot programs going on?
- Sin – There are programs to separate waste paper, rubber, plastic, and metal at certain RCPs.
    - However, the RCPs are designed for temporary storage. It is not easy to separate material from waste there because the facilities are too small and because of the warm and humid Hong Kong climate. Waste separation should be carried out "at the source".
- Tim – Do the separation programs result in a change in efficiency of FEHD operations?
- Lam – Most RCPs are very small and must store large quantities of waste. There is a lack of adequate space for cleansing/sorting equipment. This limits the scope of separation pilot schemes. Also, there is a lack of 'manpower'.
- Sin – There could even be illegal "money transactions" taking place between FEHD workers and collectors over valuable material at the RCPs.
- Tim – How does collection differ between busy and more residential areas?
- Sin – We do not provide service for commercial centers. Commercial waste is not allowed in RCPs.
    - When setting up RCPs, the main factor considered is the density of residential buildings in the area.
- Nate – So commercial centers hire private contractors?
- Sin – Yes, they must make their own arrangements.
- Martin – Does the FEHD contract private waste collectors?
- Sin – Outsourcing for waste collection is over 60%.
- Martin – Is this the same in each district?
- Sin – It varies. The posts of retiring workers are left vacant when they leave FEHD employment. These posts are then outsourced.
- Tim – What is the period of contracts with private collectors?
- Sin – Normally 2 years. Some up to 5 years.
- Tim – What is the cooperation/communication between the EPD and FEHD?
- Sin – We are each doing our own jobs. The only interaction is when the EPD approaches us with pilot schemes. It is difficult because of the core differences between the departments.
    - The EPD has a lot of pressure to introduce WR.
    - The FEHD has its own responsibilities that come before WR. This can mean that the department is sometimes unable to cooperate with the EPD.
- Sin – A possible pilot scheme will target the separation of used tires from waste. There are a number of depots selected to carry this out.

    - However, there are site constraints. For example, there is insufficient space for parking vehicles.
    - The EPD may want to consider changing its plan.
    - This will probably not happen in the near future.
- Sin – A waste disposal charging scheme may be introduced this year. There is a possibility of using plastic bags that must be paid for in order to dispose of waste.
    - A major concern with this is illegal dumping.

Appendix K

E-mail Response from the Environmental Protection Department

---

1. Besides recycling, what else is being done to deal with the limited landfill space given their expected lifespan?
   (a) Is the EPD considering any new processing techniques to recycle glass?
   (b) Is the EPD considering any new applications for the use of recycled glass?

   EPD commissioned the Hong Kong Polytechnic University (HKPU) and Hong Kong University of Science and Technology (HKUST) a few years ago to carry out studies on the applications of waste glass in construction and other related uses (e.g. waste glass to make pavement blocks / bricks and "glassphalt" for road surface). The two studies have been completed and concluded that these products / applications were technically feasible. It was encouraging to note that the HKPU's research team subsequently established a new enterprise in 2005 to manufacture and launch the (recycled glass) pavement blocks to the commercial market.

---

2. What is the discussion on a deposit-refund system or other recycling method for glass containers? What are some difficulties in implementation of the deposit refund system for glass and other beverage containers?

   In the past, there used to be extensive and vibrant local "deposit-and-return" systems at the retail level to recover glass bottles and return them to the local bottling plants for re-filling. Over the years, the retailing network for drinks and beverage in Hong Kong has undergone some significant changes that the groceries serving as the "bottle-banks" to support the "deposit-and-return" system have vanished on a large scale. Due to the increasing rent, the new retailing ends are highly compact and "space-conscious" and have lost interest to set up and operate "bottle-banks" that are not directly profit-making. When the quantity of glass bottles circulated in a "deposit-and-return" system drops below a certain level, it will no longer be cost-effective to operate. The situation is made worse when more local beverage manufacturers move their bottling plants out of Hong Kong. It was not economical to transport the glass bottles over a very long distance for refill / reuse. This explains why the majority of local beverage manufacturers and beverage importers are unwilling to implement a "deposit-and-return" recovery system.

---

3. How has/might the EPD utilize the large population of HK?

This question is not clear. Under various waste recycling programmes such as "Source Separation of Domestic Waste", Rechargeable Battery Recycling Programme, "WEEE recycling days" etc, EPD is able to obtain wide support from the communities and companies in providing free collection points at their place. Thus our collection network is efficient and cost effective. However, glass bottles are not included in the collection list under these programmes because of its fragility.

---

4. The "main-vein" of the 2005 Framework for municipal solid waste management is to stress polluter pays and producers responsibility schemes. Because almost all beverages in HK are imported how will the EPD affect those companies outside of HK? Framework sets the packaging and beverage PRS for 2008.

   PRS is a key measure which enshrines the "polluter-pays" principle in the Policy Framework for the management of municipal solid waste and beverage container is one of the specific products to be covered by PRS. Under PRS, a host of stakeholders, who can be manufacturers, importers, distributors, retailers and consumers, shall share the responsibility for the collection, recycling, treatment and disposal of end-of-life products.

   Hong Kong, like many other metropolitan cities, is not a major manufacturing base and has a lot of its consumer products imported. We will take account of this factor when we develop the PRS on beverage containers, which could effect the sharing of responsibility between the stakeholders, through take-back/recycling obligation, financial incentive or other means.

---

5. The Government will explore various options for implementing the mandatory PRSs. What are these? Director of Environmental Protection (DEP) is the enforcement authority to ensure compliance with the product-specific regulations. What powers will be given to the DEP?

   In general, PRS may involve one or several of the following core elements:

   Product take-back;
   Deposit-refund system;
   Advanced recycling fee; and
   Product tax or levy

   The core elements above can be used either individually or in combination. We will make reference to the overseas experience and take account of the local situation when developing PRS for individual product.

   We plan to submit the Product Eco-responsibility Bill to the LegCo to provide the legislative basis for PRS. It is envisaged that legislation for PRS would authorize the Director of Environmental Protection (DEP) as the enforcement authority

vested with powers of making inspection and collecting evidence to ensure compliance of the regulatory requirements. The legislation would also provide for penalties for violation of regulatory requirements.

---

6. The Government is also exploring the setting up of public spaces dedicated to recycling activities such as idle corners of land below flyovers. Any expansion for glass/plastic bottle recovery? Which regions? Will they be accessible to the masses?

   In general, lands below flyovers are not particularly suitable for conducting recycling activities because buffer areas need to be reserved and fenced off for protecting the structures of the columns. The resulting usable area will be very small, fragmented and irregular. Over the years, Lands Department has been searching for suitable lands to allocate for recycling uses through short term tenancy (STT). Up to now, 36 sites with a total area of around 7.4 hectares, locating in different areas of Hong Kong, are being leased for waste recovery and recycling operations. Naturally, the recyclers operating at these STT sites will be happy to serve the public in the neighborhood.
   (see webpage: http://www.epd.gov.hk/epd/english/environmentinhk/waste/data/stat_recycle.html for up-to-date list of STT sites).

---

7. Source separation can be achieved in Hong Kong by encouraging and assisting property management companies to provide waste separation facilities on each building floor, where feasible, and broadening the range of recyclables to be recovered. What materials are included in this? Will this include commercial establishments such as restaurants and grocery stores?

   Please see webpage for details about the source separation of domestic waste programme;
   http://www.epd.gov.hk/epd/english/environmentinhk/waste/prob_solutions/waste_super3r.html. This programme is targeted at the domestic sector. In general, the commercial and industrial sectors in Hong Kong so far have been able to achieve a reasonable high recovery rate by themselves (e.g. 64% in 2005).

---

8. We are in the process of meeting with local establishments that produce beverage container waste. By doing this we hope to learn about current recycling practices and possible difficulties. What other information could we gather that would be useful to the EPD?

   We are glad to know that FoE will study the problem of beverage container waste and meet relevant local establishments. We would be delighted to hear from you

the findings and experience that you may consider noteworthy and interesting. Hope you every success in this study.

---

9. The EPD has already begun to establish recycling within housing developments. Would implementation and evaluation of a recycling system in a 25 story service apartment be of interest to the EPD?

   EPD has been testing out various forms of domestic waste separation prior to the launch of the territory-wide Programme on Source Separation of Waste. It is recognized that there may be different modes of waste recovery for different types of buildings in Hong Kong. Housing estates which are participating the Programme will adopt the best mode of waste separation and recovery tailor-made to suit their particular physical constraints and other characteristics, by setting up appropriate waste separation facilities on floor. EPD supports service apartments join the Programme on Source Separation of Waste

---

10. According to foreign country experience, such as Germany , the cost of their Green Dot system is quiet expensive. What is the cost in recycling and treating packaging waste in each Kilogramme in HK? Why do the government haven't those data yet? How do you set the cost price when PRS?

    The cost for collection and recycling a post-consumption product under PRS could vary quite significantly from scheme to scheme. It would depend on the scope of the scheme, the collection system, environmental targets and requirements, and administrative costs etc. The cost data will be worked out when we develop the details of the scheme.

Appendix L

Interview with Laputa Eco-Construction Material Co., Ltd.

Date: 16 February, 2007
Time: 3:30 PM
Location: Pacific Coffee, Lockhart Rd., Wan Chai
Attendees: WPI team and Mr. Lam of Laputa Eco-Construction

---

1. What are the difficulties of being a glass recycler in Hong Kong?
   (a) How much does it cost to recycle glass?
   (b) How much does transportation cost?
   (c) What are the difficulties with these processes?

   Sorting glass bottles from bars and restaurants is problematic, because post-consumer glass may be mixed up with other waste, rendering it dirty and contaminated. Laputa hired private collectors to help them sort, but this was abandoned for sanitary reasons. The company already tried a pilot scheme to collect bottles from bars in Tsim Sha Tsui. It was very expensive. Laputa needed to order a 5-ton vehicle ($1000-$2000 per shift) to do so. The company does not own any trucks. In addition, workers had to be hired to operate the vehicle.

   Transportation of glass is very expensive. Laputa's only collection point is in Fanling, at their factory! Thankfully, Swire Coca-Cola donates glass bottles without charging for transportation. Kowloon dairy also donates their bottles. However, Laputa would like government help to deal with transportation costs. The most effective thing would be to ask producers for money ($1/bottle) to help with recycling collection costs. Some policy is needed to initiate this. One idea might be to have collection points where bottles are counted as they are collected. Producers would then be charged for the number of bottles belonging to them at these collection points.

   Space and location restrict business. Laputa's factory is going to be moved to Tuen Mun, where they will have more space. It took a year to build the factory and get started.

   Laputa has no funding from the government. It is difficult to ask for. There needs to be a valid application for the funding. The process of receiving funding also takes quite a while.

---

2. Would Laputa consider a pilot scheme to collect empty glass bottles from pubs and restaurants in an area such as Wan Chai?

If a pilot scheme were considered, the location would be very important. There would need to be sufficient parking space. Streets are very crowded in districts with bars and restaurants. In addition, the contamination of such bottles would have to be taken into account. Some kind of system would have to be developed to clean the bottles. Laputa already tried a pilot scheme, and it did not work in the end.

---

3. What are some of the applications in which Laputa Eco-Construction Material Co. uses post-consumer recycled glass?
    (a) What are some applications being researched by the company?

Currently, Laputa produces the glass paving block. This comes in any shape, custom tailored to suit clients' needs. The block can have a number of different colors. One variant created by the company is coated with titanium dioxide to neutralize NOx emissions from vehicles. Both types can be recycled indefinitely after being created. They are often considered aesthetically pleasing because of their sparkle. The bricks use between 20% and 50% recycled material (the goal is 80%). One ingredient used is fly ash from power plants. The rest is recycled aggregate and glass. Laputa is also exploring other applications for recycled glass, such as tiles.

---

4. Which companies supply glass for Laputa?

Coca-Cola and Kowloon Dairy both donate glass bottles to Laputa. They are delivered free of transportation charges. Kowloon Dairy crushes their bottles before packaging them in milk powder bags for delivery. Coca-Cola does not crush their bottles, but delivers them in reusable plastic collection trays.

In addition, the company receives glass baby bottles from private collectors. Laputa collects and recycles approximately one third of these waste bottles. The other two thirds of the bottles are recycled by Tim Wai. Some glass is donated to Laputa, but sometimes they are charged for it.

It is difficult to make arrangements with corporations like Wellcome, because Laputa needs to pay transportation fees to collect glass.

---

5. What is the extent of the market for post-consumer glass in Hong Kong?
    (a) Are there potential markets in surrounding countries/regions?

Laputa's profits come from selling paving blocks (glass bricks). There is no money to be made from simply selling recycled glass. In contrast, glass bricks are very successful. Most government departments use the bricks, as well as large contractors. They are used mainly on roads and in parks

In all, about 70% of Laputa's profits come from the government. Government housing authorities often want gimmicks to sell properties. If they use products such as glass blocks, they can claim that housing is environmentally conscious. BIM is one organization that touts environmental buildings.

Most eco-construction companies import material from Japan, but it is possible to localize recycling. Plenty of material is available and can be recycled locally. Paving blocks alone could cover the amount of wasted glass in Hong Kong! One reason companies like to import from Japan is because this country is more credible with the production of environmental products than Mainland China. People do not always believe that a product has been recycled if it comes from Mainland.

---

6. Is Laputa contracted for any pilot schemes?

Laputa is not contracted for pilot schemes, but the company does conduct its own trial arrangements. This yea, they will talk to secondary schools and primary schools, asking students to collect bottles for them. Laputa will then use the glass to make blocks to help pave the schools. This will not be a money-making project, but a way to generate publicity. The project will be proposed this year, allowing some time for schools to ask for money from the government. 10 schools will be targeted, but Laputa hopes to have 5 schools participating in the future. This will be a chance to promote products.

---

7. How much glass is the company able to process?

With their current machinery, Laputa is able to crush approximately 10-15 tons of glass per day. Every month, they take in about 200 tons of post-consumer glass for use in their products. Bricks can be made very quickly. The glass recycling rate has already increased from 2% to 3 or 4% just because of Laputa!

Laputa needs more glass. They can support much more intake than their current supply of post-consumer glass. They also need more of other raw materials. Laputa can use most types of glass, aside from reinforced and bulletproof. Liquor bottles can definitely be used by the company.

---

8. Why has Hong Kong's extensive deposit-refund system slowly died down?

The deposit-refund system has suffered because companies want to cut costs. Some companies export their bottles to China to be put in landfills. Vita gave up physical responsibility and now contracts third-party companies to recycle their glass bottles. Laputa has also asked for these bottles, but Vita already has a

contract with a company in mainland to dispose of these bottles. It is unknown what this contracted company does with the waste bottles (could be illegal dumping). Why put glass in landfills when it can be reused?

---

9. Has Laputa considered participating in the EcoPark?
    (a) Would the company receive any assistance – financial or technical – from the government, to participate in the EcoPark?

    The company has not considered moving into the government-sponsored EcoPark, because it is too close to residential areas. Laputa's factory is noisy, so this would cause unwelcome sound pollution to nearby residents.

    Nevertheless, Laputa was started because of increasing government support for recycling. The government will start to provide financial incentives. Education is also increasing. There are a number of TV programs about recycling and being environmentally conscious.

---

10. Why is glass not included in the government's 3-color bin recycling collection system?

    The government does not include glass in three-bin because they are afraid of disturbing business. In essence, they are afraid of favoring certain companies. Laputa is one of the largest glass recyclers in Hong Kong, so they would have a monopoly on the glass collected by the government.

---

11. What are some big factors in convincing producers to adopt EPR?

    Companies like Swire hire recyclers or participate in recycling to improve or maintain a good image.

Appendix M

Statistics of 3-Colored Recycling Bins

Distribution of 3-colored recycling bins

The number of 3-colored recycling bins provided at public places and schools is as follows:

District	Public Places (Roadside, parks, sports venues, leisure and cultural facilities, country parks, hospitals and clinics)	Schools	Total
Wan Chai	360	130	490
Central & Western	440	100	540
Eastern	410	160	570
Southern	310	120	430
Kowloon City	220	250	470
Yau Tsim Mong	350	120	470
Sham Shui Po	280	170	450
Wong Tai Sin	180	180	360
Kwun Tong	220	230	450
Tai Po	590	150	740
Yuen Long	310	230	540
Tuen Mun	370	270	640
North	350	170	520
Sai Kung	530	150	680
Sha Tin	520	270	790
Kwai Tsing	150	220	370
Tsuen Wan	490	110	600
Islands	320	60	380
Total	6400	3090	9490

In addition, about 8,800 waste separation bins are provided at public housing estates and Government quarters to facilitate residents' participation in waste recovery.

Quantity of recyclables collected through 3-colored recycling bins and total quantity of recyclables collected in Hong Kong

From 2003 to 2005, the quantity of recyclables collected through 3-colored recycling bins at public places and the total quantity of recyclables collected in Hong Kong are as follows:

Year	Source (tons)	3-coloured bins	Overall
2003	Paper	690	782100
	Metal	10	79500
	Plastic	210	206,600
2004	Paper	550	883400
	Metal	20	99600
	Plastic	160	265300
2005	Paper	323	908100
	Metal	23	108200
	Plastic	142	644300

It is observed that the quantity of waste paper and plastics recovered from the 3-coloured recycling bins decreased over the period from 2003 to 2005. A possible reason is that, as a result of the launch of the territory-wide Programme on Source Separation of Domestic Waste in 2005, more housing estates have set up waste separation facilities within their premises, thus obviating the need for their residents to take their recyclables to the 3-coloured bins at public places and schools. The increase in the market price of the recyclable materials might also have created incentives for more scavenging of the 3-coloured bins at public places. While the quantity of scrap metals recovered from the 3-coloured bins increased slightly over the same period, the amount collected was relatively small.

Environmental Protection Department
January 2007

Appendix N

Japan Containers and Packaging Recycling Law

The Containers and Packaging Recycling Law

Make the most of our "resources!"

Ministry of Economy, Trade and Industry, Japan

▼ Sources for More Information

Bureau/ Department, Section	Address	TEL
■ Hokkaido Bureau of Economy, Trade and Industry, Department of Environmental Protection and Natural Resources, Environmental Protection and Division	Kita Hachijo Nishi 2-1-1, Kita-ku, Sapporo-shi 060-0808	011-709-1754 (direct)
■ Tohoku Bureau of Economy, Trade and Industry, Department of Environmental Protection and Natural Resources, Environmental Protection and Recycling Division	Honcho 3-3-1, Aoba-ku, Sendai-shi 980-8403	022-263-1266 (direct)
■ Kanto Bureau of Economy, Trade and Industry, Department of Industrial Policy, Environmental Protection and Recycling Division	Kasumigaseki 1-3-1, Chiyoda-ku, Tokyo 100-8715	048-600-0263 (direct)
■ Chubu Bureau of Economy, Trade and Industry, Department of Industrial Policy, Environmental Protection and Recycling Division	Sannomaru 2-5-2, Naka-ku, Nagoya-shi 460-8510	052-951-2768 (direct)
■ Kinki Bureau of Economy, Trade and Industry, Department of Industrial Policy, Environmental Protection and Recycling Division	Otemae 1-5-44, Chuo-ku, Osaka-shi 540-8535	06-6966-6018 (direct)
■ Chugoku Bureau of Economy, Trade and Industry, Department of Environmental Protection and Natural Resources, Environmental Protection and Recycling Division	Kamihachobori 8-30, Naka-ku, Hiroshima-shi 730-8531	082-224-5675 (direct)
■ Shikoku Bureau of Economy, Trade and Industry, Department of Environmental Protection and Natural Resources, Environmental Resources Division	Banchi 1-10-6, Takamatsu-shi 760-8512	087-804-3964 (direct)
■ Kyushu Bureau of Economy, Trade and Industry, Department of Environmental Protection and Natural Resources, Recycling Promotion Division	Hakataeki Higashi 2-11-1, Hakata-ku, Fukuoka-shi 812-8546	092-482-5471 (direct)
■ Okinawa General Bureau, Cabinet Office, Departments of Economy, Trade and Industry, Environmental Resource Division	Maejima 2-21-7, Naha-shi 900-8530	098-866-0066 (operator)
■ Ministry of Economy, Trade and Industry, Industrial Science and Technology Policy and Environment Bureau, Recycling Promotion Division	Kasumigaseki 1-3-1, Chiyoda-ku, Tokyo 100-8901	03-3501-4978 (direct)
	● Homepage: http://www.meti.go.jp/	

Government-Designated Organization	Address	TEL
■ The Japan Containers and Packaging Recycling Association	Yusei Gojoisi Kotohira Bldg. (3rd/9th Fl.), 1-14-1 Toranomon, Minato-ku, Tokyo 105-0001	General Affairs Division 03-5532-8597 Public Relations Division 03-5532-8604
	● Homepage: http://www.jcpra.or.jp/	

Ministry of Economy, Trade and Industry, Japan

(2003.1 20,000)

Containers and wrapping waste is increasing ...that is why this law has been created.

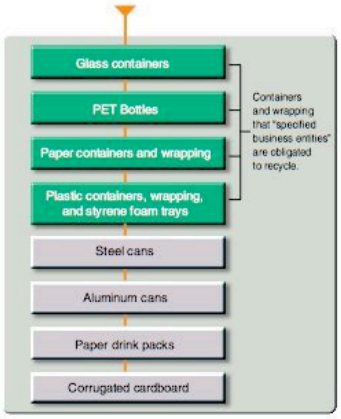
What is the "Containers and Packaging Recycling Law?"

Containers and Wrapping Account for 60% of Waste

Each year households in Japan discard about 51.45 million tons of waste (FY1999 figure). "Containers and wrapping waste" account for about 60% of this waste by volume. In order to promote the conversion of these discarded containers and wrapping into a "resource," the Containers and Packaging Recycling Law* was officially announced in June 1995 and implemented in April 1997. Consumers, municipalities, business entities, and each and every person all have a role to play in cooperating actively to build a recycling-oriented society.

*Officially called the "Law for Promotion of Sorted Collection and Recycling of Containers and Packaging."

Containers and Wrapping Targeted for Selective Collection



Businesses Required to Recycle

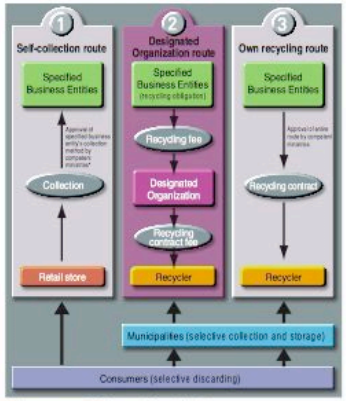
Medium or large-scale business entities of the following categories are, as a general rule, considered "specified business entities" under the Containers and Packaging Recycling Law and are obligated to recycle: 1) business entities that use "containers" or "wrapping" in manufacturing or selling merchandise, 2) business entities that manufacture "containers," and 3) business entities that import and sell "containers" or merchandise in "containers" or "wrapping." However, small-sized business entities meeting the requirements listed below are not subject to this law.

Rules for determining "specified business entities" are given on page 6.

■ Definition of Small-sized Business Entities (those exempted from recycling obligations)

Type of Business	Sales	Number of Employees
Manufacturing	¥240 million or less	20 or fewer employees
Retail/Wholesale, Services	¥70 million or less	5 or fewer employees

■ The Three Recycling Routes



*Please see page 5 "Designated Organization"

Efforts to Recycle

Under the Containers and Packaging Recycling Law, recycling roles have been assigned to specified business entities for effective use of resources. The total amount of recycling obligation under the law is based on the amount of selective collection planned by municipalities and the amount which can be recycled, and is calculated by the competent ministries. The amount of selective collection and the recyclable amount are announced by the government in its five-year plans.

■ Amount of Selective Collection and Recyclable Amount

▼ Estimated amounts of selective collection (unit: 1000 tons)

	2003	2004	2005	2006	2007
Glass bottles (colorless)	431	442	451	460	467
Glass bottles (amber)	372	381	387	395	401
Glass bottles (other colors)	197	202	206	210	214
PET bottles	214	229	243	259	273
Paper containers and wrapping	148	165	190	207	222
Plastic containers and wrapping	487	628	752	854	917

▼ Recyclable amount (unit: 1000 tons)

	2003	2004	2005	2006	2007
Glass bottles (colorless)	270	270	270	270	270
Glass bottles (amber)	200	200	200	200	200
Glass bottles (other colors)	160	160	160	160	160
PET bottles	292	311	315	317	319
Paper containers and wrapping	313	505	505	505	505
Plastic containers and wrapping	591	655	776	835	892

▼ The total amount of Recycling Obligation (Fiscal 2003)

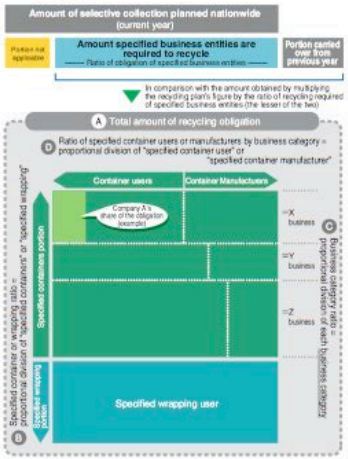
Items included in the specified selective standard	Estimated amount of selective collection for FY2003 (= a) 1000 tons	Estimated amount of recycling obligation for FY2003 (= b) 1000 tons	The amount is calculated based on the smaller figure for a) and b) above 1000 tons	Ratio for which specified business entities are responsible %	Total amount of recycling obligation for FY2003 10,000 kg
Glass bottles (colorless)	431	270	270	90	24,300
Glass bottles (amber)	372	200	200	82	16,400
Glass bottles (other colors)	197	160	160	88	14,080
PET bottles	214	292	214	100	21,400
Paper containers and wrapping	148	313	*71	92	6,532
Plastic containers and wrapping	487	591	487	91	44,317

*The figure is arrived at by subtracting the amount independently disposed of by municipalities, which is about 77,000 tons according to a survey by the Ministry for the Environment, from the estimated total amount for selective collection.

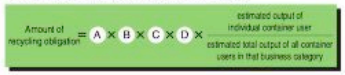
How to Calculate Amount of Recycling Obligation

Each specified business entity will have its own respective "amount of recycling obligation" in accordance with its category of business and the types of containers and wrapping involved. In addition, the amount used or manufactured will be taken into account when calculating the amount of recycling obligation.

■ Model for Calculating Amount of Recycling Obligation



Company A's Case (specified container users)



Notes on Terminology

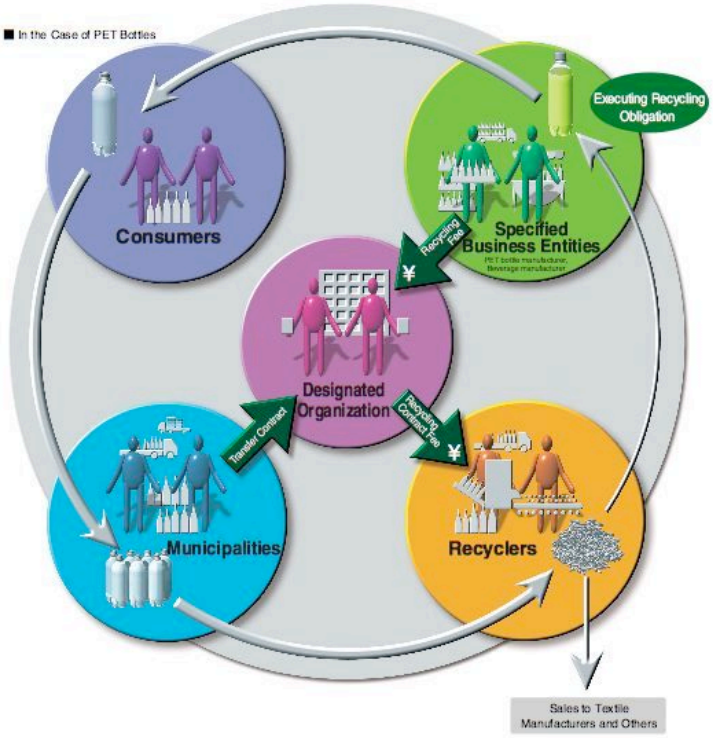
- In this pamphlet, the term "containers" is used to mean bottles, boxes or the like into which merchandise is placed, and "wrapping" to mean wrapping paper or the like in which merchandise is wrapped; and the term "containers and packaging" is used to mean both only in the names of the Law and the designated organization.
- The term "selective collection" or "sorted collection" means collection of sorted packaging waste or collection and sorting of commingled packaging waste by municipalities, which is similar to the curbside collection in the U.S.A.

● Did you know? The Containers and Packaging Recycling Law

Transforming “waste” into “resources” once again.

Mechanism for Recycling Containers and Wrapping (flowchart of recycling by the Designated Organization route)

Each person has a role to play in recycling from his or her respective position—that is the basic idea expressed in the Containers and Packaging Recycling Law. In other words, if any of the parties involved—the “specified business entity” that bears recycling obligation, the “municipality” that undertake selective collection, or the “consumer” who undertakes selective discarding of their waste—fails to fulfill their roles, waste cannot be transformed back into resources again.



■ Recycling Methods

Type	Recycling methods	Examples of recycled products
Glass containers	Making cullet, etc.	● Glass containers ● Construction and civil engineering materials, and others
PET bottles	Pelletization, etc. Polyester materials, etc.	● Fibers ● Sheet plastic ● PET bottles and others
Paper containers and wrapping	Selected pulp and waste paper + Refuse Derived Fuel Construction materials, recycled and shredded paper, bottles, etc. + Refuse Derived Fuel	● Paperboard ● Solid fuel ● Recycled and reused boards, etc.
Plastic containers and wrapping Styrene foam trays	Materials for plastics Synthetic oil Coke substitute for pig iron production Synthetic gas Coal substitute for coke production	● Stationery supplies, household sundries and other plastic products ● Materials for industrial use

Specified Business Entities

- Business entities which use “containers” or “wrapping” in manufacturing or sale of merchandise
- Business entities which manufacture “containers”
- Business entities which import and sell merchandise placed in “containers” or “wrapping”

*These businesses are called “specified business entities” and have the recycling obligation (This does not apply to small-sized businesses).

Rules for determining “specified business entity” status are given on page 6.

Consumers (selective discarding)

Recycling begins with good manners and the due consideration of individual consumers. Please follow the “discarding rules” set forth by the respective municipalities. In addition, make an effort to choose products with simpler packaging and make active use of refillable containers. With everyone’s understanding and cooperation, we can take that first, crucial step in recycling.

Municipalities (selective collection)

Municipalities play two roles: 1) conducting collection, sorting and washing of containers and wrapping in accordance with “sorting standards” specified under the law, and 2) storing in appropriate storage facilities. Containers and wrapping waste clearing both 1) and 2) are called “items meeting sorting standards.”
Items meeting sorting standards collected by municipalities which have concluded transfer contracts with the Designated Organization are received by the Designated Organization, which proceeds to the next step in recycling.

Recyclers

Recyclers transport items meeting sorting standards and process them, transforming them into “resources” once more.

Designated Organization

The Japan Containers and Packaging Recycling Association is a Designated Organization appointed by the five competent ministries (Finance; Health, Labor and Welfare; Agriculture, Forestry and Fisheries; Economy, Trade and Industry; and the Environment). It promotes smooth and appropriate recycling of items meeting sorting standards.

What are the "containers" and "wrapping" that specified business entities are obligated to recycle?

What are Containers and Wrapping?

"Containers" can be thought of as things into which merchandise is placed (this includes bags), and "wrapping" as materials in which merchandise is wrapped. Further, under the Containers and Packaging Recycling Law, containers and wrapping are defined as "things that become unnecessary once the merchandise has been consumed or otherwise separated from them."

Materials and Shapes

Glass Containers	● Containers made primarily of glass (excluding those made of silicate glass or milk glass) and which are listed here.	1) Bottles, 2) cups and cup-shaped containers, 3) plates and trays, 4) containers having a structure or form similar to 1) to 3), and 5) stoppers, lids and caps for containers or items resembling these.
PET Bottles	● Containers made mainly of polyethylene terephthalate (to be filled with beverages and soy sauce) and which are listed here.	1) Bottles, 2) other containers having a structure or form similar to 1).
Paper Containers and Wrapping	● Containers or wrapping made mainly of paper (excluding paper drink packs and items consisting mainly of corrugated cardboard) and which are listed here.	1) Boxes and cases, 2) cups and cup-shaped containers, 3) plates and trays, 4) bags, 5) containers having a structure or form similar to 1) to 4), 6) stoppers, lids and caps for containers or items resembling these, 7) containers used as a part of a main container, which are processed or glued to the container so as to protect or immobilize the merchandise placed in this container, and 8) wrapping.
Plastic Containers and Wrapping	● Containers or wrapping made mainly of plastic (excluding the above PET bottles) and which are listed here.	1) Boxes and cases, 2) bottles, 3) casks and buckets, 4) cups and cup-shaped containers, 5) plates and trays, 6) containers consisting of a sheet with indentations, 7) tube-shaped containers, 8) bags, 9) containers having a structure or form similar to 1) to 8), 10) stoppers, lids and caps for containers or items resembling these, 11) containers used as a part of a main container, which are processed or glued to the container so as to protect or immobilize the merchandise placed in this container, and 12) wrapping.

Method for distinguishing containers and wrapping composed of two or more materials

▼

Classify them according to the heaviest of the materials of which they are composed (the material that has the largest percentage of all in terms of weight)

Items not listed above ▼ are exempt from the law.

Exemption 1

When the item contained is not merchandise:
- Envelopes containing letters and direct mail
- Paper bags and boxes containing gifts
- Containers and wrapping placed in households, etc.

Exemption 2

When they are used for "supply of services," not "merchandise:"
- Dry cleaning bags
- Containers and wrapping with coupons, gift certificates, etc.

"Determining Criteria" and "Main Examples" of Containers and Wrapping

Examples of Containers

Containers which become unnecessary when removed from the included merchandise

- Boxes for candy or toys
- Boxes for shoes or household electronics
- Pocket-sized bag for tissue paper
- Containers for lipstick or stick glue
- Multi-packs containing beverages or natto
- Outer shrink-film for a packet of cigarettes
- Plastic or paper bags received at supermarket check-out counters
- For package of multiple-roll toilet paper
- Outer shrink-film for cup noodles
- Bag for straws that come with beverage packs
- Bag for chopsticks that come with box lunches, etc.

Examples of Wrapping

Wrapping which becomes unnecessary when removed from the included merchandise

- Wrapping paper at department stores and other retailers
- Wrapping film for covering fresh food products on trays
- Paper and film used to wrap hamburgers, caramels, etc.
- Stretch-film for wrapping lunches sold at convenience stores, etc.

*This applies to wrapping that exceeds one half of the minimum area necessary to cover the entire item of merchandise. Thus, tape for binding vegetables in bunches, the band label on socks and similar bands are exempt from the law.

Other Items Generally Considered as Containers or Wrapping

Lids, caps and other items forming a part of containers

- Stoppers and lids for containers (lids on cup noodles, pudding, etc.)
- Caps (tops to aerosol cans)
- Pumps and trigger-style nozzles on shampoo and other bottles
- Inner lids (on bottles of liquid cosmetics)
- Container mouth seals (seals on the mouths of tubes containing flavoring agents)

Items used to protect or immobilize merchandise or resembling lids or trays

- Molded material to contain machine parts
- Crayon case inner sheets
- Shock absorbing materials made of expanded polystyrene materials
- Soft sheets or nets for wrapping merchandise
- Film or other items resembling lids which cover the surface of butter or strawberries placed in packs
- Cardboard inserts for maintaining the shape of shirts

Exemption 3

Items which do not become unnecessary when removed from the contents or which are a part of the merchandise:
- CD cases
- Book jackets
- Cases for musical instruments, cameras, and others.
- Glass display cases for dolls, etc.

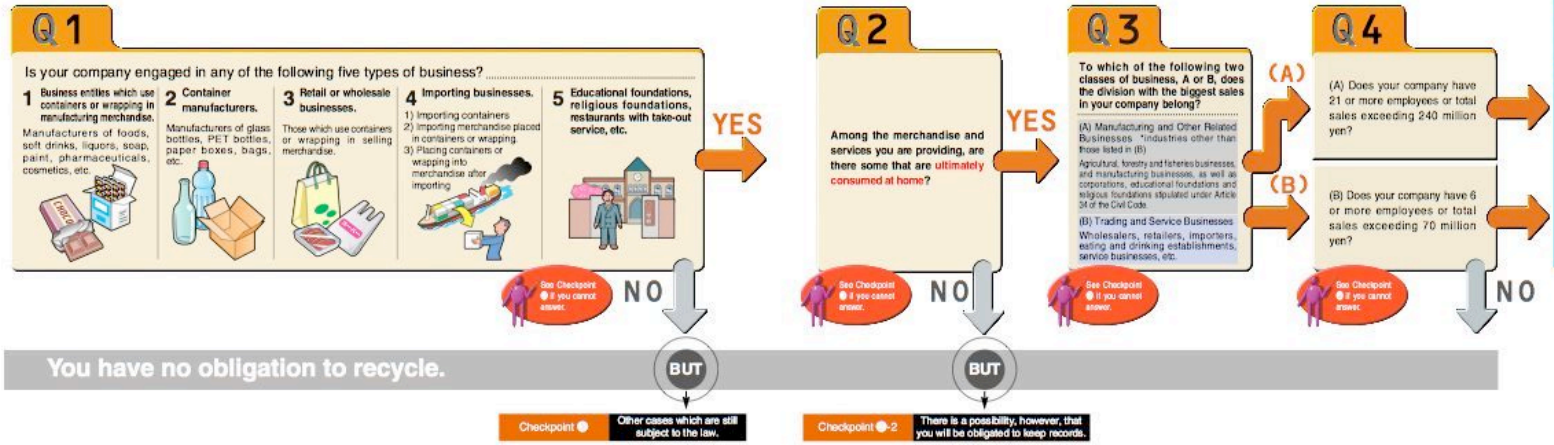
Exemption 4

In accordance with what is commonly understood as such:
- Wrapping which covers less than one half of the surface of merchandise
- Labels, stickers, seals and tapes
- Items which are used after physical separation from "containers" or "wrapping"
- Partitions in boxes of sushi, etc.

Chart for determining whether or not you are obligated to recycle.

Method for Determining Specified Business Entity Status

* Please refer to the respective checkpoints below when you cannot answer the questions or are uncertain of your status.



Checkpoint ●

If your company has a division that handles containers or wrapping, please proceed to Q2.

Checkpoint ●

<1> Cases in which merchandise is not consumed at home.

Even when containers and wrapping are used, they are not consumed at home in the following cases. Even in these cases, though, there is still a record keeping obligation. For information regarding keeping these records, please see pages 14-15.

● Plastic bags containing sauces made available at restaurants (because they are consumed in the course of business activities at the restaurant, and not considered to become household waste).
● Containers or wrapping placed solely for the purpose of shipping merchandise (because they should be normally disposed of properly at the shop or place of business, as business waste which ❶ are placed as part of a delivery service, ❷ are not provided to the customers as part of the merchandise, and ❸ will not require the customer to bear waste disposal obligation).
● Glass and other containers containing pharmaceuticals shipped solely to hospitals and disposed of at the hospitals after their use.
● A case in which a business entity is selling "rice balls" (dried rice), for example, to be used in overseas travel, 90% of which, according to the results of its own survey, are generally consumed overseas (items disposed of overseas are not considered to be consumed at households).

<2> Regarding "Record Keeping Obligation"

Even if you do not belong to the example given in <Q2>, if you answer YES to <Q4>, you will be responsible for keeping records. It is important to keep records in order to calculate accurately the amount of recycling obligation and to perform follow-up confirmation. Records must be closed each year and retained for a period of five years after closing. For more detailed information, please see pages 14-15.

Checkpoint ●

If your company has two or more divisions with approximately equal sales, please choose A or B based on an overall determination of which division is largest considering ❶ sales, ❷ number of employees, and ❸ scale of facilities. If your company has a division which manufactures or sells merchandise, you are engaged in that kind of business, even if the main division is construction, transport, communications, real estate or the like.

Checkpoint ●

<1> Calculating number of employees

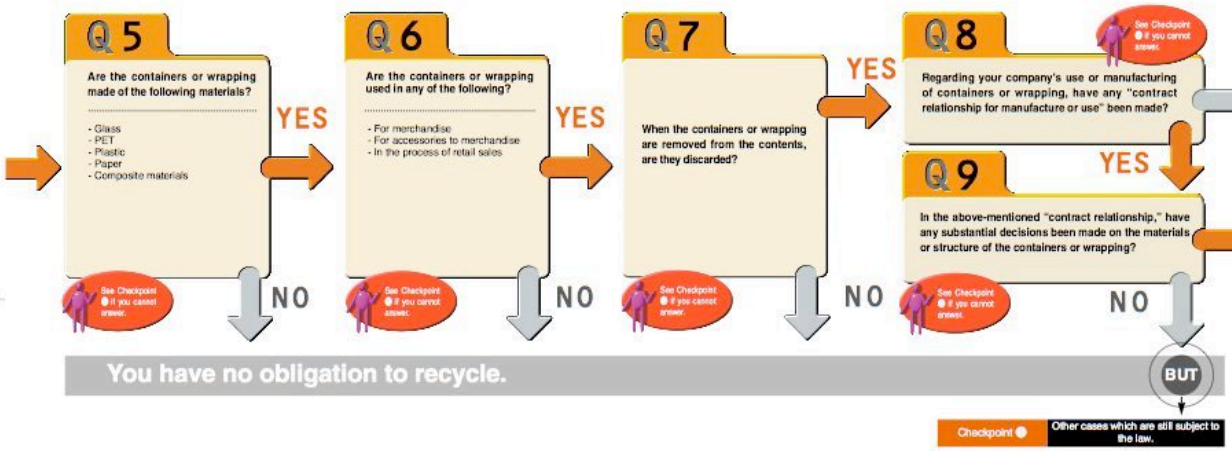
Please consider the total number of employees at your company, not just the number of employees in separate divisions. Specifically, employees are considered as follows:
❶ For multiple branches, the total number of employees overall.
❷ judged as the "number of persons normally employed."
Here, the "number of persons normally employed" is decided in accordance with the construction of the Labor Standards Law and Basic Law on Small and Medium Businesses. In general, this does not include part-time or temporary workers, but here "part-time or temporary workers" means "person not requiring advance notice of discharge," as follows
● Daily hired,
(excluding, however, those who continued to be employed beyond a one-month period)
● Persons employed for a term of two months or less,
(excluding, however, those who continued to be employed beyond a two-month period)
● Seasonal workers employed for a term of four months or less
(excluding, however, those who continued to be employed beyond a four-month period)
● Persons employed for a probation period
(excluding, however, those who continued to be employed beyond a fourteen-day period)

<2> Calculating total sales

Here, "total sales" means the sales that is commonly understood as such. For this reason, you can use whatever your company itself uses in settling its accounts. Also, as the purpose is to determine how much income your company has earned overall and how much economic power it possesses, please consider the sales of your company overall.
In counting sales by business category, the following procedures are normally followed.
● Mining and manufacturing business: counting sales of merchandise,
● Transport and service business: counting the value of the services provided,
● Wholesale and retail businesses: counting sales of merchandise,
● Agriculture, forestry and fisheries businesses: counting sales of merchandise.

Method for Determining Specified Business Entity Status

* Please refer to the respective checkpoints below when you cannot answer the questions or are uncertain of your status.



Checkpoint

<1> Meaning of glass, PET, plastic and paper materials
The "materials" of the containers and wrapping of <Q5> indicate those defined on page 6.

<2> Composite materials
Regarding containers and wrapping made of multiple materials which would be hard to separate, please determine the type of containers or wrapping on the basis of the material of the highest ratio by weight.
● Example of a composite material: trays formed from fillersheet (50% or more calcium carbonate content) are considered to be calcium carbonate containers, and thus non-plastic containers and wrapping, and are exempt from the law.

Checkpoint

The use of containers and wrapping in <Q6> is for merchandise or its accessories.
● Gifts and services (rental videos, dry cleaning) do not fall within the scope.
● Regarding samples (for trial use, etc.), if they are clearly distinguishable from merchandise to be sold, then they are exempt from the law, but if they are indistinguishable from merchandise being sold, then even if they are being called samples and distributed free of charge, they are subject to the law.
● For other examples, please see page 7 "Main Examples of Containers and Wrapping."

Checkpoint

For judging whether or not containers or wrapping will be discarded once removed from the contents, please see page 7 "Main Examples of Containers and Wrapping."

Checkpoint

Entities that are entrusted with the manufacture of containers or wrapping from entities that use the containers or wrapping will be considered specified business entities, regardless of whether or to what degree they have received manufacturing instructions or materials from the users.

Checkpoint

Regarding the obligations under the Containers and Packaging Recycling Law, please see pages 4-5.

Specified Business Entity

The obligations under the Container and Packaging Recycling Law apply to you.

If any points remain unclear, **please consult with us.**
*Our contact information is listed on the back cover of this booklet.

*** If you fail to fulfill your obligations, you will be subject to penalties.**
(For details, please see page 14.)

Checkpoint ●

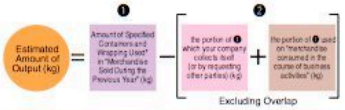
● Did you know? The Containers and Packaging Recycling Law

You can also fulfill your obligations by paying a recycling fee to the "Designated Organization."

The "Recycling Fee" and Methods of Calculation

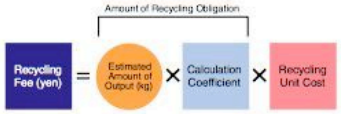
"Estimated Amount of Output" x "Calculation Coefficient" x "Recycling Unit Cost" = "Recycling Fee"

How much to pay as "recycling fees"—first, calculate the "estimated amount of output" based on the amount of output of the previous year. The point is to separate the amount passed on to the consumers from the amount ❷ collected by your company or consumed in the course of business activities, and declare only the portion which ultimately ended up as waste discarded from households (❶-❷). Business entities that can perform this calculation themselves should select the "ordinary calculation" and those that would have difficulty should select the "simplified calculation."



*For "specified container manufacturers," please substitute "manufactured" in place of "used."

In order to enable individual specified business entities to calculate with ease the amount of recycling which they are responsible for, a "calculation coefficient" is set. The "recycling unit cost" is calculated from recycling costs. Both of these values change each year. The amounts and ratios used as the basis for the coefficient are obtained from the Japanese government, and the recycling unit cost is announced by the Designated Organization. When these two figures are multiplied with the "estimated amount of output," the figure obtained is the "recycling fee" payable to the Designated Organization.



When and Where Is Application Made?

Application for and conclusion of recycling contracts can be done at the Chambers of Commerce or the Industry and Commerce and Industry Associations nationwide, which act on behalf of Designated Organizations. Please inquire at your nearest Chamber of Commerce and Industry or Commerce and Industry Association.

■ Recycling Operation Flowchart

Payment May Also Be Made in Installments

When the recycling fee due to the Designated Organization exceeds 100,000 yen, payment may also be made in installments. Note that the number of installments and due dates differ depending on the size of the recycling fee.

Annual Recycling Fee	Number of Installments	April	July	October	January of subsequent year
100,000 yen or less	Total payment due	—	100%	—	—
100,000 – 30 million yen	Total payment due	—	100%	—	—
	3 installments	—	50%	25%	25%
30 million yen or more	2 installments	50%	50%	—	—
	4 installments	40%	30%	15%	15%

Let's calculate your recycling fee

Can you calculate your "estimated amount of output"?

*For "specified container manufacturers," please substitute "manufactured" in place of "used."

*Under the Containers and Packaging Recycling Law, "ordinary calculation" is used as a general rule. Please make an effort to understand ❷ of the formula.

Able to calculate ▶

"Ordinary Calculation"

*Please see "Recycling Fee Calculation Methods" (separate paper).

Unable to calculate ▶

"Simplified Calculation"

*Please see "Recycling Fee Calculation Methods" (separate paper).
Specified containers and wrapping used* in "merchandise sold in the previous year" (kg) is calculated.
*For "specified container manufacturers," please substitute "manufactured" in place of "used."

Calculation and application can be made on our Website

On the Website of the Designated Organization, the Japan Containers and Packaging Recycling Association, we have provided a "calculation page" to assist calculating the "recycling obligation amount." You can also make an application for a recycling contract online. Please feel free to make use of this service.

The Japan Containers and Packaging Recycling Association
http://www.jcpra.or.jp/

● For Specified Business Entities

Regarding Record Keeping and Examples

■ Record Keeping

1	Recycling obligation amount	
2	Estimated amount of output used in calculating recycling obligation	
3	■ User Estimated amount of use of specified containers and wrapping for the current year	❶ Amount of specified containers and wrapping used in merchandise sold during the previous fiscal year ❷ Estimated amount of specified containers and wrapping to be used in merchandise (for the year of commencing use of specified containers and wrapping or discontinuing use) ❸ (amount of specified containers and wrapping used in merchandise in the initial year/number of months during which merchandise was sold in the initial year) x 12 (for the second year after use of specified containers and wrapping commenced, or for the third year after commencement, if the amount of the second year is not fixed)
	■ Manufacturer Estimated amount of sales of specified containers for the current year	❶ Amount of specified containers and wrapping sold during the previous fiscal year ❷ Estimated amount of specified containers and wrapping sold (for the year of commencement of manufacturing of specified containers and wrapping or discontinuing use) ❸ (amount of specified containers and wrapping sold in the initial year/number of months during which merchandise was sold in the initial year) x 12 (for the second year after manufacturing of specified containers and wrapping commenced, or for the third year after commencement, if the amount of the second year is not fixed)
4	In the case that the ordinary calculation method was used to obtain the estimated amount of output in 2.	❶ Amount of specified containers and wrapping collected by your company or by requesting other parties for collection, calculated according to stipulations by the competent ministries ❷ Amount of specified containers and wrapping not disposed of as containers and wrapping household waste, calculated according to stipulations by the competent ministries
5	■ User In the case that merchandise placed in specified containers and wrapping is exported	❶ Types of specified containers and wrapping ❷ Amount of specified containers and wrapping ❸ Export destination of merchandise placed in containers and wrapping
	■ Manufacturer In the case specified containers are exported	❶ Types of specified containers ❷ Amount of specified containers ❸ Export destination of specified containers
6	In the case approval has been received for own collection	❶ Types of specified containers and wrapping for which approval has been received ❷ Amount of specified containers for which approval has been received ❸ Collection method for specified containers for which approval has been received
7	In the case that the estimated amount of output is obtained by ordinary calculation	❶ Type and collection method for specified containers and wrapping which your company is collecting ❷ Type and collection method for specified containers and wrapping which your company is requesting another company to collect
8	Terms and conditions of recycling contract if concluded with the Designated Organization	❶ Date of conclusion of recycling contract ❷ Amount of containers or wrapping meeting sorting standards for recycling under the recycling contract ❸ Due date of recycling fee under the recycling contract and date this was paid

Note: please do not mix usage of "ordinary calculation" and "simplified calculation" on the same page.

If a Specified Business Entity Fails to Fulfill Its Obligations, It Will Be Subject to Penalty.

If for any reason a specified business entity with the recycling obligation does not fulfill that obligation, the business entity will be subject to penalties through "guidance and advice," "recommendation," "publication," and "orders" of the government.

❶ When there is failure to fulfill recycling obligations
❷ When records are not kept, when records contain false statements and when records are not retained
❸ When upon request from the competent ministries for a business report, a report is not provided or the report contains false statements
❹ When the business entity refuses inspection by the competent ministries or obstructs it

*For ❶, if "guidance and advice," "recommendation," "publication," and "orders," are not complied with, a fine not exceeding 500,000 yen will be imposed.
For ❷ ~ ❹, in case of non-compliance, a fine not exceeding 200,000 yen will be imposed.

■ Record-Keeping Example (case of a specified container user using the ordinary calculation method)

Business classification	Food manufacturing industry, soft drink manufacturing, tea or coffee manufacturing industry, alcoholic beverage manufacturing industry, oil and fat processing, soap, detergents, synthetic detergents, surfactants and paints manufacturing industry, pharmaceuticals manufacturing industry, toiletry, cosmetics, toothpaste and other manufacturing industry, retail sales industry, other industries
Classification of containers or wrapping	Glass bottles (colorless, amber or other colors), PET bottles for beverages or for soy sauce, other paper containers, other plastic containers

"Items" in records will differ

		For a specified container manufacturer	For a specified wrapping user
Name of merchandise using the specified containers (*) (When containers of almost the same shape, color and weight are used for various types of merchandise, they may be listed and added together in one column.)	Bottles for detergent	Same as to the left	* Change containers to "wrapping"
Structure and type of material	Other plastic		Delete this item
①: Weight of one specified container <*Note1> (g)	33		①: Amount of specified wrapping received (kg)
②: Number of units sold of the merchandise placed in the specified containers (*) during the current fiscal year (number of units)	2,530,000	②: Number of specified containers manufactured and sold in the current fiscal year (number of units)	* Change containers to "wrapping"
③: Weight of the specified containers used with the merchandise sold during the current fiscal year ① x ② ÷ 1,000 (kg)	83,446	③: Amount of specified containers sold in the current fiscal year (kg)	Delete this item
In the case the merchandise placed in the specified containers (*) is exported: ④ Weight of those containers (*) (kg)	None	④: Amount exported (kg)	* Change containers to "wrapping"
In the case the merchandise placed in the specified containers (*) is exported: Export destination (name of country or importer)	—	Same as to the left	
⑤: Weight of specified containers (*) used for the merchandise sold within Japan ③ - ④ = ⑤ (kg)	83,446	⑤: Amount of specified containers sold within Japan (kg)	* Change containers to "wrapping"
⑥: Weight of portion of ⑤ collected by your business entity or by requesting other parties (kg)	None	Same as to the left	Same as to the left
⑦: Weight of portion of ⑤ consumed in the course of business operations (kg)	4,120		
⑧: In the case that ⑥ or ⑦ cannot be calculated, the ratio of containers and wrapping discarded as household waste	—		
⑨: Estimated amount of containers and wrapping discarded as household waste ⑤ - (⑥ + ⑦) or ⑤ x ⑧ (kg)	79,370		
⑩: Coefficient used in ordinary calculation <*Note2>	0.40084		
Weight of recycling obligation ⑨ x ⑩ (kg)	31,815		

Items regarding recycling contracts with the Designated Organization

1.Date of conclusion of contract	year	month	day	3.Due date of recycling fee	year	month	day
2.Amount of estimated recycling	kg			4.Date of payment of recycling fee	year	month	day

<Note 1>: For the weight per unit of specified containers (or wrapping), use the figure obtained by weighing several of the specified containers (or wrapping) together (generally, ten units or more), then calculating the average weight per unit in grams (rounding the figure to the nearest gram). However, in the event that this figure is a single digit or lower, round the number to two significant figures (rounding to the nearest tenth or hundredth gram). If handles or other items are attached to the specified containers or wrapping in question and it would be difficult to separate them, the weight should include them.

<Note 2>: Use the coefficient for each fiscal year to make the calculations (refer to the "Recycling Fee Calculation Method" on the insert).

● For Specified Business Entities

Please display “Identification Marks”

The purpose of the identification markings is to facilitate the sorting of discarded items by consumers when they put out the waste and to promote selective collection by municipalities. Based on the Resource Effective Use Promotion Law (official name: Law Concerning Promotion of Effective Use of Resources) before its revision, there has already been an obligation to display identification marks on steel or aluminum cans for alcoholic or non-alcoholic beverages and PET bottles for alcoholic, non-alcoholic beverages or soy sauce, but from April 2001, this obligation has been extended to plastic and paper containers and wrapping.

Business Entities Subject to the Law, and Targeted Containers and Wrapping

● Business entities using containers or wrapping, business entities manufacturing containers or wrapping and business entities importing and selling containers or wrapping bear the Identification Marking obligation.

● Note that even small-sized business entities, unlike in the case of recycling obligation, are not exempt from the Identification Marking obligation.

● Recycling obligation and Identification Marking obligation, as a general rule, do not apply to containers and wrapping of merchandise consumed for the purpose of business activities.

▼ For inquiries regarding Identification Markings…

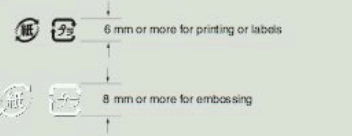
	TEL	FAX	Homepage
Ministry of Economy, Trade and Industry:			
Industrial Science and Technology Policy and Environment Bureau, Recycling Promotion Division	03 - 3501 - 4978		http://www.meti.go.jp/
Designated Organization	**TEL**	**FAX**	**Homepage**
Japan Containers and Packaging Recycling Association: Research and Planning Division	03 - 5532 - 8591 / 8558	03 - 5532 - 9698	http://www.jcpra.or.jp/
Printing Pattern	**TEL**	**FAX**	**Homepage**
Plastic Containers and Packaging Recycling Promotion Council	03 - 3501 - 5893	03 - 5521 - 9018	http://www.pprc.gr.jp/
Paper Containers and Packaging Recycling Promotion Council	03 - 3501 - 6191	03 - 3501 - 0203	http://www.kami-susinkyo.org/
Plastic Material Indication for Plastic Packaging	**TEL**	**FAX**	**Homepage**
Japan Plastic Industries Federation	03 - 3586 - 9761	03 - 3586 - 9760	http://www.jpif.gr.jp/
Voluntary Marking	**TEL**	**FAX**	**Homepage**
Paper Drink Packs Council	03 - 3264 - 3903	03 - 3261 - 9176	
Corrugated Cardboard Recycling Council	03 - 3248 - 4851	03 - 5550 - 2101	
Markings for Steel or Aluminum Cans and PET Bottles	**TEL**	**FAX**	**Homepage**
Steel Can Recycling Association	03 - 5550 - 9431	03 - 5550 - 9435	http://www.rits.or.jp/steelcan/
Aluminum Cans Recycling Association	03 - 3582 - 9755	03 - 3505 - 1750	http://www.alumi-can.or.jp/
PET Bottles Recycling Promotion Council	03 - 3662 - 7591	03 - 5623 - 2885	http://www.petbottle-rec.gr.jp/

Method of Identification Markings (plastic marking and paper marking)

① Marking Rules

● **Design**
The design of the Identification Marks shall basically be as per the marks shown herein. As long as Marks remain easily recognizable and conspicuous, minor modification or decoration is allowed to the prescribed design.

● **Size**
The vertical length of the Identification Mark shall be:

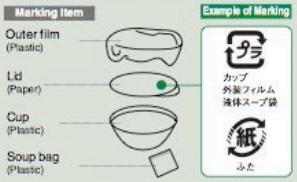


● **Marking Method**
Identification Marks shall be indicated on the surface by printing, embossing or labels.

② Multiple Packaging and Collective Marking

● In case of so-called multiple packaging which consists of separable components, such as cups for instant noodles (the cup, a lid, outer film and soup bag), or shampoo bottles (the bottle, cap and pump), or which consists of outer packaging and inner packaging contained therein, such as cake box (inner bag and outer box), each component (other components are called "integrated containers and wrapping" in the rules and regulations) is regarded to be one container or wrapping, and the Identification Mark shall basically be placed directly on each of them.

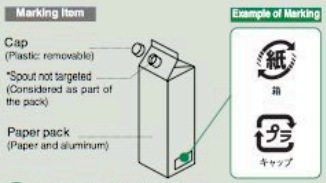
● However, the marks for respective components may be collectively placed on one of them if they are to be discarded at almost the same time. In this case, the names of components (called "role names" in the rules and regulations) shall be indicated near their respective Marks.



③ Composite Packaging

● In case of plastic spouts on paper packs of Japanese sake (which also contain aluminum) and paper labels glued on plastic bottles not separable from glass bottles, or laminated film of plastic and aluminum, the inseparable unit is regarded to be one container or wrapping. The Identification Mark to be placed on such a unit is decided by the heaviest material in the unit.
For example, for containers and wrapping made of plastic, aluminum and paper, if the plastic accounts for the most weight, they are considered primarily plastic packaging, and the plastic marking is displayed.

● However, the plastic shrink labels surrounding PET bottles used for beverages or soy sauce, many of which come with perforations to make it easy to remove them, are treated as a separable component in multiple packaging, as discussed ❷ on the left.

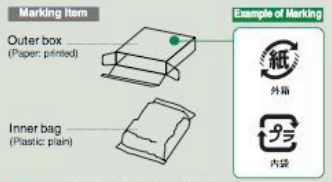


④ Plain Containers and Wrapping and Those on which Markings Cannot be Made

● Items on which labels have been glued or those made by a molding process in which it is possible to engrave markings do not qualify as plain.

● For plain containers and wrapping and those on which the marking is not physically possible but which come with other structural parts that can be removed (the "integrated containers and wrapping" of ❷ on the left) including one or more for which there is Identification Markings obligation (steel or aluminum beverage cans; beverages or soy sauce PET bottles; plastic or paper containers and wrapping; called "related containers and wrapping" in the rules and regulations), the Identification Marks along with the role name will be displayed on one of the "integrated containers and wrapping." In this case, if there is a piece of "integrated containers and wrapping" which will be discarded at almost the same time as the plain containers and wrapping, or that on which the marking is not physically possible, the marking will be displayed on that.

● If there are no "related containers and wrapping" among the other structural parts, or if there are, but they are all plain or cannot be marked on, there is no Identification Markings obligation.



⑤ Wrapping Paper

● Wrapping paper (made of paper or plastic) to be used by retail stores is exempt from the Marking requirement if its size is 1,300 square centimeters or less. However, the Identification Marking is preferred even for such small sized paper if the cutting shape is known when the paper is ordered.

● Wrapping paper manufactured to wrap a specific merchandise is not exempted regardless of its size.

⑥ Imported Goods

Importers assume the obligation of the Identification Markings in the following cases:

● They provide directions regarding specification of materials or structure of containers and wrapping or use of their trademarks.

● Japanese language is used on containers and wrapping by printing, embossing or labels.

■ Penalties

Any entities designated as "indication identification entities" or that have the obligation to make identification markings that fail to make the necessary indications or comply with the specified requirements will be subject to government "penalties" through a process of guidance, public announcements, and injunctions in accordance with the provisions of the Law for the Promotion of Effective Utilization of Resources.

* Smaller enterprises as stipulated in the Small and Medium Enterprise Basic Law or designated by government ordinances will be not be the target of such guidance, if the amount of their receipts corresponds to government-designated requirements.

⑦ Material Indication

● Regarding plastic containers and wrapping, there is no legal obligation to indicate the type of plastic used or the presence of other materials, but it is still desirable to do so.

● Even when displaying them voluntarily, one must follow guidelines in JIS K 6899-1200 (ISO1043-1 1997) regarding symbols for materials.

● For composite materials, two or more materials are to be indicated, and the most prevalent material is to be underlined.

● A combined indication will have a colon separating the name of the role from the symbol for the material, as in the example below right.

⑧ Marking Guidelines

● In order to facilitate implementation of Identification Markings, it is expected that industrial organizations establish guidelines for each industry and member companies follow these.

⑨ Voluntary Marking

● There is no legal obligation for Identification Markings for paper drink packs (not using aluminum) and corrugated cardboard packaging, but related industrial organizations have voluntarily adopted markings for these and are displaying them.

Appendix O

Interview with Friends of the Earth acting director Edwin C. F. Lau

Location: Friends of the Earth (FoE) office, Wan Chai
Time: 2:30 pm
Attendees: Edwin C. F. Lau and the WPI team (Michelle Ladouceur, Martin Tsoi, Tim Ebner, Nathaniel Rosso)
Chair: Tim Ebner
Secretary: Michelle Ladouceur

---

1. As a long-time member of FoE, can you tell us some of the most sucessful things the organization has done to promote producer responsibility legislation in Hong Kong?

    - Since 2000
        - FoE has tried to lobby government legislation for producer responsibility.
        - Government-sponsored and non-government organization (NGO) pilot schemes have not been effective enough.
        - FoE has spoken to many producers to initiate change towards better environmental concern.
        - Lau joined the Waste Reduction Committee, which proposed to the government to develop legislation to reduce waste.
    - In 2003, on 5 June (World Environment Day), FoE launched a producer responsibility (PR) campaign.
        - A truck filled with waste plastic was dumped in front of the factory of the largest distilled water supplier in Hong Kong. FoE wrote to them, asking for a meeting. Banners were put up against 'freeriding' on the lack of landfill restrictions.
        - Finally, the company (embarrassed) responded and arranged a meeting with FoE. The company has many resources, and would easily be able to set up a recycling system for its bottles.
    - 2003 – Operation "Moonkick"
        - Moon cakes are manufactured locally. Boxes include a high ratio of packaging items (~20) to cakes (4).
        - It is generally easier to change the ways of a local manufacturer. Offers a better position for lobbying.
        - There was a press conference, in which FoE showed the packaging from all the different brands of moon cake.
        - The producers became embarrassed. They finally agreed to negotiate and cut down packaging.
            - Material has been gradually cut down each year.

        - When designing simple packaging, one has to bear in mind the waste recycling facilities exist in HK for people to dispose of their recyclables.
    - Off the record, the government is truly grateful for the push on producers by NGOs. They are limited by rules that do not allow them to be so bold.

---

2. What are some of the difficulties in HK slowing down the introduction of PR legislation?

    - Mainly, the government is weak. There is a lack of pressure on the private sector to change. The legislative council does not provide enough pressure. Legislation is seen as a last resort.
    - Government prefers to make Businesses to change by encouraging them to take part in (pilot programs, etc.) before PR legislation is introduced. There is a transition period. In addition, businesses do not always follow these recommendations. They tend to wait till legislation to come before doing something on a voluntary basis.

---

3. In your career, have you experienced working with beverage producers?
    a. Are beverage producers in HK generally receptive to PRS (producer responsibility systems)?
    b. Which corporations are more receptive than others?
    c. What are some positive ideas corporations are adopting to become more responsible on their own?

    - Producers generally do not like the idea of PR very much. Therefore, government and green groups have tried to lobby them to assume their roles. The producers are reluctant to change. They stall with studies and research.
    - *ASIDE: Tires selected as a product included in the WRFP.*
    - Bigger corporations are somewhat receptive to PRS because of concern for their public 'image'. They want to maintain a good reputation.
    - Also, producers somewhat implement PR programs on a low profile, because they are afraid of increased standards and other additional pressure on them from the community.
    - Producers who are already "thinking green" want PR legislation so that there is a level playing field for all companies. Others avoid it because they are not taking environmental steps on their own.
    - Simple packaging for moon cakes and other products reduce waste at the beginning, rather than the end of the product cycle. Some of the moon cake boxes no longer made of metal, instead, they are made of recycled paper so they can be recycled easily with other waste paper.
        - Takes advantage of existing recycling systems.

---

4. As someone involved with the Waste Reduction Committee, what is the overall outlook of the government on sustainable development? What are some of the barriers preventing this idea from being introduced to Hong Kong?

- The government's view of sustainable development (SD) is somewhat having bias on economy. Their main concern is for the economy to prosper, then everyone will be happy and thus less opposing views from the community.
    - However, they are also trying to balance many aspects (interests of the commercial sector) when considering SD.

---

5. What is the extent of communication between the EPD and FEHD? In your opinion how does this affect the departments' ability to promote green legislation?

    - The EPD is trying to promote the "4R's" principle and keep waste out of landfills as much as possible.
    - The FEHD's goal is only to get rid of the waste as quickly and efficiently as possible. They don't care whether material is recyclable or not.
    - Because of this difference in goals, waste management is hindered.
    - *Example:* Polystyrene waste separation pilot scheme.
        - FoE proposed to the FEHD to sort out polystyrene from waste. They suggested 2 locations to start. Recyclers were contracted by FoE and sent out to pick up the foam. FEHD frontline workers were merely required to set this material aside. This required very little change from normal operations.
        - Everyone benefited from the situation. The FEHD did not have to call in a large collection truck as often as before. In addition, waste was reduced.

- FoE and NGOs try to motivate the FEHD to do things to limit waste that they think are "extra" (and would not normally do on their own). These organizations contribute their own effort and resources to make solutions work.
- Having a "green" outlook high up in the government will automatically influence the smaller departments.
- The most effective WR plans involve using existing systems and facilities.
- Transportation is more cost-effective when recycling collection is consolidated down to several strategic collection points.
- Recycling and waste collection are very economics-driven. Take scavengers, for example. They collect aluminum cans because the cans are valuable and can be resold to recycling collectors on the street.
- FoE contacts producers and distributors of polystyrene. They are asked to cooperate with recycling. They agree to help by hiring recyclers and finding producers who need the waste polystyrene. Some even agree to rent foam

compactors to reduce the size of the foam waste, in order to cut transportation costs.
    - There is some profit to be made from recycling this material. More money is made by producers who buy the recycled foam and use it in products which are sold to countries like the USA.
    - Networking is the key to success in initiating these recycling programs. The other major factor is demonstrating that there is money to be made by recycling.
- Tim – Import tax on beverages?
- Lau – A viable system might be one where producers are forced to contribute to a recycling fund when importing their products into HK.
- Glass bricks make up a major outlet for waste glass. This is an example of low cost recycling.
- Tim – If we were designing a PRS for a district in HK, would a particular district be better than others?
- Lau – You just need to identify the source of glass bottle waste (e.g. Wan Chai, where there are many bars and restaurants). Any reason for choosing glass? PET is still not widely recycled. A bigger amount of PET is recycled compared to glass, but it is small in relation to the total amount of PET being consumed. The material is also easier to recycle.
- Nate – Only 1.6% of glass was recycled in 2005. In addition, the three-bin system does not target glass. Government seems to be ignoring glass.
- Martin – Glass is infinitely reusable, whereas recycled PET can only be used a small number of times.