

# **The Study of Beverage Container Recycling Process and Potential Market for Reverse Vending Machine (RVM) in JAPAN**

## **Research Report**

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by

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## Certification

I certify that the research report entitled, “The Study of Beverage Container Recycling Process and Potential Market for Reverse Vending Machine (RVM) in JAPAN”, submitted for the Dual Degree of Master of Science in International Corporation Policy (ICP, APU) and the Master of Engineering in International Material Flow Management (IMAT, UCB) course is base on the work by my own. This report is original and has not been submitted for any diploma or degree of any other academic institutions.

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Date : 28th / June / 2011

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## Abstract

Japan is a typical developed country with mass production and huge amount of disposal. Within the household waste, 60% of these solid wastes are packages and containers. It has become a big problem in the recent years, since there is no more space for landfill, and the dioxin emission from incineration made great harm to human health. Although the recycling rate is very high, litter strewn problem still exist. In order to reduce the amount of household waste, and the behavior of littering, the research took Reverse Vending Machine (RVM) as a solution.

Structural dialogue and interview were used as research methodology of this report attempting to find out the most suitable scenario for RVM installation. During the field research trip in Kanto Region, Kansai Region and Kitakyushu, RVM practice and the network of RVM including stakeholders have been identified.

There are several points need to be took into consideration in this report, such as deposit regulation, consumer behavior, and social participan. Detail will be explained in the following chapters, and here are some brief conclusions of this report:

- RVM project relies on the supports from municipalities strongly.
- Without the cooperation form retailer, RVM project may not run longer.
- Beverage manufactures and recycling companies are not so interested in RVM installation.
- Foreign RVM manufactures are willing to cooperate with local Japanese companies, which have more network connection in locality.
- Refund is an attractive incentive for consumers.

# **Chapter1. Introduction**

## **1.1 Background and Motivation**

Japan is a narrow country composed of several islands. It is located in East Asia with a population over 126 million. Because of the high density of population, there are not so many spaces for landfill infrastructure. To save the space of land use, 80% of solid wastes in Japan are treated in incineration plants. There are approximately 2000 incinerators in the world, and 70% of them are located in Japan. After 1960s, high economic growth brought mass production, and huge amount of distribution, consumption and disposal. Most of the municipalities chose landfill as their solution to treat solid wastes before 1975. After 1975, Japan started to establish a lot of incinerations to deal with solid wastes. These incinerators generate a huge amount of dioxin every year.

In United State, the population is three times much more than Japan, but there are only 168 incinerators. The amount of incineration in Japan is 10 times more than the other developed countries, dioxin emission also ranks number one worldwide. Dioxin emission not only harms human health, but also pollutes river, soil and damages natural environment.

Table 1.1 explains the current solid waste treatment infrastructures in Japan. Since 1995, the implement of “Containers and Packaging Recycling Law”, both the amount of incineration and landfill infrastructures decreases smoothly. The amount of incineration had decreased about 35%, and the amount of landfill had decreased around 25% in these 15 years. Landfill is also the secondary treatment after incinerating. Thanks to the recycling regulations, the lifetime of landfill became longer from 8.7 years to 18.7 years remainder.

Year	Incineration (Amount)	Capacity of Incineration (tons/day)	Landfill (Amount)	Capacity of Landfill (1000 m <sup>3</sup> )	Reminder of Landfill 1000 tons/year )	Reminder of Landfill 100 M.m <sup>3</sup> )	Reminder of Landfill (year)
1994	1,887	186,117	2,392	458,032	14,142	1.51	8.7
1995	1,880	188,844	2,361	462,636	13,602	1.42	8.5
1996	1,872	191,239	2,388	477,017	13,093	1.59	9.9
1997	1,843	192,243	2,266	492,341	12,008	1.72	11.7
1998	1,769	192,618	2,128	493,501	11,350	1.78	12.8
1999	1,717	195,125	2,065	501,168	10,869	1.72	12.9
2000	1,715	201,557	2,077	471,719	10,514	1.65	12.8
2001	1,680	202,733	2,059	468,702	9,949	1.60	13.2
2002	1,490	198,874	2,047	469,400	9,030	1.53	13.8
2003	1,396	193,856	2,039	471,943	8,452	1.45	14.0
2004	1,374	195,952	2,009	449,493	8,093	1.38	14.0
2005	1,318	189,458	1,847	449,611	7,328	1.33	14.8
2006	1,301	190,015	1,853	457,217	6,809	1.30	15.6
2007	1,285	189,144	1,832	449,507	6,349	1.22	15.7
2008	1,269	187,303	1,823	455,788	5,531	1.22	18.0
2009	1,243	186,205	1,800	461,095	5,072	1.16	18.7

Table 1.1: Solid Waste Treatment Infrastructure in Japan

(Source: Ministry of Environment, Japan)

## 1.2 Problem Statement

In these 30-40 years, waste problem became more and more serious. Production of canned drinks grows rapidly in 1960s. It was about 800 million cans in 1970, and then reached 21 billion cans in 1988. Some of these metal cans are not well treated, and scatter over of beverage cans on roadside, coast, and river became a big problem. PET bottles are easy to carry and reserve, so that it becomes another boom after canned beverage. In order to deal with the scattering problem, the local municipalities and associations have taken various actions on regulations, campaigns and routine cleaning works. Beverage container deposit is also under their consideration.

Within all kinds of container and packaging waste, containers for beverage use accounts for a high percentage. The following Figure 1.1 shows the usage of different kinds of beverage containers from 2000 to 2009. According to the figure, the output metal cans are getting lower and lower. However, PET bottle increases slightly in these ten years.

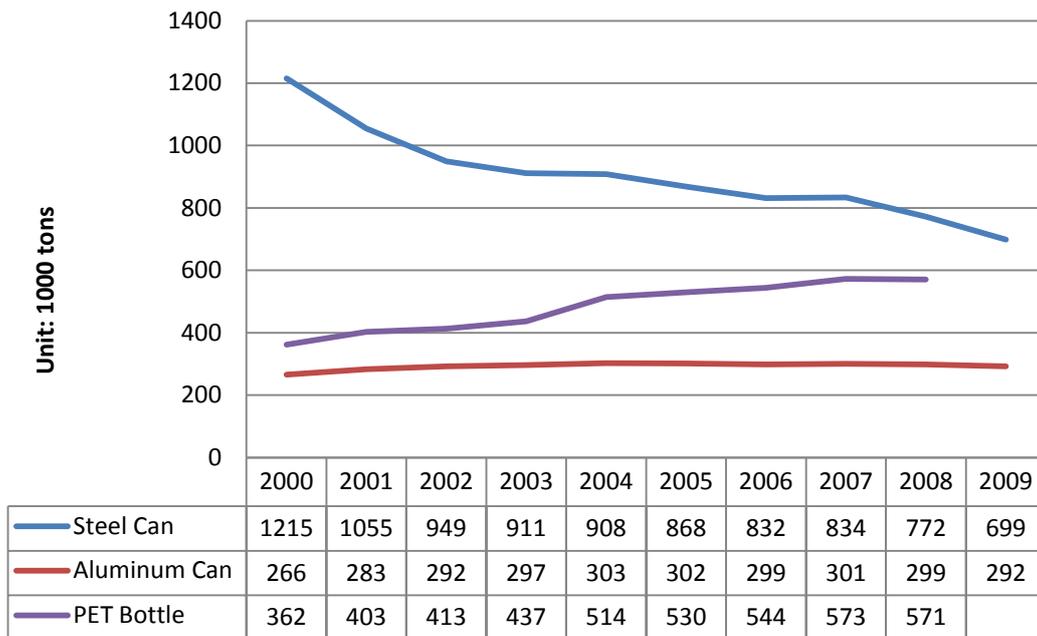


Figure 1.1: Usage of Beverage Container

(Source: Japan Steel Can Recycling Association, Japan Aluminum Can Recycling Association, Committee for Milk Container Environmental Issues, the Council for PET Bottle Recycling )

### 1.3 Research Questions

- What is the content of beverage container recycling regulation?
- How does the current recycling company process the beverage container?
- What is the material flow of beverage container recycling in Japan? How is the future trend?
- What is the role for each stakeholder to play in the recycling process?
- What is the typical consumer shopping behaviors regard to beverage containers?
- How does the partnership of current RVM work in Japan?

- What kind of benefit could create for each stakeholder?
- Who would be the potential customers of RVM systems?
- What is the difference between system in the cities and countryside?
- Which kinds of technology are available for beverage container recycling?
- Which business model for financing RVM systems would be applicable in Japan?

## **1.4 Research Objects**

This research takes reverse vending machine (RVM) as a solution to promote the recycling activities by residents or consumers. Within all the beverage containers, this paper will only focus PET bottles and metal cans.

In this chapter, there have been a brief description of the current situation, background, and the usage trend of each beverage containers in Japan. In Chapter 2, provides insight about the regulation, principal entities and the recycling flow in Japan. In Chapter 3 discusses three recycling practices in Tokyo Metropolitan, Osaka, and Oita Province to show the different recycling schemas between cities and countryside. In Chapter 4 is focused on recycling schemas of different materials, and also technologies of RVM. In Chapter 5, the roles and responsibilities of stakeholders in the recycling process will be explained. In Chapter 6, will offer some views of potential market niches and future trend, and then a brief conclusion in Chapter 7.

## **Chapter2. Regulations in Japan**

“Containers and Packaging Recycling Law” is the first Extended Producer Responsibility (EPR) law in Japan. For household waste, so far it is the affairs of municipalities in locality. However, the recycling process costs municipalities a lot. In order to share the burden, “Containers and Packaging Recycling Law” set up some duties for target companies such as container or beverage manufactures to follow. It is also necessary for them to provide financial aid to support the whole recycling process.

### **2.1 Background of Containers and Packaging Recycling Law**

In Japan, containers and packaging material account for 60% (volume) of household waste. As the solid waste increases, both landfill and incineration plant work under pressure. It is estimated that one day these waste treatment plants will be too full to accommodate these solid wastes. With this reason, Japan government set up “Containers and Packaging Recycling Law” in 1995. Not only for the packaging of beverage, the other packaging materials such as paper or plastic container, are also included. In these 15 years, it had been revised for several times in response to the changing times.

### **2.2 Targets Materials**

According to “Containers and Packaging Recycling Law”, the recyclable waste could be divided into several categories by different materials and uses. Also, it is necessary to put certain marks on the packages, which can help the public easily sort them. Table 2.1 shows the basic classifications.

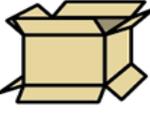
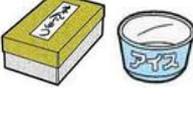
Material	Items	Symbol	Imagine	Beverage Use	Recycling Target in Law
Metal	Steel Can			Yes	No
	Aluminum Can			Yes	No
Glass	Glass	None		Yes	Yes
Paper	Carton (Milk, Others)			Yes	Yes
	Carton (Milk)			Yes	Yes
	Corrugated Cardboard			No	No
	Others			No	No
Plastic	PET (Bottle)			Yes	Yes
	Others			No	Yes

Table 2.1: Target Materials of “Containers and Packaging Recycling Law”

(Source: The Japan Containers and Packaging Recycling Association)

Within these categories, there are four items which have been traded in the free market for a long time. There are steel can, aluminum can, carton and corrugated cardboard. These four items have their own trading process before “Containers and

Packaging Recycling Law” was published. As the result, they are not in the list of target materials by “Containers and Packaging Recycling Law”.

## 2.3 Current Situation and Implementation

Thanks to the Containers and Packaging Recycling Law, the recycling rate of PET bottles reaches 77.5% in 2009. Because the material of PET bottle is not as expensive as metals, the recycling rate is relatively low before the implement of Containers and Packaging Recycling Law. Figure 2.1 shows the recycling rate of each material for beverage use from 2000 to 2009.

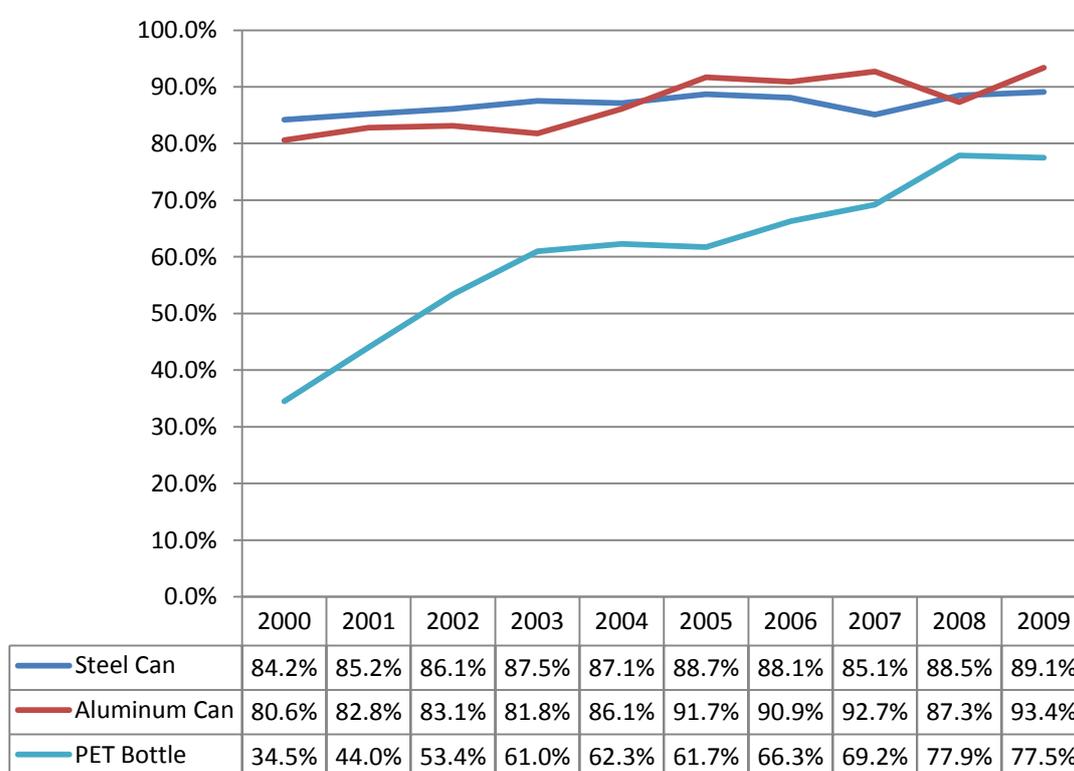


Figure 2.1: Recycling Rate of Each Material

(Source: Japan Steel Can Recycling Association, Japan Aluminum Can Recycling Association, the Council for PET Bottle Recycling.)

In order to give time to target groups to adapt to the Containers and Packaging Recycling Law, the first step of implementation only focused on the large enterprises. The target materials are glass bottle and PET only. In 2000, the small and medium

enterprises were also included into the target groups, and target materials extended to paper-base package and plastic packages. Until now, small enterprises are not included in the target group yet. Table 2.2 shows the implementation status from 1997.

Target group	1997~	2000~
Large Enterprises	Glass bottle, PET	
		Paper-base package, Plastic package
The Small and Medium Enterprises	Glass bottle, PET	
		Paper-base package, Plastic package
Small Enterprises	Excluded	

**Table 2.2: Implementation Status**

(Source: The Japan Containers and Packaging Recycling Association)

The definition of Small Enterprises is as following.

- Manufactures: Business sales are under 240 million JPY/year and employees are less than 20 people.
- Commerce, Services Industry: Business sales are under 70 million JPY/year and employees are less than 5 people.

## 2.4 Material Flows

It requires some participants to implement the Containers and Packaging Recycling Law. For target groups, there are three routes for them to implement the obligation of Containers and Packaging Recycling Law. In the recycling network, the Japan Containers and Packaging Recycling Association play an important to the target companies, municipalities and recycling manufacturers. Figure 2.2, 2.3 and 2.4 show the three routes for target groups to achieve the recycling goal, and also the material flow and cash flow among these participants.

### 2.4.1 Route 1: Voluntary Recycling Route (Reusable Materials)

Returnable glass bottles for beer, milk, and soda drinks can be reused by target companies. The recycling rate of reusable glass bottles is up to 95% or more. This way, the target companies can choose voluntary recycling route to implement the Containers and Packaging Recycling Law under the supervision of Ministry of Environment. The target companies have to submit current recycling status to the ministry every year. Figure 2.2 shows the Voluntary Recycling Route in detail.

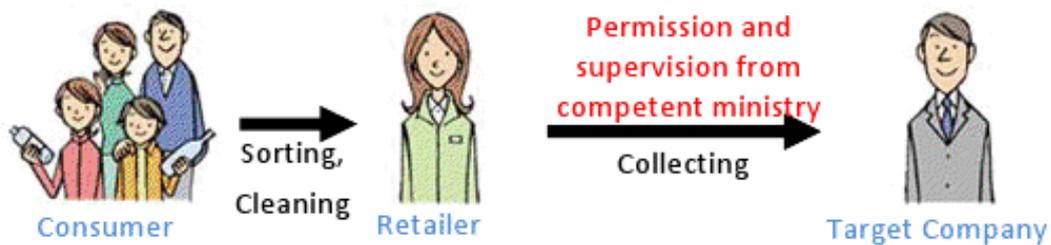


Figure 2.2: Voluntary Recycling Routes

### 2.4.2 Route 2: Individual Route (Recyclable Materials)

Under the supervision of Ministry of Environment, target groups can entrust recycling manufacturer to process their recyclable waste. It requires permission from ministry and strictly verification to confirm if the whole recycling route is ran properly or not. It is the most common ways for target groups to deal with these recyclable wastes. Figure 2.3 shows the Individual Route in detail.

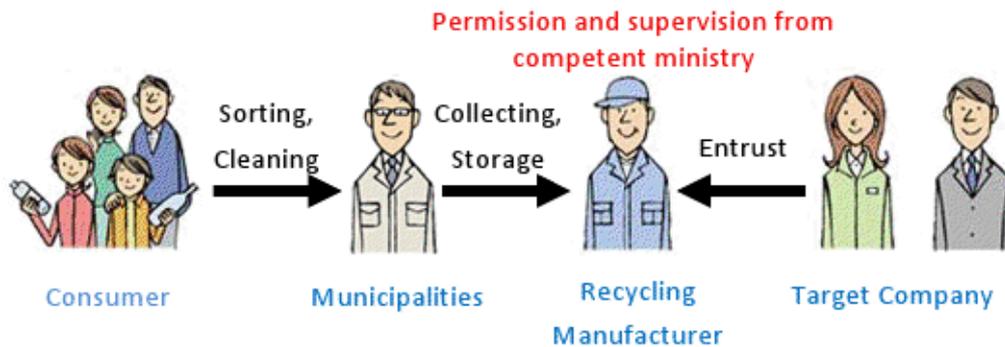


Figure 2.3: Individual Route

### 2.4.3 Route3: Designated Juridical Persons Route

Designated Juridical Person is The Japan Containers and Packaging Recycling Association is assigned by five competent ministries:

- Ministry of the Environment,
- Ministry of Economy, Trade and Industry,
- Ministry of Finance Japan,
- Ministry of Health Labour and Welfare,
- Ministry of Agriculture, Forestry and Fisheries.

The function of The Japan Containers and Packaging Recycling Association is to supervise the process of recycling and to make the process smoothly and accurately. In Japan, most of municipalities choose Designated Juridical Person Route to deal with their recyclable household waste. Municipalities entrust the recycling obligation to The Japan Containers and Packaging Recycling Association by paying processing fees. This is also the most common way for municipalities to running recycling process in Japan. In 2010, there are more than 900 cities (50% of all) entrust The Japan Containers and Packaging Recycling Association with recycling process.

Figure 2.4 shows the material flows and cash flows in Designated Juridical Person Route in detail.

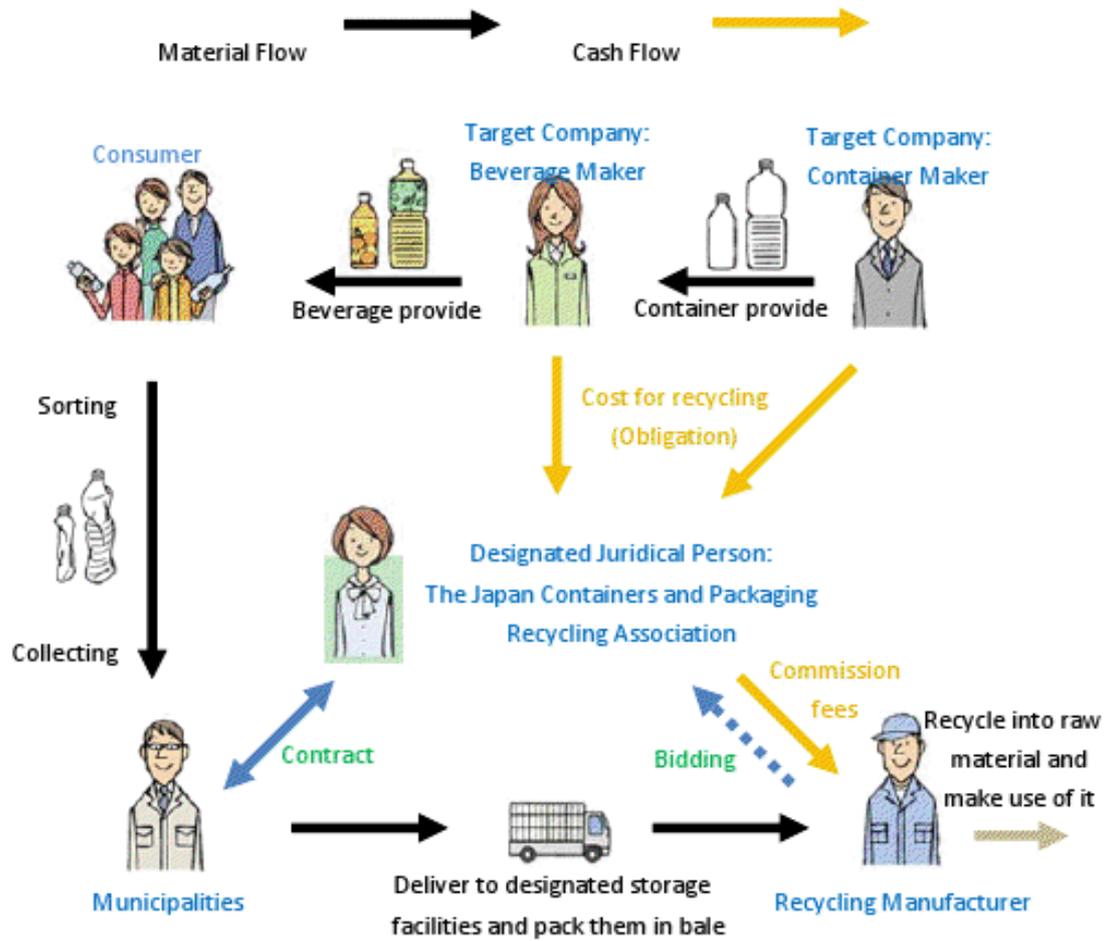


Figure 2.4: Designated Juridical Persons Route

(Source: The Japan Containers and Packaging Recycling Association)

### Chapter3. Recycling Practices in Japan

This chapter explains some recycling practices in Japan. In general, household waste disposal per person between 1998 and 2008 is around 770 gram per day in average. On the other hand, the waste treatment expense per person keeps decreasing from 17,800 JPY per year to 14,200 JPY in 2008. The following table shows the data in detail.

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Household Waste Disposal (g/day/person)	780	782	797	806	799	800	791	782	777	766	733
Treatment Expense (1000JPY/year/person)	17,800	17,900	18,700	20,500	18,800	15,400	15,200	14,900	14,600	14,600	14,200

Table 3.1: Household Waste Disposal and Treatment Expense Per Person in Japan

(Source: Ministry of Environment, Japan)

Within these household wastes, containers and packaging material accounts for 60% of total volume. For this reason, municipalities also make up strict rules to reduce the household waste besides what has already been set up by the central government (Containers and Packaging Recycling Law). Japan is also famous for its highly mandatory society. All these regulations are implemented under the supervision of the public.

To understand more insight, three different practices in Tokyo Metropolitan, Osaka, and Oita Prefecture have been chosen as research targets. Field research trip (on site observation) is taken as to measure and to find out the different recycling schemas among big cities and countryside. Detail will be explained in the next section.

## 3.1 Tokyo Metropolitan

### 3.1.1 Basic Information



Figure 3.1: Location of Tokyo Metropolitan

- Location: Tokyo Metropolitan is located on the eastern side of the main island, Honshu, and includes the Izu Islands and Ogasawara Islands.
- Population : 13,010,279
- Population Density : 5,970/km<sup>2</sup>
- Area: 2,187.08 km<sup>2</sup>, including 23 special wards, 26 cities, 5 towns and 8 villages.
- Household : 6,269,250

### 3.1.2 Performance of Tokyo Metropolis

- PET: 39,486 tons
- Steel containers: 24,840 tons
- Aluminum containers: 14,397 tons

### 3.1.3 Implementation

The rules of household waste collection and separation are decided by each municipality. There are 23 special wards, 26 cities, 5 towns and 8 villages in Tokyo Metropolis, and each municipality has different regulations and targets to implement the Containers and Packaging Recycling Law. In this section, Chuo Ward—one of the 23 special wards is chosen as a research target. Area of Chuo Ward is around 10.18 km<sup>2</sup>, and the population is about 118,898. The population density is 11,680/km<sup>2</sup>, and there are 67,564 households in Chuo district.

In Chuo Ward, recyclable waste is collected once a week. All household wastes should be disposed in specified place by specified date. Chou Ward separates household waste into 4 categories: Burnable, unburnable, plastic packages or containers and recyclable containers. In order to improve the quality of these recyclable materials, it requires some simple treatment before disposing. The following Figure 3.2 and 3.3 shows the steps.

- PET bottle

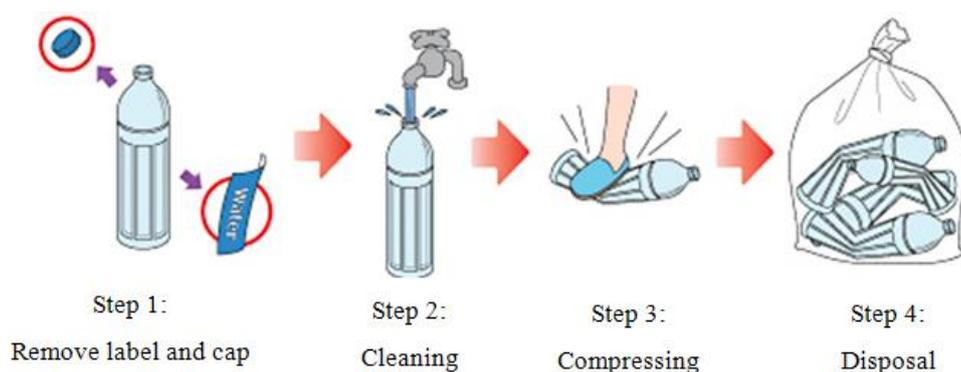


Figure 3.2: Steps of Recycling PET bottles

(Source: Chuo district, Tokyo, Japan)

- Others (Glass bottles, Cans)



Figure 3.3: of Recycling Glass Bottles and Cans

(Source: Chuo Ward, Tokyo, Japan)

Chuo Ward entrusts The Japan Containers and Packaging Recycling Association to deal with PET and glass bottles. In this case, Chuo Ward has a contract with The Japan Containers and Packaging Recycling Association. After sorting and collecting, these recyclable wastes will be sent to the recycling manufacturer, who wins the bid that year. After processing these recyclable wastes into raw material, recycling companies could get commission fees from The Japan Containers and Packaging Recycling Association.

In the case of Chuo Ward, waste glass containers are recycled by JW Glass Recycle Co., Ltd. In 2009, JW Company recycled 631,890 kg of transparent glass container, 349,830 kg of brown glass container, and 649,050 kg the other kinds of glass container. On the other hand, PET bottles are recycled by Tokyo PET Bottle Recycle Co., Ltd. In 2009, they recycled 613,610 kg PET bottles and turn it into fiber flakes, sheets or bottles.

Although metal cans recycling is not under supervising of Containers and Packaging Recycling Law, municipality still has to follow the bidding rules to decide recycling company to process metal cans.

### 3.1.4 Quality and Efficiency Improvement

According to the Chuo Ward Separating and Collecting Plan (June, 2010), there are 3 points to improve the quality and efficiency of recyclable waste. The content of the plan includes resident education, company cooperation and increasing recycling steps. Company which installs the vending machines also has the responsibility to provide recycle service. It involved the residents, nearby stores, offices and schools. The performance of Chuo Ward in recent years shows in Figure 3.4.

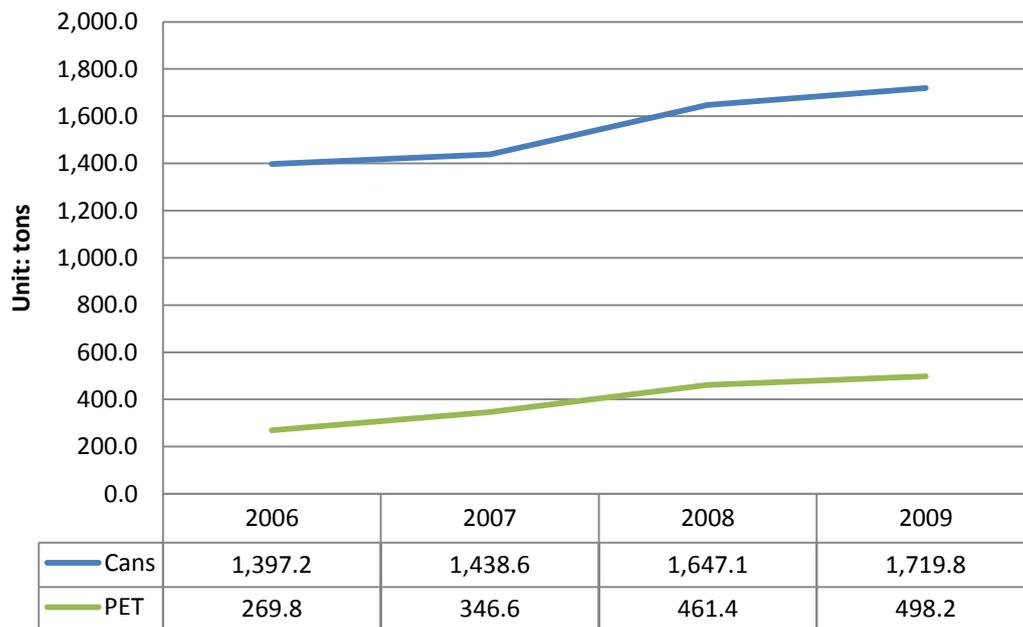


Figure 3.4: Recycling Performance of Chuo Ward, Tokyo

(Source: Chuo Ward, Tokyo)

## 3.2 Osaka Prefecture

### 3.2.1 Basic Information



Figure 3.5: Location of Osaka Prefecture

- Location: Osaka Prefecture is located in the Kansai region on the main island, Honshu. The capital is the city of Osaka. It is also the center of Osaka- Kobe- Kyoto area.
- Population : 8,839,639
- Population Density : 4,660人/km<sup>2</sup>
- Area: 1,897.86km<sup>2</sup>, including 2 government ordinance cities, 2 core cities, 7 special cities, 27 cities and 10 towns.
- Household : 3,779,054

### 3.2.2 Performance of Osaka Prefecture

- PET: 12,939 tons
- Steel containers: 14,744 tons
- Aluminum containers: 3,258 tons

### 3.2.3 Implementation

According to the data from Ministry of Environment, Osaka Prefecture discharged more than 3.5 million tons of waste in 2009. Compare to the other cities, waste disposal per person per day in Osaka Prefecture ranks number 1 within Japan. Because Osaka Prefecture has been put in a position as an industry area from long time ago, waste disposal contains 40% industry waste of total waste. It is around 25% in Tokyo Metropolis, and 30% in Oita Province.

On the other hand, the recycling rate in Osaka Prefecture is still much lower than the other cities. In 2009, the recycling rate in Osaka Prefecture is 11.8% only. It is around 23.4% in Tokyo Metropolitan, and 20.6% in Oita Province.

$$\text{Recycling Rate (\%)} = \text{Recyclable Waste (kg)} \div \text{Total Waste (kg)}$$

In 2010, Osaka Prefecture just published their separating and collecting for the next 6 years. According to the interview with Mr. Fujimoto in Osaka Environmental Planning Department, they are now planning to publish an Eco-Point card to encourage their residents to join recycling activities actively. Since this idea just started for several months, they do not have any specific plan yet. RVM is not in their list, neither.

In this section, Osaka City was allotted as research target. Osaka city is one of the government ordinance cities in Osaka Prefecture. It is not only the financial district of Osaka, but also the principal shopping and tourist areas. Osaka Prefecture office is also located in this area. Area of Osaka City is around 222.30 km<sup>2</sup>, and the population is about 72,668,113. The population density is 12,000 /km<sup>2</sup>, and there are 1,242,746 households in Osaka City.

The recycling process is very similar with Tokyo Metropolitan. In Osaka City, recyclable waste is collected once a week. All household wastes should be disposed in specified place by specified date. Osaka City separates household waste into 3 categories: recyclable waste, plastic package or containers and ordinary garbage. Recyclable waste includes PET bottle, metal cans and glass containers. Before disposing, it is also necessary to remove the label and cap, and then clean the inside of the containers.

Osaka Cities entrusts The Japan Containers and Packaging Recycling Association to deal with PET and glass. In the case of Osaka City, waste glass containers are recycled by three companies, Karatani Co., Ltd, Yamaichi Shousha Co., Ltd and Takahashi Co., Ltd. In 2009, Karatani Company recycled 1,430,520 kg, Yamaichi Shousha Company recycled 372,930 kg, and Takahashi Company recycled 96,460 kg waste glass of Osaka City. PET bottles are recycled by Lesrec Co., Ltd (Eco Staff Japan). In 2009, they recycled 327,550 kg of PET bottles.

#### **3.2.4 Quality and Efficiency Improvement**

According to the 6th Osaka City Separating and Collecting Plan (Osaka City, June, 2010), there are 4 main points to achieve the target of 3R society. First of all, they set up education programs for elementary school students helping them to understand the importance of recycling activities. Second, they cooperated with mass media and highlight the 3R ideas to the public. Third, they built information center and encourage small and medium enterprises to join these environmental friendly programs. Finally, they also work with retailers and producers, and encourage them to make more use out of recyclable material. The recycling performance of Osaka City shows in Figure 3.6.

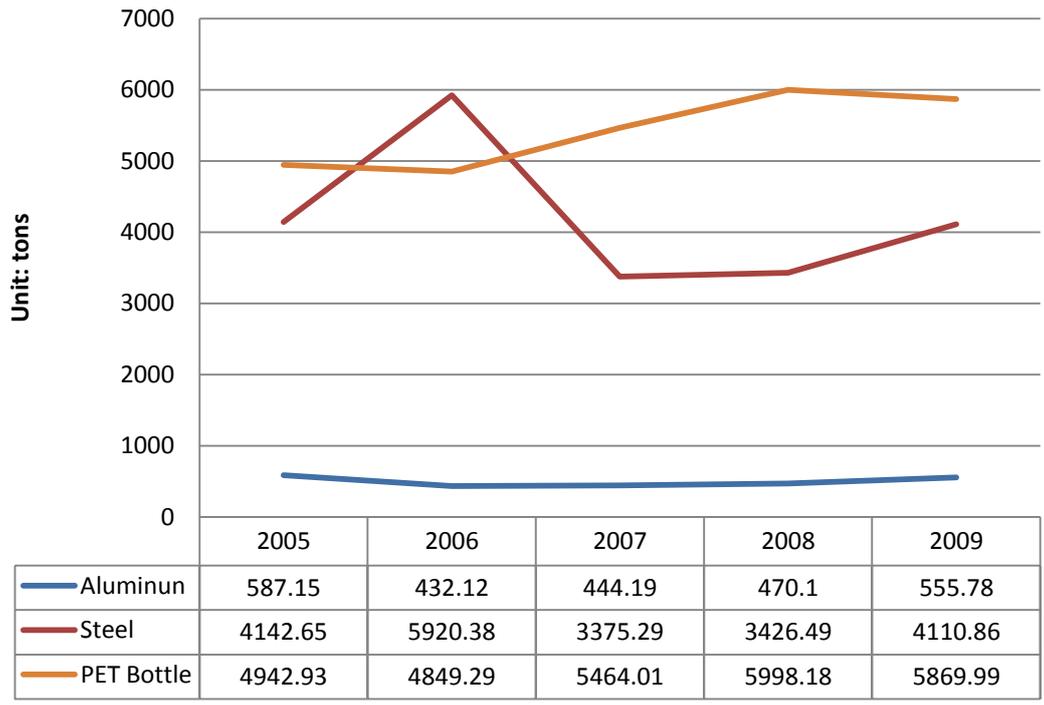


Figure 3.6: Recycling Performance of Osaka City

(Source: Osaka City, Osaka)

### 3.3 Oita Prefecture

#### 3.3.1 Basic Information



Figure 3.7: Location of Oita Prefecture

- Location: Oita Prefecture is located on Kyushu Island. The prefectural capital is the city of Oita.
- Population : 1,191,740
- Population Density : 188/km<sup>2</sup>
- Area: 6,339.55km<sup>2</sup>, including 14 cities, 3 districts, 3 towns and 1 village.
- Household : 498,912

### 3.3.2 3.3.2. Performance of Oita Prefecture

- PET:2,031 tons
- Steel containers: 1,943 tons
- Aluminum containers: 1,066 tons

### 3.3.3 Implementation

In this section, Beppu City was selected as research target. Beppu City is the second largest city in Oita prefecture, and it is also famous for its hot springs. Beppu City is considered a tourist town and it has the largest number of hot spring sources in Japan. Area of Beppu City is around 123.15 km<sup>2</sup>, and the population is about 125,848. The population density is 1,010/km<sup>2</sup>, and there are 59,129 households in Beppu City. In Beppu City, it requires special garbage bags to dispose household waste. The images of assigned garbage bags show in Figure 3.8.



Figure 3.8: Different Kind of Garbage Bags in Beppu City

(Source: Garbage and Recycle, Beppu City, Oita, Japan)

There are three colors of assigned garbage bag, green, transparent and pink. Each color can only be used to collect specific items. Different color of bags should be disposed in specific place by the specific date. There are two sizes of garbage bags for purchasing, and it is very convenient to buy these bags in almost every convenience stores and supermarkets in Beppu City.

- Green Bag (for burnable waste): Kitchen waste, plastic containers, and other packages. Green bags are collected twice a week. (Large Size: 210 JPY/10bags, Small Size: 105 JPY/10bags)
- Transparent Bag (for unburnable waste): Batteries, light bulbs, small electrical appliances and metallic objects. Transparent bags are collected twice a month. (Large Size: 210 JPY/10bags, Small Size: 105 JPY/10bags)
- Pink Bag (for recyclable waste): PET bottles, glass, steel, and aluminum containers. Transparent bags are collected twice a month. (Large Size: 189 JPY/10bags, Small Size: 94 JPY/10bags) It is also necessary to follow the same pre-treatment to remove the cap and label, and then clean the beverage containers before disposing.

Beppu does not work with The Japan Containers and Packaging Recycling Association to handle with recyclable household waste. All of these recyclable wastes

are collected by municipality, and then sent to private recycling. Since Beppu City is relatively a small city, so that there is no proper treatment plant to deal with these wastes. Therefore, they cannot help but sending all of these wastes to the other province nearby with bigger scale of treatment and facilities.

### 3.3.4 Quality and Efficiency Improvement

According to the 6th Beppu City Separating and Collecting Plan (Beppu City, June, 2010), there are 10 plans to achieve the target of 3R society. For example, they encourage the public to use returnable bottles or containers which are made of recyclable raw materials. On the other hand, they reinforce the idea of recycling in elementary education, and then set up information center to provide information support. The performance of Beppu City in recent years shows in Figure 3.9.

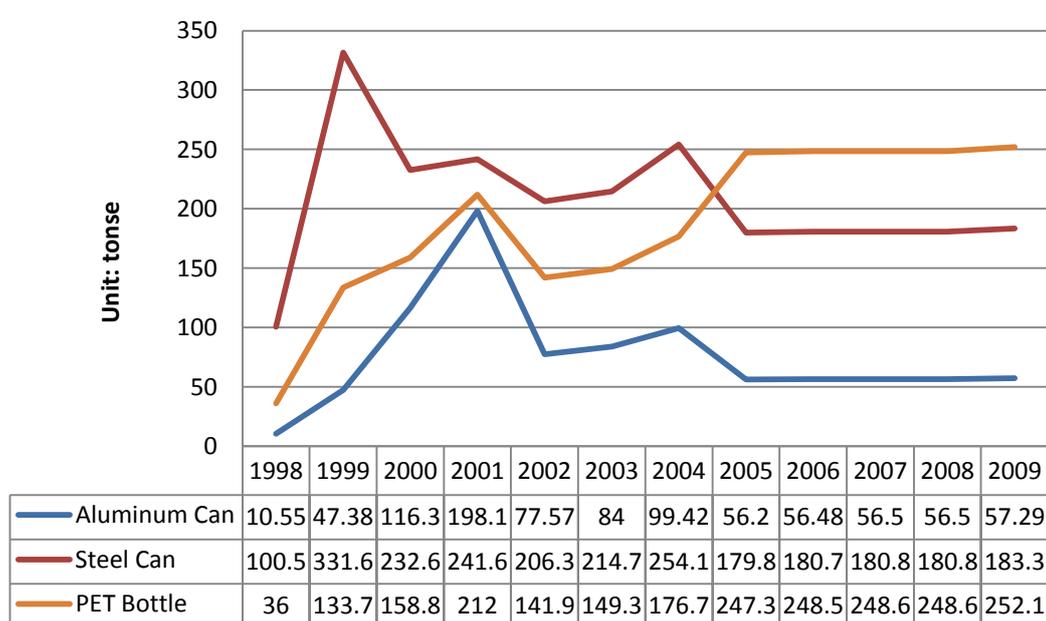


Figure 3.9: Recycling Performance of Beppu City, Oita Prefecture

(Source: Beppu City, Oita)

## **Chapter4. Recycling Process**

This chapter will explain the recycling schemes of metal cans and PET bottle. Two recycling companies were observed during field research trip to know the current technology, process, and also their viewpoint of RVM (Reverse Vending Machine). It will be explained in the following section.

### **4.1 Recycling Schemes and Manufactures**

Recycling manufacture which wins the bid from The Designated Juridical Persons or other target entities such as companies, retailer, municipality or schools have the right to deal with these recyclable wastes. It is their duty to transport and process them into raw material. Also, The Designated Juridical Persons and target companies provide subsidies to recycling manufactures to support the whole recycling process ensuring the continuous operation and make sure the process runs smoothly.

In order to understand the current situation of beverage container recycling industries, site visit has been employed. In this case, two companies—the KARS and NPR in Kitakyushu Eco-Town during this trip were visited.

Kitakyushu was an industry area which was famous for governmental steel refine factories, but these heavy manufactures also brought serious environmental problems afterward. As the reason, Kitakyushu Eco-Town has been established in 1997.

Eco-Town got financial support from government, and there are more than 20 companies, university or experimental have been established now. Not only beverage container recycling, but also car recycling, electrical appliances recycling, PCB recycling, and fluorescent light recycling...etc, these companies are all concentrated here to provide service and research to Kitakyushu and nearby cities.

Not only the recycling industries, there are also renewable energies companies with experience in wind turbine, solar panel installation and biomass plant. It is not only the first Eco-Town within Japan, but also the hugest one. It is the first organization in Japan which won “Global 500” from United Nation in 1990. In 2006, TIME magazine also introduce the environmental improving model in Kitakyushu.

#### 4.1.1 Metal Cans

It is not easy to distinguish aluminum and steel cans by appearance, so that most of these metal cans are collected together. After collecting by municipalities, these cans will be transported into separating center. In this stage, separating center makes use of strong magnet to separate aluminum and steel cans, and then compress them into bales.

In the next process, these metal bales will be sent to recycling manufactures, and then be melting down by high temperature (aluminum: 700 °C, steel: 1600°C). 60% of these aluminum bales are processed, and then become the raw material again.

Figure 4.1 shows the metal bale and processed raw material.



Figure 4.1: Metal Bale and Raw Materials

According to the data from Japan Aluminum Can Recycling Association, the can-to-can rate of aluminum is around 65% in average from 1999 to 2009. The following chart shows the product of recycled aluminum cans. On the other hand, recycled steel also have multiple applications. Of course steel cans, and also spare parts

of automobile or aggregate for construction. Figure 4.2 shows the applications and products of recycled aluminum cans.

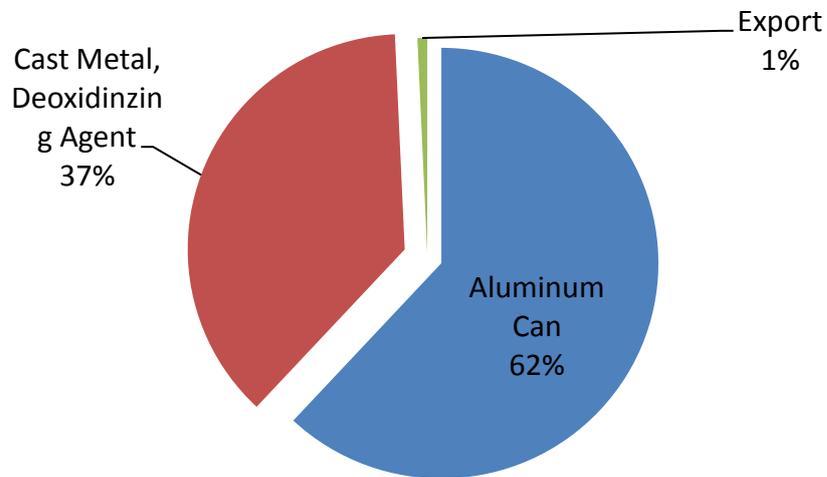


Figure 4.2: Product of Recycled Aluminum Cans

(Source: Japan Aluminum Can Recycling Association)

KARS (Kitakyushu Akikan Recycle Station) is a metal can recycling company, which is located in Kitakyushu City, Fukuoka. It is established in 2000 (H12), and the main service is beverage metal can recycle. Figures below show the Images in KARS.



Figure 4.3: Equipments in KARS

(Source: KARA)

There are two factories of KARS to deal with the whole recycling process. Factory one is in charge of material (steel/aluminum) separating, foreign matter

checking and compressing. After compressing, these metal cubes are sent to the next door—Factory Two. Factory Two is in charge of the process of making metal pellet.

Regardless of what material the cans are made from (steel or aluminum), all lids of beverage cans are made of aluminum. It contains about 10% aluminum (lid part) in each steel can, and the price of aluminum is higher than steel. Figure 4.4 shows steel can and aluminum lid before assembling. In order to improve the purity of their products, KARS separates the aluminum lid parts from steel cans in Factory Two. It is the first and the only can recycling factory which is able to do this process.



**Figure 4.4: Can with Aluminum Lid (Before Assembling)**

The main benefits of RVM (Reverse Vending Machine) are material (steel/aluminum) separating, foreign matter checking and volume compressing. If RVM could be installed widely, KARS can save all the processes of Factory One. In reality, KARS is not dealing with these beverage cans for only one city. The sources of these beverage cans are available in huge amount. Because of different rules from municipalities, KARS cannot ask all of them to separate different material of cans (steel/aluminum) or do foreign matters checking.

Consequence, whether or not they are separated, all these metal cans have to go through the same separating process. Of course, it is helpful for them if the material has been separated on site, but it is difficult to practice in reality. Until now, there are very less RVM practice in Kyushu Island.

#### 4.1.2 PET Bottles

Figure 4.5 shows the eco friendly mark, which is used on the PET recycled products. After disposing by consumers, PET bottles are transported to municipalities. It will be stored up by municipalities for a while, and then recycling manufactures are in charge of collecting, picking out foreign matters, compressing and then storage. PET bottles are compressed into bales in this stage. One PET bale is composed of 600 PET bottles, and weight 16 kg in average.



Figure 4.5: Recycled PET Bottles Used

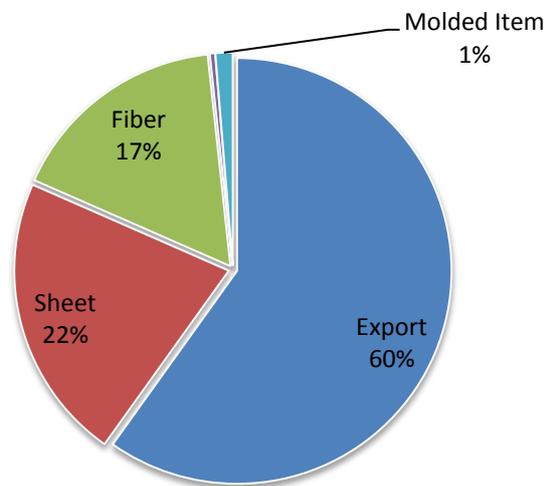
(Source: The Council for PET Bottle Recycling)

In recycling manufacture, these PET bales are crashed into small flakes, which can be processed into variety of applications, such as window curtains, tapes and other molded items. Figure 4.6 shows the PET bale and processed raw materials.



Figure 4.6: PET Bale and Raw materials

According to the data from The Council for PET Bottle Recycling, there is a huge amount of used PET have been sent aboard. Most of these used PET are sent to China. Figure 4.7 explains the outputs of recycled PET bottles in detail. In Figure below 60% of used PET is exported to outside Japan. In October of 2008, the worldwide financial crisis also ruined the PET recycling market in China temporarily. The price of used PET in Japan also experienced a dramatically fluctuation. In 2009, the price of PET bales grows steadily, and the average price for exporting is around 43 JPY/kg. The amount of export in 2009 is approximate 261,000 tons.



**Figure 4.7: Product of Recycled PET bottles**

**(Source: The Council for PET Bottle Recycling)**

NPR (Nishi-nippon PET-Bottle Recycle Co., Ltd) is located in Kitakyushu City, Fukuoka. It was established in 1997. The main shareholders are Nippon Steel Corporation and Mitsui Co., Ltd. Each of them has 29% of total share. NPR works 24 hours per day with the capacity of 20,000 tons per year in average.

There are plenty applications of these PET pellets or flakes. It can be used widely as raw material in several manufacture industries to produce clothes, bags, or other plastic related products. Technologically, it is also possible to produce PET

bottles by these pellets. Because of the view of consumers, these pellets are mainly used in different industry, but not PET bottle manufacture.

In NPR's view, the use of RVM could save the foreign matter picking part in their recycling process, but it is out of their duty. NPR only deals with recycling part and PET bottles' collecting is not its responsibility. Same as KARS, NPR services a lot of cities, and RVM with small scale makes no different to their whole process.

## **4.2 RVM and Technologies**

The research finds out that, there are at least 3 RVM makers are existed in Japan. They are TOMRA JAPAN, ENVIPCO JAPAN and STEC. Although the principles and technologies of RVMs are very similar, their market strategies are different.

It is worth noticed that TOMRA and ENVIPCO are foreign companies, thought, both of them work with local Japanese companies to support locality. TOMRA JAPAN puts more attention on Kanto Area (Capital Area), and ENVIPCO JAPAN shares the market in Kansai Area. On the other hand, STEC is 100% ventures exclusively with local Japanese company's investment. Since the technology is no big different, the market direct might decide the success of projects.

### **4.2.1 TOMRA JAPAN**

TOMRA JAPAN is set in 2008. The main shareholders are Sumitomo Cooperation (50%) and TOMRA Systems Japan (50%). Sumitomo Cooperation which also has great experience and performance in the fields of machinery, chemical products, shipbuilding and construction. These two companies work together to establish the RVM market in Japan. TOMRA JAPAN not only produces PET bottle recycling machine, but also machines for recycling cans and glass bottles.

The technology of TOMRA JAPAN is no big different from the other competitors. When putting the PET bottle into TOMRA RVM, device inside works. In order to decrease the volume for storage, device separates different materials, and then crumbles or compresses PET bottles or cans into small pieces. It is regarded that TOMRA RVM can save 7/8 space for storage, and could help the transport and recycling process to work more efficient. The following table 4.1 shows the current RVM models, which are provided by TOMRA in Japan.

	T63 PET	T63 CAN	T63 Trisort	UNO
Separation	Transparent / Color	Aluminum / Steel	PET / Can / Glass	PET / Can / Glass (second-term election)
Treatment	Crumbling	Compressing	PET: Crumbling Can: Compressing Glass: No	No
Speed	2 sec. / Bottle	2 sec. / Can	2 sec. / Unit	3 sec. / Unit
Storage (Unit: Bottles or Cans)	Transparent-600 Color-40	Aluminum(350ml)-1000 Steel (350ml)- 650	Right Storage: <ul style="list-style-type: none"> <li>◦ Transparent PET-600</li> <li>◦ Color PET-40</li> <li>◦ Aluminum (350ml)-1000</li> <li>◦ Steel (350ml)- 650</li> </ul> Left Storage: <ul style="list-style-type: none"> <li>◦ PET /Can /Glass- 600</li> </ul>	Upper Storage: <ul style="list-style-type: none"> <li>◦ Cans (350ml)-250</li> <li>◦ PET (500ml)-175</li> <li>◦ PET (1.5 L)-61</li> </ul> Lower Storage: <ul style="list-style-type: none"> <li>◦ Glass (330ml)-250</li> <li>◦ PET (500ml)-200</li> <li>◦ PET (1.5 L)-75</li> </ul>
Electricity Input	208V 50/60Hz 16A	208V 50/60Hz 16A	208V 50/60Hz 16A	100V 50/60Hz 10A
Size	W760 x D1042 x H1892 (mm)	W760 x D1042 x H1892 (mm)	W1520 x D1042 x H1892 (mm)	W800 x D600 x H1830 (mm)

**Table 4.1: Specification of TOMRA RVMs**

(Source: TOMRA JAPAN)

There are more than 300 RVM have been installed within Japan. Most of them are located in Kanto Region and Choubu Region. There are three types of container refund: point card, lottery, and cash coupon. Until now, there are more and more companies and institutions are willing to set up RVM, such as Higashi Kurumi

shopping center, Sumitomo Cooperation and Kanazawa-sogo High School. Figure 4.8 shows the images of TOMRA RVM.



Figure 4.8: Images of TOMRA RVM

(Source: TOMRA)

#### 4.2.2 ENVIPCO JAPAN Co., Ltd

Headquarter of the ENVIPCO Holding N.V is located in Connecticut, USA. Fuji Electric Co., Ltd is also famous for industrial machines and electric applications worldwide. ENVIPCO and Fuji Electric Group have worked on beverage container recycling projects since 1996. In 2002, these two companies set up ENVIPCO JAPAN in Osaka to promote RVM.

Since the office of ENVIPCO JAPAN is located in Kansai region, they also started their project from Kansai Region in the beginning. Avoiding the first line in capital area, their experiences in Kansai region also bring their RVM into Kanto Region recent years.

The technology for crumbling and compressing are not so different from TOMRA. As the other competitors, ENVIPCO can also arrange the types of incentive according to the request of consumer. Point card, lottery and cash coupon are all available for their system. Table 4.2 is the specification of current RVM models by

ENVIPCO. In order to response to customer needs, it also provides some optional devices, such as LED display or off-site operating device.

	Metal Cans RVM	PET Bottles RVM
Target Containers	Less than 1L	Less than 2L
Speed	25 Cans/ min	25 Bottles/ min
Treatment	Compressing	Compressing
Storage	1500 (350ml)	350 (500ml)
Separation	Steel / Aluminum	Transparent / Color
Electricity Input	AC 100V, 50/60Hz	
Size	815 (W) x 838 (D) x 1900 (H) mm	
Weight	350kg	
Incentive	Point Card	
Common Part	<ul style="list-style-type: none"> <li>◦ Barcode Reader</li> <li>◦ Non Target Containers Rejecter</li> <li>◦ Self-Diagnose Function</li> </ul> Option: <ul style="list-style-type: none"> <li>◦ Point Card / Coupon Refund Device</li> <li>◦ LED Display</li> <li>◦ Off-Site Operating Device</li> <li>◦ DATA Communicating Device</li> </ul>	

**Table 4.2: Specification of ENVIPCO RVMs**

**(Source: ENVIPOCO JAPAN)**

Figure 4.9 shows the relationships among these stakeholders. Envipco plays a role to build a network between municipality, retailer, and recycling company.

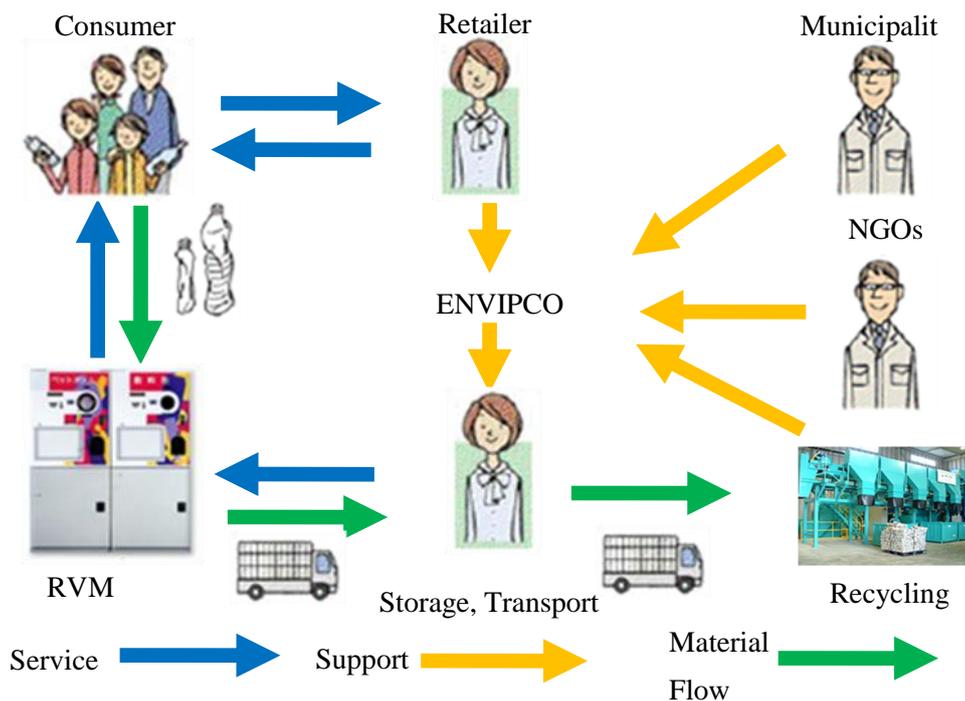


Figure 4.9 Network of ENVIPCO RVM

(Source: ENVIPCO JAPAN)

### 4.2.3 STEC

Lucky Can RVM is provided by STEC. Lucky Can RVM provides metal cans recycling service only, PET bottles or the other materials are not acceptable. Attempts have been made to contact their sales group, but Lucky Can RVM had been removed from product list on their official website. STEC focuses IT orientated service and related hardware now. According to their introduction, there are still some practices within Japan. Thought, only one Lucky Can RVM (out of service) is found in Kyoto—it is sure that Lucky Can RVM is still running somewhere. On some personal blogs, there are some bloggers shares their experiences of using Lucky Can RVM in 2009. Figure 4.10 shows the images of Lucky Can RVM.



Figure 4.10 Images of lucky Cans

(Source:<http://blog.goo.ne.jp/negokunta/e/9ec7319d0f5e71f6c3ccd5d41eae65eb>)

Although the market share of STEC decreased, it is still an interesting example of beverage can recycling machine. In order to encourage the recycling behaviors, Lucky Can combines recycling machine with slot machine. When customers put one can into the slot, Lucky Can can distinguish the material of the container (steel or aluminum). If there is any foreign matter left inside or the material cannot be distinguished, Lucky Can may not work. For example, when a glass bottle is put in the slot, Lucky Can may not accept it, but makes some sounds to call the player's attention.

After distinguishing the material, Lucky Can RVM compresses and separates different materials into different storage. At the same time, display of slot machine works. When it shows the same picture on the row, player will get discount coupon. The probability of winning is around 10%. This program also involves local communities and stores, which provide discount coupon. Not only encourages the recycling behavior, Lucky Can also promotes the local economic development. Most of the Lucky Can machines are placed in cities with great population, such as Tokyo and Osaka. The specification of Lucky Can RVM shows in the following Table 4.3.

Maker	STEC Co. Ltd	
Weight	217 kg	
Energy Input	AC100V±10V(50/60Hz)	
Energy Demand	130W (Standby Mode), 1100 (Compressing Process)	
Functions of Parts	Slot	Horizontal style of slot accepts only one can each time. 190、250、350、500ml of aluminum or steel beverage cans are acceptable.
	Distinguishing Device	Distinguishing device can prevent foreign matter goes into the machine. After checking the material, it also separates the can into different storages.
	Compressing Device	Compressing device helps to compress cans into 1/5 sizes.
	Storage	Two storages can collect 1,000 can of each material (steel & aluminum)
	Printing Device	When player wins the slot game, it will print the discount coupon right away.
	Display	Lucky Can makes use of LED display to save energy demand, and it could also show advertisements on it.
	Other Devices	These devices provide the current information of Lucky Can. For example, when the storages are full or the compressing device is breakdown, it will show error signs on display to inform the player not to put can into the machine anymore.

**Table 4.3: Specification of LUCKY CAN**

(Source:Lucky Can, STEC)

Although it is very attractive for children that STEC combines RVM with slot machine, most Japanese are more practical, especially housewives. In general, they love to accumulate one penny by one penny, than bet on one chance just for discount coupon.

## **Chapter5. Stakeholders**

For a better understanding of the current situation in Japan, stakeholder dialogue technique was used. A period of one month dialogue and observation is carried out in various locations in Japan including those have been introduced above. Target stakeholders were identified—these include target companies, municipalities, NGOs and consumers in Northern Kyushu, Kansai Region and Kanto Region.

There are at least 600 reverse vending machine machines have been installed and operated within Japan, though consumers are still not well familiar with them. Also, there is no bottle deposit regulation in Japan, so that the low-profit bottle refund cannot catch the public or consumers' attention. For the target companies, recycling companies and retailers are still playing a passive role in RVM installation. This chapter will explain the current situation and practices which have been observed during the field trip and during the dialogue with stakeholders.

### **5.1 Target Company**

The most important aim of the Containers and Packaging Recycling Law is to involve the target companies into the recycling chains. Company which produces beverage package, container or make use of these products are obligated to be responsible for its products or to recycle it. In general, it includes all the large enterprises and part of small and medium enterprise (SMEs) that have been mentioned in section 2.3. From this section, information is given in detail of the practice of bottle recycling experience and their understanding toward RVM.

### **5.2 Beverage Manufactures**

Beverage Manufactures are the main target companies, which are involved by the Containers and Packaging Recycling Law. The research established four dialogues with four beverage manufactures—the Suntory Beer, Coca-cola, Kirin

Brewery and Asahi Soft Drink. Responses from CSR (Corporate Social Responsibility) departments were collected; and below is the brief summary:

- **Suntory holdings limited**

The company visit was arranged with CSR department of SUNTORY HOLDINGS LIMITED to its factory in Kyoto. Suntory group was established in 1899, and it is also one of the biggest beverage manufactures in Japan with a total sales revenue of around 155 million JPY (approximate 2 million USD) in 2009, and 91% of their sales is related to soft drinks, beers, health supplements, and other related foodstuffs. Market direct is Japan—accounts for 86% of their sales. Suntory Group also produces other famous international beverage brands such as Pepsi (soda drink), Lepton (tea) and Häagen-Dazs (ice cream) in Japan.



**Figure 5.1: Assembling & Filling Up Stations and Outdoor Storage for Returnable Containers**

**(Empty Tanks and Glass Bottles)**

Kyoto Factory produces many different kinds of beers; and the production is at least tons of beers per day. Figure 5.1 shows the assembling & filling up station and outdoor temporarily storage for empty-returnable-containers in Suntory Beer of Kyoto Factory.

Suntory Group pays high attention to the sustainable issues recent years, but it more focus on the product manufacturing and waste control of raw material. These environment friendly activities of Suntory Group emphasize the whole manufacturing

process, including protecting water resource, quality and waste control to reduce package materials. In 2009, the recycling rate reached 100%, which means all products, materials, or wastes they produced can be recycled or reused again.

Except returnable tanks and glass bottles, Suntory Group is not the one who executes the recycling process for PET bottles and metal cans. It is, however, understood that Suntory set the system boundary and their responsibility is defined yet voided after their products are shipped to retailers. And Suntory Group is not the only beverage company which has this kind of practice.

- **Coca-Cola (Japan) Company, Limited**

Coca-Cola (Japan) Company, Limited was established in 1957. The total sales revenue reached around 194,834 million JPY in 2010. There are more than 500 related subsidiaries, branch offices, factories companies within Japan; and each of them has their own position to divide the work from marketing, developing & research, beverage manufacture, transport to sales and recycling.

Tamo Factory in Tokyo is one of the beverage manufactures which they called “bottler”. The responsibility for a “bottler” includes producing beverage, transport of raw material and product, sales, and recycling. Same as Suntory Group, the recycling rate of Tamo Factory had reached 100% in 2009. According to the containers and packaging recycling law, they set up plenty of recycling boxes beside their vending machines, but most of their beverage containers became household waste.

It had run RVM temperately with TOMRA Company in Omotesando, Tokyo. The visitation was made to Omotesando which is the area of great amount of department, fashionable brand shops, and fancy stores. Takeshita dori and Meiji Jingu nearby also attract thousands of tourist and fashion tracing young people every day. In 2009, Coca-Cola (Japan) Company, Limited had set up TOMRA’s RVM for

short-term commercial and marketing campaign, but now none of them exists anymore.

- **Kirin Brewery Company, Limited**

Kirin Brewery Company, Limited was established in 1899, and it is also one of the biggest beverage manufactures in Japan. Especially, they have great market share of alcohol beverage in Japan. In 2009, the total sales revenue reached 2.3 trillion JPY (approximately 270 million USD), and 80% of the sales is food and beverage related. Soft drinks account for 30%, and alcohol beverages account for about 50%. Their main market is Japan, it accounts for 73% of their sales in 2009. Kirin Group also produces other famous international beverage brands such as Tropicana (juice) and Volvic (mineral water) in Japan.



**Figure 5.2: Images of Kirin Beer, Kitakyushu Factory, Fukuoka**

Kirin Beer Kitakyushu Factory is located in northern Kyushu Island in Japan, and it could produce at least tones of beers per day. According to their CSR department, all factories of Kirin Group are trying to approach the target of zero emission and environmental friendly manufacture recent years.

In Japan, the shape of beverage containers is not fixed by law, so that every beverage manufacture is working on creating more attractive beverage containers to catch consumers' attention. On the other side, Kirin Group and Suntory Group purchase the same aluminum lids for their beverage cans. These two beverage

companies also combine their products for saving delivering cost and CO<sub>2</sub> emission for transport.

Although, Kirin Group works very hard on sustainable tasks, they are failed short behind other companies in the same business category when it comes to after sale recycling process. Kirin Group is like the other beverage manufactures. They are willing to research, develop or make use of recyclable raw material, but they cannot keep eyes on the whole recycling process after sales. When questioned about RVM, their CSR group gave a polite answer, saying that thank you for the advice. It seems like that RVM does not tended into any short or long term planning of the company.

- **Asahi Soft Drink CO. L td**

Asahi Group was found in 1949 with sale revenue around 1.5 trillion JPY (approximately 17 million USD) in 2009. Soft drinks account for 25% of their sales where alcohol beverages account for 65% of the share.

Visit to Asahi Soft Drink Akashi Factory, which is located in Hyougo, Kansai Area, yields below finding. The company works for 24 hours per day, and produces more than 20 kinds of soft drinks, including soda water, juice, coffee, and tea. Most of beverage manufactures in Japan has PET bottles forming process in their factory, and same as Akashi Factory.



Figure 5.3: Images of Asahi Soft Drink, Akashi Factory, Hyougo

They purchase pre-form tubes then form them in the factory, just like the any other beverage manufactures. The idea of RVM is to decrease the volume of used PET bottles and cans to save transportation expenditure. Somehow the idea of pre-form tubes is similar with RVM—decreasing volume to save transportation / logistic cost. Also, recycling rate in Asahi Group reached 100% in manufacture side in 2009.

Overall the beverage industry in Japan, they have good performance on environment issues. They are willing to research and develop new material to save cost and also create more eco-friendly environment, but it all focus on the vision of manufacture. Although it is also their responsibility by law to take care of their used bottles, they put more attention on returnable bottles. As a result, they prefer to entrust third party recycling companies to handle all of this one-way bottles / cans than doing it by themselves.

### 5.2.1 **Retailer**

According to the Containers and Packaging Recycling Law, it is necessary for retailer to recycle the container and package. As the reason, it is very common to see recycling boxes in front of supermarket, convenient store, and even beside vending machine. In generally, supermarket is the most common place for daily shopping. According to the data from chain supermarket Daiei, 17 tons of aluminum cans (about 870,000 aluminum) and 13 tons of PET bottles (about 270,000 PET bottles) were collected within one month in March, 2011. Daiei has more than 100 supermarkets across Japan and they are still using the most common way like the other supermarkets —setting recycling box in front of stores. Figure 5.4 shows the images of these recycling boxes in front of supermarket, convenient store, and beside vending machine.



Figure 5.4: Images of Recycling Boxes

Because retailers are the executor of the containers and packaging recycling law in the front line, so a lot of retailers have been involved in RVM project. Take MaxValu for example, they had set up RVM in relatively small Aioi City, Hyogo, and Ichigawa City, Chiba. MaxValu has more than 600 shops all over Japan, but not all their shops have RVM installed.

The reason is very clear. Most of these retailers get subsidy, support or pressure from local municipalities. According to the “Proposal for Container Recycling System” (2003, Organization of Kansai Unity), it costs at least 6.7 million JPY (about 79,000 USD) per year to run one RVM project. (2 RVMs for cans and 2 RVMs for PET bottles)

Within these cost, retailer may cover the daily maintenance, electricity expense, and eco-point bottle refund to customers. It is about 1.8 million JPY (about 21,000 USD) per year. It is impossible for retailers to install RVM for at their own cost.

Dialogue with the retailers suggested that most of the retailers just play passive roles to cooperate with municipalities.

### 5.2.2 Other Target Companies

According to the definition of target companies in Chapter 2.3, educational institutes, non-profit organizations, juridical entities, hotels, and restaurants are also involved in the containers and packaging recycling law. By observation, these kinds of stakeholders have low interested in RVM. Due to the sale of beverage is not the main financial resource, RVM installation brings more cost than benefit.

Eventually, there are still a few educational institutes or schools that are willing to install, yet it more under the premise of building awareness and environment education. Tokyo Polytechnic University in Kaminagawa is an example. There are around 5000 students and employees, and it has installed RVM in Atsuki Campus.

The deposit between retailer and beverage manufacture has run for a long while, although it is not an official regulation. Therefore, restaurants which provide beverage with returnable glass bottles would like to return these used glass bottles to beverage manufacture. Beverage manufacture may send these bottles to their factory, then cleaning and refilling up. The returning rate of these returnable glass bottles almost reaches 100%. On the other hand, used glass bottles from household are all so-called one-way bottles. They may not be sent back to beverage manufactures, but crash into piece then ship to glass recycling companies.

From another point of view, PET bottles and steel/aluminum cans are all one-way containers, which cannot be cleaned up and refilled. At the moment, sending to recycling companies is the only solution for used PET bottles and cans. Since the deposit of PETs and cans is not existed, it is understandable that restaurants and retailer are not so keen on collecting these recyclable wastes.

## **5.3 Municipalities**

In Japan, municipalities are in charge of household waste. The main task of municipalities is to set up the rules for residents to follow, and also educate the public how to separate the recyclable household waste. Additionally, they also have to provide proper collecting, cleaning process and storage for these recyclable household wastes. In order to deal with these household wastes, some municipalities cooperate with Designated Juridical Persons (The Japan Containers and Packaging Recycling Association), which can help them to find a way for these recyclable household wastes.

In order to prevent litter strewn on the street, some municipalities take reverse vending machine into their consideration. Because there is no regulation of beverage container deposit in Japan, it is very difficult for the other participants to run RVM without any support from municipalities. Until now, municipalities are still the main player in RVM installation. It is very rare to have seen RVM installation—most of the installations are located in Honshu, the largest island of Japan. In the following section, some cases of RVM practice will be introduced.

### **5.3.1 Kanto Region (East of Honshu, Japan)**

Kanto Region is the capital area which composed of seven prefectures: Tokyo, Chiba, Kanagawa, Saitama, Gunma, Tochigi, and Ibaraki. During this field research trip RVMs are found in Tokyo and Chiba. In Atachi Ward and Chioda Ward, both of them chose TOMRA as their partner in RVM project. On the other hand, Ichigawa City picked FUJI Envipco as their partner. Below are the detail explanations:

- **Atachi Ward, Tokyo**

Atachi Ward is located north of Tokyo, and it is also one of the special wards of Tokyo. Since 2006, Atachi Ward has started the RVM project with TOMRA. Before this project, there were more than 18,000 recycling stops in this district. Although the recycling rate is up to 60%~70%, it contains a lot of foreign matters in the recycling boxes. It takes time and money to separate and pick these foreign matters out. These uncompressed waste also cost a lot when transporting.

In this attempt, Atachi Ward Office published “Eco Net Point Card” in 2006. All residents can register in the ward office and get registered-card for free. Until 2009, there are more than 48,000 point cards have been published. In recent year, they changed the old “Eco Net Point Card“ to IC cards—residents can also save eco-points easily in their Suica and Passmo, which are the most common transport IC card in Kanto Region. There are serial numbers on each IC card, so that it is no worry for resident if they lost their card. Old card will be invalid in 30<sup>th</sup>, Sep, 2011.

In order to lighten the burden of RVM installation, feed-in tariff for setting up RVM is around 99 JPY/kg in 2008. The Figure 5.5 shows some images of TOMRA RVM in Atachi Ward. Figure 5.6 shows the images of the new Eco-Point Card and Card Reader, which can be found in the service counter in each cooperating partner.



Figure 5.5: TOMRA RVM in Atachi Ward



Figure 5.6: Eco-Net Point Card and Card Reader

With this point card, every used PET bottle can earn 5 points (approximate equal to 0.5 JPY). People who earned 1,000 points can get 100JPY gift coupon. This gift coupon can be used in specific shops within Atachi District. It requires cooperation among local communities and stores. Because of the well communication and collaboration in the region, this project also won the excellent award of from Environment Minister in 2007. Until now, there are more than 70 RVMs had been installed in Atachi Ward.

- **Ichigawa City, Chiba**

Ichigawa City is located in northwest Chiba, and it is only 20 km from the capital area. Since 2006 Ichgawa City District has started the RVM project with FUJI Envipco, and published magnetic point card called “Ichgawa Ecobo card”, which can be used within Ichigawa City only. “Ichigawa Ecobo Card” not only focuses on the beverage container recycling, but also other volunteer activities. Residents who join the assigned volunteer activities in Ichgawa City can earn points also. These points exchange to assigned garbage bags or free admittance to several public infrastructures. Figure 5.7 shows the images of Envipco RVM and “Ichigawa Ecobo Card”.



Figure 5.7: Envipco RVM and Eco-Point Card in Ichigawa City

Until 2011, there are 8 Envipco RVM has been installed in Ichigawa City. In Ichigawa City, only metal can RVMs can be found. It is regarded that these metal can RVMs are installed as experiment (testing) in the beginning. If it works well, this project may extend to PET bottle RVM in the coming future. With Ichigawa Ecobo Card, this point card, every metal can earn 0.5 points. People who earned 100 points can get free entrance to public several facilities such as zoo, botanical gardens, pool or exchange for gifts.

### 5.3.2 Kansai Region (West of Honshu, Japan)

Kansai Region is also composed of seven prefectures: Kyoto, Osaka, Hyogo, Nara, Wakayama Shiga, and Mie. Several RVM installations are found there, and most of them picked FUJI Envipco as their RVM partner.

#### ▪ Suita City, Osaka

Suita City is located in northern Osaka. The best RVM practice is found in Foods Market SATAKE. It makes use of the RVM form FUJI Envipco, which does not require any magnetic or IC cards to earn point. After residents press the finish bottom, “Reco Ticket” will be printed right away. The word “Reco” is terms for recycle and ecology.

Each PET bottle and metal cans can earn 1 point, and the exchange rate is the highest compare to the other regions. 1 point is equal to 1 JPY, and the point can be used only in the store who publishes it. It not only saves the cost for point cards manufacture and management, but also promotes the sales and gives feedback directly to the stores who participates in this project. It is very common to see that residents lines up with huge bag of beverage containers as Figure 5.8 shown.



Figure 5.8: : Images of Envipco RVM in Suita City

The structure of RVM is designed simply and easily for market employee to maintain. For this reason, they can deal with basic operating problems quickly. Previously a research showed STEC RVM was found installed nearby Suita Station. Unfortunately, none of them still exists up to now. It seems like that STEC RVM is not existed in this region anymore.

- **Aioi City, Hyogo**

Aioi City is located in western Hyogo, and it is also famous for its shipbuilding industry. Since 2002, Aioi City has started the RVM project with FUJI Envipco, and published magnetic recycling point cards for recycling beverage containers. Everyone can get this point card in the service counter for free.

In the beginning, RVMs for both PET bottles and metal cans has been installed. Now, only metal can RVMs can be found in supermarket COOP and AEON. Each metal can, can earn 1 point, and 300 points can be exchanged for assigned garbage bags (300JPY). Figure 5.9 shows the Envipco metal can RVMs and magnetic recycling point card.



Figure 5.9: Images of Envipco RVM in Suita City

- **Ikaruga Town, Nara**

Ikaruga Town is located north Nara. They just started RVM project in 2008. Compare to PET bottles, the cost of recycling metal can is much cheaper. So that Ikaruga Town puts more attention on metal can recycling in this case. Same as the other practices, each metal can earn 1 point, and 500 points can be exchanged for gifts in the Town Office. Figure 5.10 shows the images of RVM in Ikaruga Town.



Figure 5.10: Images of Envipco RVM in Ikaruga Town

It is suggested (personal opinion) that RVM project does not run well in Ikaruga Town. It does not involve retailers in this case. These metal can RVMs are set up in front of Town Office, and other public lands. Not so many residents would like to go there just for earning points by metal can recycling.

Without supports from retailers, Ikaruga Town has to deal with all of the spending by themselves. In the other cases, retailers could in charge of gifts exchanging, electricity spending, basic maintenance and point card promotion, which cannot only provide more convenience RVM location, encourage residents, but also share the responsibilities of municipality. In this case, Environmental Department of Ikaruga Town has to carry on all of these tasks. Although this case is not so well-arranged, it is a good start for Ikaruga Town anyway.

- **Kameoka City, Kyoto**

Kameoka City is located western of Kyoto. It is a city between the city center of Kyoto and Osaka. A metal can RVM (FUJI Envipco) is found in front of a little alcohol beverage shop, Sake Ichiban, which sells different kinds of wine, beer, and Japanese sake. One metal can (350ml only) can exchange for 1 JPY discount coupon, but discount coupon is only valid on that day in the store. Figure 5.11 shows the images of RVM and coupon ticket.



Figure 5.11: Images of Envipco RVM in Kameoka City



Figure 5.12: of STEC RVM in Kameoka City (Breakdown)

The previously mentioned Lucky Can RVM was also found nearby Chiogawa station unexpectedly. Unfortunately, it looks like it had broken for a long while. Input slot is stuck, and also covered by spider webs. Figure 5.12 shows the images of Lucky Can RVM.

### 5.3.3 Others

- **Mizuho City, Gifu**

Mizuho City is located north of Gifu. Mizuho City District has started the RVM project since 1997. Mizuho City runs this project with TOMRA. Mizuho City would like to buy RVMs in the beginning, but the costs of these RVMs were over their budget too much. So they cannot help but renting RVM, and works with TOMRA with

contract instead. Different from the other RVM practices, their main target group is residents in Mizuho City only. So that the point cards are distributed to every family in the city and non-resident cannot apply for it. It is a little discriminate that residents live in nearby cities cannot make use of these RVMs. Each metal can or PET bottle can earn 0.5 point, and 500 points can be exchanged for gifts, such as toilet paper, garbage bags, and washing powder. Figure 5.13 and Figure 5.14 show the images of RVM and Eco-Point Card in Mizuho City.

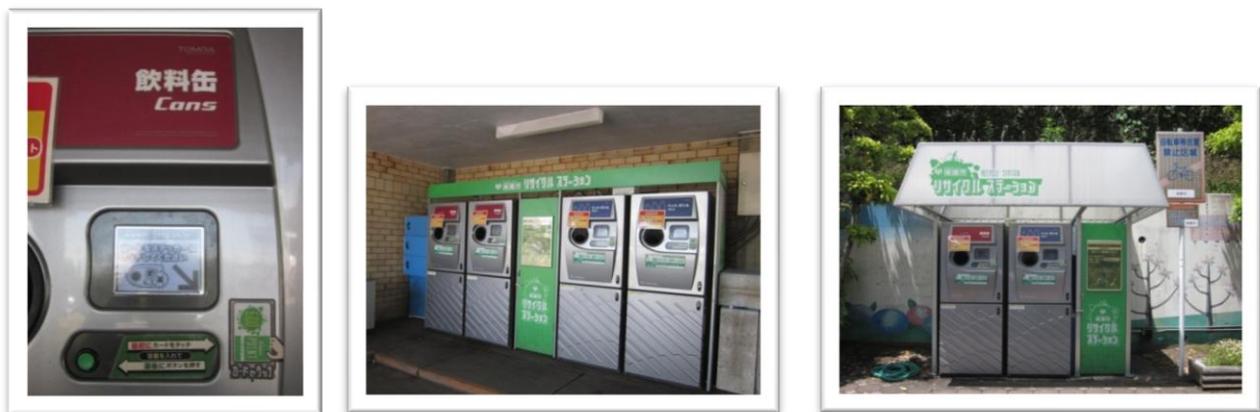


Figure 5.13: Images of TOMRA RVM in Mizuho City



Figure 5.14: Images of Mizuho Eco-Point Card

It is suggested (personal opinion) that for independent shops the best practice of RVM is the one (FUJI Envipco) in Suita City, Osaka. It promotes not only recycling activities of residents, but also profit of shops. On the other hand, the practice in Atachi District, Tokyo, is also very impressive. TOMRA RVM has high possibility to expand

into the other cities nearby Tokyo in the nearly future, since their system can combine with current transport IC cards (Suica, Passmo). Until now, there are more than 32 million transport IC cards (Suica: 24 million, Passmo: 8 million) had been published. It could be a huge amount of potential users.

## **5.4 Other Participants**

### **5.4.1 Consumer**

In Japan, each region has its own rules to deal with household waste. As a resident, it is necessary to follow the regulations, which are made by municipalities. Generally, consumers are asked to sort and clean up the recyclable household waste before they discharge it. But in practice, even if the residents do not follow the regulation, there is no penalty given. As a result, it becomes a focal topic that measure on how to encourage the public to join the recycling activities needed to be drawn to attention.

On principle, Japanese somehow cares about the others' criticism and public opinion very much, especially in small communities. In order to evade these criticisms, Japanese are willing to obey the rules which are set up by municipalities. That is why this system works smoothly under the supervision of every citizen.

### **5.4.2 The Japan Containers and Packaging Recycling Association**

The Japan Containers and Packaging Recycling Association is also a key player between municipalities and recycling manufactures. Although they do not have the power to decide anything for municipalities or target companies, they have the right to make a statement to influence the trend of the regulations in central government.

The following list shows more than 50% of municipalities entrust them with Glass Bottle and PET recycling process. (Metal cans are not target material by Containers and Packaging Recycling Law.)

- Glass Bottle (Transparent) : 51.4% ( 900 of 1750 municipalities)
- Glass Bottle (Brown) : 54.8% ( 959 of 1750 municipalities)
- Glass Bottle (Others) : 66.2% (1158 of 1750 municipalities)
- PET : 67.3% (1178 of 1750 municipalities)

Although the association does not deal with all the recyclable waste for all municipalities, it has huge network among municipalities, government, beverage and recycling manufactures. Every year, the association put work out for tender, and the recycling manufacture with lowest tender can win the bid. For municipalities and beverage producers, it is the easiest way to entrust the association with recycling process. The Japan Containers and Packaging Recycling Association have detailed list and information of related industry and companies.

## **Chapter6. Market Niches and Future Trend**

This chapter focuses on the consumer behavior and market niches in the coming future. Each country has different culture and social network. In the following section provide reflection on the back side of daily recycling practice to know more about the potential RVM market in Japan.

### **6.1 Consumer Behavior**

#### **6.1.1 Deposit**

As mentioned in the previous chapter, the recycling rate is very high in Japan on the other hand, deposit institutions are only used in some specific returnable glass bottles, for example beer and carbonated drinks. Wholesale traders charge retailers deposit for 5~10 JPY per bottle, and then retailers put this amount into their sales price. When consumer brings back the empty bottles, retailer will return the deposit to them. And also, the wholesale traders will return the deposit to retailers when they get their empty bottles back.

Base on different bottles or areas, consumer can get 1~10JPY/ bottle for returning the empty bottles. The price of deposit all depends on the acceptance between retailer and beverage manufacture. Although it requires the cooperation among consumers, retailers and beverage producers, consumers can not make any influence on the deposit system.

Unfortunately, according to the questionnaire by Japan Glass Bottle Association (2008), there is less and less people are willing to buy beverage with glass containers. The products which are sold in supermarket are almost so-called one-way bottles. The returnable bottles are used often in restaurants, because the customer may leave the bottles after finishing their drink.

Unfortunately, there is no deposit regulation in Japan for PET bottles and metal cans. Although it has been discussed for a long while, it cannot reach a conclusion. Beverage manufactures may worry about the market if they put the price of container deposit on their products, and it is also a long way for legislation. Since nothing is sure on this topic, there are some more different ideas come out. Some coffee shops (ex: Starbucks) start the activity “My Cup”, consumers purchase drinks with their own cups can have 20 JPY discount.

Figure 6.1 is another example for Paper Cup Refund. Consumers can purchase their drinks with their own cups with 10 JPY discount, or get refund by returning their used paper cups. Most of these paper cup deposit refund machines are set up in private area, such as office, school and city hall to avoid abusing.



Figure 6.1: Deposit Refund Machine for Paper Cup

### 6.1.2 Education and Social Participation

Until now, all the penalty systems in Japan have been set up only for companies that do not follow the regulations. Although all municipalities have their own rules for waste separating and collecting, there are no punishments for people who failed to separate household waste. So that it is very amazing practice that the recycling rate is still high under the situation without deposit and punishment.

Japan is a society which is tied with social participation strongly. From the elementary school, children are taught how to separate recyclable waste. Not only in the classrooms. It is common that schools arrange the visit to recycling center or beverage manufacture. Since their young grade, kids are taught to disassemble the milk carton, compress metal can, and remove the cap and label of PET after finishing their drink.

Public school plays an important role in learning process, and it is also somehow the center of the community. To attract the attention of school kinds, the styles of recycle promoting advertisements or newsletters is trying to cater to young people recent years. Public schools sometimes work with municipalities or companies to implement new recycling projects. With the financial support from government, a lot of recycling activities and research are done in the campus. It is the easiest way to test the market and to collect research data.

It is observed that schools play an important role in the learning process, and housewives also have important positions in practicing. Housewife is a very powerful group when talking about social participation. There are more than 20 million housewives in Japan, and they pay more attention on living environment than the other groups. These housewives not only follow the fixed rules, but also take part actively in waste recycling and even initiate or join some related activities as voluntaries.

### **6.1.3 Loyalty Card Service**

In order to promote the sales or purchasing behavior, point card is a very common tool in Japan. In electric shops, consumer who purchases eco-friendly household appliances can get more points than the other products. When consumer shopping in super market with their own bags, they can earn points and exchange to gift coupon. On the other hand, the case of loyalty card for container recycling is relatively

not so common. As mentioned in Chapter 5, there are some municipalities have published Eco-Point card for residents to gain point. Figure 6.2 shows the Shinjuku Eco Point Card.



Figure 6.2: Shinjuku Eco Point Card

(Source: Shinjuku Ward, Tokyo)

It can be conclude that loyalty card service has its advantages and disadvantages. For the good part, it is a plus if loyalty card can combine with the other social activities or campaign. As mention in section 5.3.1 “Ichigawa Ecobo Card” not only can save eco points by recycling beverage container, but also gain some more points by joining volunteering activities. In average, everyone has at least 5 membership cards or more in Japan. It is really troublesome to carry them all the time. As the reason, if Eco-Point Card can combine with the current card, such as credit card, membership card or transport card. Combine membership care can make the practice a lot easier and make it more convenient to consumers. Also it may increase the willingness of customer to come back to shop.

Although a lot of supermarkets have published their own membership cards, all of these current Eco-Point Cards are published by municipalities. The cost for printing and maintenance have to be took into consideration also. It is another issue about the personal information disclosure when the loyalty card is lost.

## 6.2 Industry

### 6.2.1 Target Company

Since the Containers and Packing Recycling Law had extended the responsibility of producer, target companies which do not obey the Containers and Packing Recycling Law may be fined up to 1 million JPY. It is their responsibility to put recycling mark on their product, and also recycle the used containers. Under the regulations, beverage producers have three routes to implement the policy. The detail has been explained in Chapter 2.

- Route 1: Voluntary Recycling Route (Reusable Material)
- Route 2: Individual Route (Recyclable Materials)
- Route 3: Cooperate with Designated Juridical Persons

Compare to the idea of “beverage container recycling”, target companies are more into “reduce” and “reuse” raw material for container package. Recent years, many beverage manufactures are willing to development new materials for lighten the weight of containers. Figure 6.3 is an example of I-lohas mineral water, which could be produced through mass production already.



Figure 6.3: Image of i-lohas PET Bottle

(Source: <http://i-lohas.jp/>)

I-lohas mineral water is produced by Coca-Cola (Japan) Co., Ltd. In 2010 this product won the award of promoting circular society from ministry of the environment.

It lightens the 500ml PET bottle from 21g to 12g. This new bottle is much easier to be compressed after consuming. This development not only can save the material use, but also save the cost and space for transport.

Not only PET bottles manufacture, most of beverage manufactures in Japan are also working on the product design to reduce material use. However, there are not so many beverage manufactures go into detail for the afterward recycling process.

### **6.2.2 Recycling Company**

Recycling manufacture is not an active player in promoting recycling behaviors, neither. Recycling manufactures cannot influent the consumer behavior directly; instead, they focus more on improving recycling and refining process. According to the contract with target companies or municipalities, recycling company can get commission by weight. The more recyclable waste they treated, the more they can earn.

## **6.3 Other Participants**

### **6.3.1 Municipalities**

Municipality is the main player in the locality. It is the rule decider, executor and also the supervisor. As a rule decider, every municipality is asked to set up 5 years plan and annual report every year, and most of the recycling projects are initiated by them. As an executor, municipality has to carry out the responsibility of separating, collecting, foreign matter removing, transporting and storing. As a supervisor, all residents, companies and organizations in locality are their supervising targets. The recycling process runs under the supervision of municipality. It is also in charge of encouraging and educating the public. With the resource from government, municipalities are more probably willing to push new recycling project.

Organization of Kansai Unity did the following spreadsheet two Tables 6.1 and 6.2 to calculate the cost of RVM project. Table 8 shows the cost of RVM Station installation per year by different models. In Model A, municipality works independently, while in Model B, municipality works with external support from retailers.

Model A	Cost (million JPY)		Item	Cost (million JPY)		Model B
Municipality	6.7	3.14	RVM	3.14	3.9	Municipality
		1.36	Regularly Maintenance	1.36		
		-0.6	Income	-0.6		
	1.5	1	Transport, Storage	1	1	(Municipality)
			Daily Maintenance	0.5	1.8	Retailer
		1.06	Eco-Point	1.06		
		0.24	Electricity	0.24		

**Table 6.1: Cost of RVM Station Installation per Year by Different Model**

**(2003, Organization of Kansai Unity)**

According to the table, the total cost of a RVM project costs at least 6.7 million JPY. If retailer can take part in the project, it could share the budget burden for municipality. Table 9 shows the cost per year by different materials. According to the table, the total cost for setting two metal can RVM is around 1.8 million per year, and 7.2 million JPY for PET RVM. In Model A scenario, it costs municipality 1.8 JPY/ metal can, and 7.2 JPY/ PET. In Model B scenario, it costs municipality 1.1 JPY/ metal can, and 6 JPY/ PET. The more station they installed, the lower the cost could be.

	2 RVM Station			10 RVM Station			20 RVM Station		
Amount of RVM	CAN x 2, PET x 2			CAN x 10, PET x 10			CAN x 20, PET x 20		
Target Market	10,000 People			50,000 People			100,000 People		
Material	Aluminum	Steel	PET	Aluminum	Steel	PET	Aluminum	Steel	PET
Amount of container (million containers)	0.83	0.83	0.48	4.11	4.09	2.38	8.3	8.2	4.8
Weight (ton)	13.6	29.4	19	68	147	95	136	294	190
A	Cost (JPY/Year)	6.7 million JPY		32 million JPY			56.5 million JPY		
	Cost (JPY/Container)	1.8		7.2	1.7		6.9	1.5	
B	Cost (JPY/Year)	4.9 million JPY		23 million JPY			37.6 million JPY		
	Cost (JPY/Container)	1.1		6	1		5.7	0.8	

**Table 6.2: : Cost of RVM Station Installation per Year by Different Materials and Models**

**(2003, Organization of Kansai Unity)**

### 6.3.2 Interest Groups

Guild is a formal association of companies with similar jobs. For example, in beverage industry, there are associations such as Japan Soft Drink Association or Brewery Association of Japan. Container producer includes Japan Glass Bottle Association and The Can Manufactures Institute of Japan. And recycling promotion includes Japan Aluminum Can Recycling Association and The Council for PET Bottle Recycling.

These interest groups provide a network of information-sharing within the industry. Becoming a member of guilds somehow mean a company is certified. All of the members have to follow the regulations set by guilds, such as providing data, pay the dues or coordination of the activities. As the result, guilds and associations can get complete data easily and can have influence on their members. Even government

sometimes also has to rely on guilds and associations to collect data. In Japan, it is a very common way to gather stakeholders in the same business category.

## **6.4 Future Trend**

According to the evaluation report of Containers and Packaging Recycling Law (2006, Ministry of Economy, Trade and Industry), the market trend may go toward the following points in the coming future.

The current recycling process depends on the voluntary supports from residents to separate and clean the recyclable waste. However, the quality of collected household waste, somehow, is not treated properly. It contains foreign matters which could be an extra cost for picking them out. These foreign matters could also affect the quality of recycling process. Therefore, it is estimated that in the coming future, there will be new technology which can be used to separate the household waste, or the regulations of discharging will become stricter and stricter. In order to reduce the amount of waste and save the cost of waste treatment, some municipalities are planning to charge their residents for discharging household waste.

Besides the three recycling routes mentioned in Chapter 2, it is considered that retailers will share municipality's responsibility in the coming future. In practice, municipalities collect most of the recyclable household waste in the current system. In order to share the burden of municipalities, it is predicted that regulation will be extended, and retailer stores will replace part of the function of municipalities. RVM is also under consideration these years; because it could help to reduce the foreign matter, compress the volume of containers and save the personnel and transport costs. However, this idea not yet reaches a conclusion.

## **Chapter7. Conclusion**

### **▪ Any Difference Recycling Practices between City and Countryside?**

The amount of waste disposing per person is no big difference between big city and countryside across Japan (Tokyo: 1098g/day, Beppu City: 1073g/day). The location to installed RVM, however, suggests the advantages. In order to increase the utility rate of RVM, it is recommended that installations are placed with high density of population.

Location of RVM installation could affect the recycling activities of residents. Some municipality independence models set up RVM in public land. It is disadvantage that only few people are willing to go there specifically just to use RVM machine just for a penny of refund. In general, supermarket has good performance in gathering recyclable waste. Even without any refund, it is common to see residents bring their recyclable waste to supermarket while shopping.

### **▪ Who May Get Benefits from RVM?**

In Japan, the current recycling process is very complete and well-practiced already. According to the high recycling rate, the separating and collecting process which is based on voluntary support runs very smoothly in Japan. As the result, RVM system without refund is not attractive at all. The case of Envipco, TOMRA and STEC RVM are somehow providing a kind of refund.

Furthermore, there is no deposit institution for beverage container in Japan. The refund form RVM is only provided from municipalities and stores in locality. In the case of Atachi District, RVM project runs with feed-in tariff project. For people who set up the RVM can get 99JPY/ kg as the subsidy for installation.

From the viewpoint of recycling manufactures, the more the recyclable waste they collect the more benefit they can get. As mentioned in Chapter 2, no matter the

recycling behavior of consumer is strongly related to the quality and quantity of their works, recycling manufactures do not take RVM into consideration. They are more focus on their refining works.

In the case of Japan, since the container deposit is not existence, there is nobody who can get huge benefits from RVM. According to the calculation in Chapter 5, in order to run a RVM project, both municipality and retailer have to spend more than what previously spent conventionally. Although RVM is a new approach of recycling behavior, it is better way to cooperate with the other industry, association or stores in locality as much as possible to create another win-win situation.

- **Who is The Potential Customer? Who Can Provide Financial Support?**

The best way to approach the target is to work with municipalities, which have a lot of resource form central government. As mentioned in the previous section, retailers and recycling companies cannot earn so much on RVM. The installation, maintenance and cost for energy demand are all extra cost for them. That is why they are not willing to set up RVM.

As a result, NGOs or municipalities could be potential customers. Municipalities represent the government in locality. Municipalities cannot only get financial support from government easily, but also have network to cooperate with local association or guilds.

Besides the municipalities, recycling association and school could be another option. These Non-profit organizations do not care about the profits, but social responsibility. RVM could be a tool for arouse the public's attention, and it is also a good practice to educate school children the value of recycling behavior.

Except the subsidy from government and municipalities, big beverage companies, chain stores or other organizations with CSR (Corporate Social Responsibility) target annually may have budget for giving back the public. Small

retailers may not take the initiative as a leader in RVM investment in the beginning, but it still have some spaces to discuss—for instance if it shows that RVM can bring them more customers, small retailers may be willing to join the partnership.

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