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Volume-Based Waste Fee System

1. Introduction

In order to reduce waste generation at the source and maximize waste recycling, the Korean government introduced the Volume-Based Waste Fee (VBWF) system in 1995.

In Korea, local municipalities have a responsibility to collect, recycle and treat municipal solid waste from household, small business and commercial sectors. Traditionally, all municipalities levied waste fee on each household through property tax or monthly lump-sum fee. Under this fixed-fee system, cost per each residence remained constant regardless of the amount of waste generated, which created a false impression that management services of municipal solid wastes are free of charge.

Households and commercial sectors are required to purchase designated VBWF bags to throw away their garbage under the VBWF system. This way, the public has more incentive to generate less waste because they pay for waste treatment in proportion to the amount they dispose. By providing a free collection mechanism for recyclable waste, VBWF induces the public to be more active in waste separation and promotes waste recycling.

After 8 years of implementation, the VBWF system has proved to be very successful in curbing the municipal solid waste generation in Korea. Between the periods of 1994~2001, municipal solid waste generation has decreased by 16.6 percent, and at the same time, the recycling rate increased from 15.7 percent in 1994 to 43 percent in 2001.

This first volume of the Korea Environmental Policy Bulletin gives an empirical review on the performance of VBWF system in reducing municipal waste in Korea.

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2. Policy Features

2.1 Objective

The main objective of the Volume-based Waste Fee (VBWF) system is two-fold: to impose waste treatment cost on each polluter based on the amount of waste generated, and to provide free collection service for recyclable wastes, thereby inducing reduction in generation of wastes at source and encouraging the collection of recyclable wastes.

In the past, waste collection fee was charged on a fixed rate through property tax or monthly fee regardless of the amount disposed. However, with the introduction of VBWF system, households and small sized commercial sectors are required to purchase specified bags to throw away their garbage, thus waste collection fee is charged in proportion to the amount thrown away. Furthermore, by providing free collection service for recyclable waste, incentive is given for households to separate recyclable items from other solid waste.

In Korea, with respect to the responsibility of managing municipal solid waste from household and small quantity generators of business and commercial sectors, local municipalities have a responsibility to collect, recycle and treat municipal solid waste and central government has a responsibility to make national waste management plan and to provide technical and financial supports to local government. Traditionally, all communities in Korea paid for waste management services through property tax or monthly lump-sum fee levied on each household. Under this fixed-fee system, cost per each residence remained constant regardless of differences in the amount of waste generated, which created a false impression to the citizens that management services of municipal solid wastes are provided free of charge. The local government that is responsible for managing municipal solid waste did not pay much attention on the reduction and recycling.

Rapid urbanization, population explosion and increases in income and consumption inevitably gave rise to mass generation of waste on an unprecedented scale. The changes in consumption pattern for most people preferring luxurious

goods also resulted in shortening of product life span and bring about early discard of recyclable products, such as furniture, home electronics and home appliances. Increases in overall consumption and use of disposable products, excessive packaging and amount of food preparation are creating even greater challenges for waste management authorities.

In Korea, municipal solid waste (MSW) generation increased sharply during the early 1990s and most of them went directly to landfill sites. However, due to the small land area and high population density, it was becoming difficult to obtain more land for landfill sites. The total amount of municipal waste generation was growing at 83,962 ton/day in 1990, 92,246 ton/day in 1991 and 75,096 ton/day in 1992. About 93 percent (78,016 ton/day) out of the total quantity of solid wastes were dumped into the landfills in 1990, about 89 percent in 1991, 89.2 percent in 1992, 86.2 percent in 1993, and 81.2 percent in 1994 respectively. Still, recycling rate remained at a low level, about 4.6 percent in 1990, 7.4 percent in 1991, 7.9 percent in 1992, 11.5 percent in 1993, 15.4 percent in 1994. With increased public concern for cleaner environment in their neighborhood, establishing landfill sites became more difficult.

For these reasons, finding ways to reduce waste generation was very crucial and issues associated with waste generation and management could not be resolved without efforts to reduce the growing amount of waste generation. Against this backdrop, the Korean government introduced the Volume-based Waste Fee System.

2.2 Target Waste and Waste Sources

The type of waste subject to the Volume-Based Waste Fee System is municipal solid waste from households, commercial sectors, small businesses and office buildings. The wastes from commercial sectors should be similar to those of household wastes, in that they can be collected, transported, stored, and treated in the same way as the household wastes.

The emission sources are residential houses, commercial sectors, office buildings, institutions such as schools and government, and small-sized businesses disposing of less than 300kg of waste

<Table 1> Waste Sources and Types

Source		Types of waste	Use of VBWF bag	Cost born by the Source	Notes
Household and small commercial sector	Urban area	Household waste	Yes	Yes	Separate collection
		Recyclable waste (paper, cans, bottles, metal, plastics)	No	No	Separate collection
		Bulky waste (furniture and electric home appliance like refrigerator, etc)	No	Yes	Separate collection
		Construction and demolition debris	No	Yes	Separate collection
		Food waste	No	Yes	Separate collection
	Rural village (farming/fishing)	Agricultural waste	No	Yes	Village-level VBWF
Large commercial sector/small business		MSW type ¹⁾	No	Yes	Large quantity generator more than 300kg/day

Note: 1) Large quantity generators were excluded from the system originally but are recommended to use VBWF if the waste type is similar to those that apply to the system.

<Table 2> List of Recyclable Waste

Categories	Items
1. Paper	- Newspaper
	- Book, note, paper bag, calendar, packaging paper
	- Paper cup, Paper pack
	- Box (snacks, packaging, others)
2. Cans	- Steel can, aluminium can (drink, food)
	- Other cans (butane gas, pesticide container)
3. Bottles	- Drinking water bottle, the other bottles
4. Metal	- Scrap iron (engineering utensil, wire, nail, iron board, etc)
	- Nonferrous metal (nickel silver, styrene, electric wire)
5. Plastics	
- Extended Polystyrene	- Fruit box, etc
- PETE (1)	- Drink bottle(coke, soda, juice), water bottle, soy sauce bottle, oil bottle
- HDPE (2)	- Water bottle, shampoo and detergent container, white rice wine bottle
- LDPE (4)	- Milk bottle, rice wine bottle
- PP (5)	- Boxes (beer, coke, soju), garbage can, dustpan, water gourd dipper
- PS (6)	- Yogurt bottle, shawa bottle
6. Textiles	- Cotton
	- Other clothes
7. Waste from farming village	- Pesticide bottle
	- Waste vinyl for farming
8. Others	- Recyclable items depend upon regional circumstances

per day. Large-scale generators producing more than 300kg per day are not subject to the VBWF system and they are required to treat wastes on their own responsibility. They can commit waste collection and treatment to private hauler.

The system does not apply to burnt coal briquettes, recyclable wastes and bulky wastes such as discarded refrigerators and furniture. Recyclable wastes are distinguished into 4~5 categories - paper, metal cans, glass bottles, plastic, other metals - and are emitted separately. Bulky wastes such as home electronics, home appliances and furniture are also excluded from using the designated trash bags, but are charged for their collection and disposal. For disposal of bulky wastes, a sticker should be purchased from the county or city district offices. The price of the sticker is decided by each municipality according to the type and size of the item to be discarded. Bricks and tiles generated from the construction work are categorized as construction and demolition debris, and need to be discarded in a bulky sack specified by the local government. Food wastes were discarded in VBWF bags with the other solid waste at the early stage of the VBWF system. However, to promote re-utilization of food waste, it is now collected in designated food waste bins or bags.



2.3 Specifications of VBWF Bag

Korea has adapted to using bags over containers for several reasons. In Korea, population density is high and large number of the population live in apartments and condominiums. Even regular houses are in close proximity with its neighbors and are adjacent to the road, thus it is difficult to place large garbage collection bins in front of the house.

Types of waste collection containers to base rate and billing system are generally cans, prepaid bags, prepaid tags or stickers. Each system has specific advantages and disadvantages such as providing economic incentive for waste reduction, assuring stable revenue for waste agencies simplicity of billing, easy collection of waste, sanitation and budgetary constraints. For container system, authorities need to set up an inventory and distribution system, which are expensive to install, and its billing system is more complex. Prepaid bags are more advantageous since they are relatively inexpensive to implement because residents pay for the collection and treatment of wastes by purchasing bags and no billing is required. Less hassle is involved for pre-paid bags because public pays directly for the purchase of the bag and no billing is required.

Considering Korea-specific housing conditions, budgetary constraints and facilitation of implementation, volume-based prepaid bags, instead of containers have been chosen for the Volume-Based Waste Fee System in Korea.

Each municipality can choose the appropriate type, color and materials of the designated VBWF

<Table 3> Composition of VBWF Bag

Composition		Primary Usage	Note
PE	HDPE	Bags for general use	
	LDPE	Bags for general use	
AP+starch+LDPE (biodegradable)		Bags for food waste compost-use only	Aliphatic polyester
AP+starch+HDPE (biodegradable)		Bags for food waste compost-use only	
CaCO ₃ +HDPE (LDPE)		Bags for incinerator-use	Contains more than 30% of Calcium Carbonate (CaCO ₃)

Notes: There are different quality standards on each composition type, and bags are made in accordance with the standards.

bags, taking into consideration of their unique situation, e.g. treatment facilities capability, convenience for the residents, environmental suitability, etc. The composition of VBWF bags are PE (polyethylene), PE with more than 30 percent of biodegradable resin or PE with more than 30 percent of calcium carbonate. Tensile strength and other specific standards are set for each bag with different composition. The bag containing calcium carbonate is primarily used for incineration treatment and biodegradable resin bag is used for food waste compost. The color of the bag for household use should be translucent or obscure to protect personal privacy. Bags for public use (street cleaning, etc.) are light blue colored and are not used interchangeably with other VBWF bags. The bags for food waste disposal should be transparent to avoid mixture of different substances.

There are various sizes of VBWF bags for residents' convenience. General use bags come in standard volumes of 2, 5, 10, 20, 30, 50, 75, 100 liter sizes; public use bags come in 30, 50, 100 liter sizes and food waste bags come in 1, 2, 3, 5 liter sizes.



2.4 Rate of VBWF Bag

Payment system of the Volume-Based Waste Fee in Korea is a direct payment system, where residents pay for solid waste services by purchasing the standard bags. The cost for waste treatment is recovered from the sales of VBWF bags. Therefore, the price of a VBWF bag includes collection, transport and treatment cost as well as production costs of making the bag. In principle, the full cost of collection, transport and treatment should be included in the price of the VBWF bag. However, the price of bags are gradually increased because a sudden increase in the waste treatment cost might cause negative side effect. Therefore, each municipality sets a different rate of burden (resident's share of the full cost) for the public depending upon its financial circumstances and treatment cost.

For waste that is difficult to be contained in VBWF bags (i.e. small quantity of demolition waste debris, bulky wastes, other wastes from small business sector), the total treatment cost is levied on the generator.

2.5 Distribution and Sales of VBWF Bag

VBWF bags are sold at local grocery stores, convenience stores and other markets which are in close proximity and are easily accessible to the public. There are approximately 100,000 stores nationwide. Local government can supply VBWF bags to these stores directly or consign the distribution of VBWF bags through financial institutions or cleaning agencies.

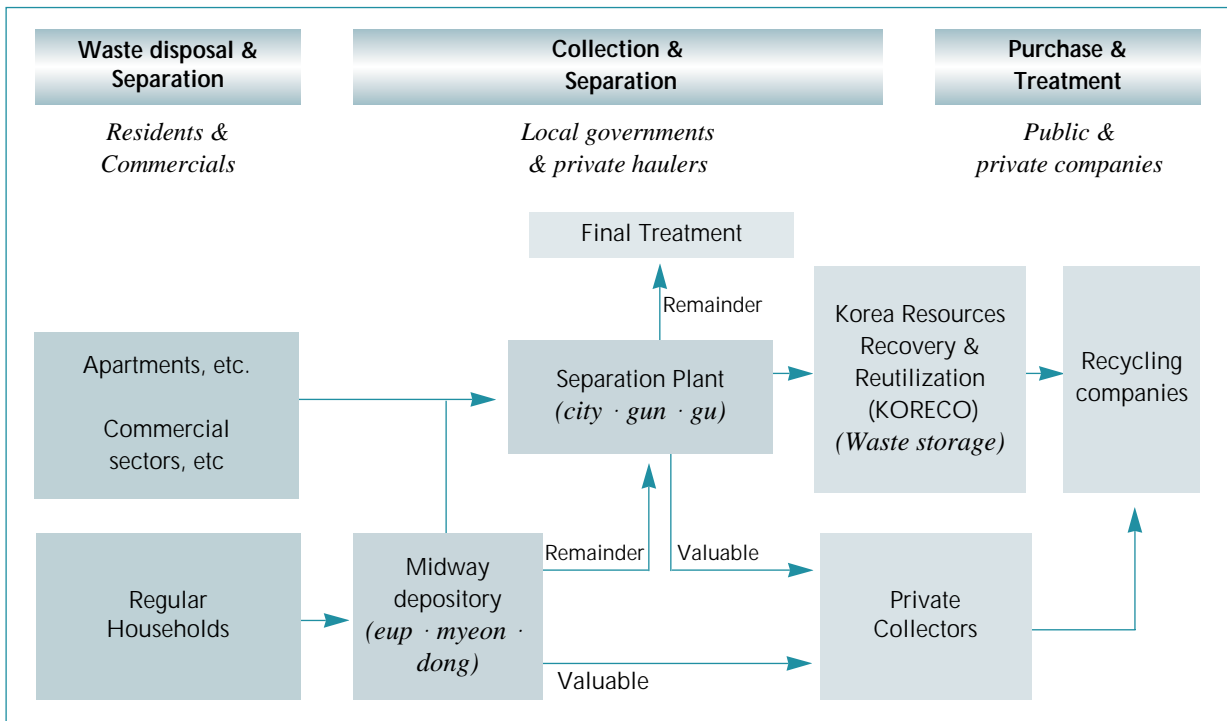
2.6 Waste Collection

Waste collection time is set by the local municipality who takes into consideration its unique conditions. For aesthetic reasons, most municipalities set waste discharging time after sunset (after 8 p.m) in the evening prior to the day of the waste pick-up. Residents living in apartments discard their wastes in a collection container within their apartment complex and regular household residents discard their wastes in front of their home to be collected by garbage trucks. The discarded wastes are generally picked up between 3 a.m. and 5 a.m.

For recyclable waste, residents separate the recyclable waste into recyclable item disposal bins and it is collected regularly at a designated time.

With bulky waste such as home appliances and furniture, residents are required to discard the waste by attaching appropriate stickers and these stickers can be purchased from local administrative office or a hauler who collects bulky wastes.

For food wastes, apartment residents discard them in food waste-only container bins and regular household residents discard them in food waste-only bags. Discarded food wastes are collected by a hauler either everyday or every other day depending upon municipality's capability.



<Figure 1> Collection System for Recyclable Waste

2.7 Collection System for Recyclable Items

Separate procedural guideline is set for collecting and treating recyclable waste. Recyclable wastes are, in principle, collected free of charge. If a community or association brings in separated recyclable waste to recycling centers, it can be traded with other recycled goods or be compensated with monetary rewards.

1) Waste Separation

Apartments and other communal residential areas separate recyclable wastes into 5 types, while typical residential areas separate them into 2-3 types, mainly paper and other recyclable items. Communal areas are required to designate collection sites and place separate collection bins for recyclable items in their neighborhood. Residential areas, where placing collection bins are inconvenient, recyclable wastes are collected on a door-to-door basis.

2) Waste Collection

As mentioned above, recyclable wastes are

collected either by door-to-door, through collection bins or at designated areas on a certain date, or by face to face depending upon the characteristics of the neighborhood and local government's circumstances. When amount of recyclable waste increases, number of collection is adjusted. In communal areas, 5 types of separated recyclable waste are picked up as it is, and in residential areas, separated recyclables are collected in 2-3 types or in mixed status.

2.8 Preventing Illegal Dumping

In cases when designated VBWF bags are not used and wastes are disposed indiscriminately in inappropriate places (i.e remote hill areas) or illegally incinerated, a maximum fine of 1 million won (US\$ 910) is imposed on the violator. The education of the person and delayed collection of waste disposed are also enforcement tools. In order to monitor illegal behavior, members of local environmental group and citizens movement are designated as monitoring personnel for the enforcement work of illegal behavior. Supervision-specialists are also employed for longer period monitoring. Municipalities operate pollution report centers, too.

2.9 Recent Developments

1) Re-usable Bags

Even though free distribution of disposable vinyl bags at grocery stores has been restricted since 1999, about 15 billion sheets of vinyl bags are still being used. In order to further reduce the use of vinyl bags, re-usable VBWF bags were introduced in July 2002.

Re-usable VBWF bags can be purchased at the grocery stores to carry the purchased goods and later use it as regular VBWF bags when disposing garbage. The use of vinyl bag to carry purchased goods can thus be reduced. The re-usable VBWF bags are designed pleasantly with convenient hand straps for easy carrying.

2) Separate Collection for Disposable Vinyl Bags

Disposable vinyl bags are being used in excessive amounts and 5-15 sheets of vinyl bag are founded in a 20-liter size VBWF bag disposed by households. Since such over-use of vinyl bags harms stability of the landfill sites, a system has been established for separate collection of disposable vinyl bags. Vinyl bags are collected separately either for free of charge or for charge according to each community's circumstances.

3) Village-level VBWF system for Rural Areas

In rural areas, houses are scatterly located and thus burning or disposing waste without using the trash bags are often found. Village-level Volume-Based Waste Fee System was introduced in July 2002 to effectively deal with waste management and to prevent illegal behavior in rural areas. The main purpose of this system is to prevent illegal burning and dumping in rural areas where it is difficult to monitor.

In village-level VBWF system, the head of municipalities is required to install community waste collection bins for both recyclables and trash separately where residents bring their waste and the municipality conducts waste collection, transport and treatment duties. In order to prevent illegal dumping, supervisors for waste collection need to be designated and self-monitoring system should be operated. The waste fee is levied on the whole community and the payment is made through the village fund. Later, each household is

charged on an average rate.

Target village of this system are villages with less than 50 households; villages that are not currently part of the waste management district; and the ones which headman of Kun decides necessary excluding capital city of Kun. Currently, remote rural areas with less than 50 households are excluded from waste collection areas, however, efforts are made to introduce village-level VBWF system.

Agricultural waste vinyl, pesticide bottles, and recyclable items are separated from regular household waste, and agricultural machinery and waste oil are collected separately and transported to the nearest recycling centers.

4) Responsibility for Maintaining Cleanliness

Deserted garbage can be often found in vacant lots in urban areas after introduction of the Volume-based Waste Fee System. In order to prevent the piling-up or leaving of wastes in the neighborhoods of housing areas, responsibility for maintaining cleanliness was introduced in each city or town. Cases of piled up wastes left for a long period of time harm the atmosphere of a city, and ruin its sanitary conditions.

Under this scheme, mayor or the head of provincial and local government can issue an order to the owner of the land or premise to clean up deserted waste or incinerated (burnt) waste. If the order is not complied within a month of issuance, the owner of the land can be fined for an act of negligence.

This scheme was introduced through the Article 7 of the Waste Management Act in 1999. The Act emphasizes the need for cleanliness of buildings and lands and mandates necessary actions to be undertaken if cleanliness is not maintained.

After the enforcement of this scheme, many exemplary cases of improvement of vacant lots has been on the rise through such activities as growing of flowers or turning the vacant lot into a parking space.

5) Separate Collection of Food Waste

At the time of VBWF introduction in 1995, food waste was disposed with other solid wastes through VBWF bags. However, since most food waste is soggy, it creates foul odor, spawns a

great amount of leachate in landfills and decrease incineration efficiency. Since food wastes contain a high degree of organic matters and nutrients, one of the best solutions is to recycle them in order to obtain value from these organic resources. Now, food waste is separated in food waste-only collection bins or food waste-only bags and collected by municipalities or haulers. Starting in 2005, direct landfilling of food waste generated in urban areas will be completely banned.

Separate collection and recycling obligations for food waste has been enforced since 1997 mainly for large-scale food waste generators such as restaurants and group-meal facilities in the beginning. However, the system has now been expanded to small-scale generator and regular households.



6) Rewards for Reporting Illegal Waste Dumping

Anyone found to throw away garbage without using VBWF bags or illegally burning waste is imposed with maximum of 1 million won (US\$ 910) of negligence fine in accordance with the waste management law.

Since imposition of fines for unlawful activities has its limitations in effectively preventing such behaviors, the reward system for reporting unlawful activities was introduced in 2000. Anyone who reports unlawful activities is paid as much as 80 percent of the fine charged to the violator. This system contributed to expanding the social awareness on preventing the indiscriminate dumping of wastes.

Members of citizen's groups and environmental NGOs are appointed as the voluntary monitoring group for unlawful dumping. Unlawful activities can be reported through environmental pollution report center or through the inter-net.

7) VBWF for Public Areas

Unlike residential areas, public areas such as

public parks, amusement parks, tourist resorts, mountain paths, stadiums and beaches do not generate waste on a regular basis, and for this reason, a system different from that of residential areas is needed.

If the entrance fee to the location does not include waste treatment cost, visitors are required to directly purchase VBWF bags and if the cost for waste treatment is included in the entrance fee, then VBWF bags can be handed out to visitors or have the garbage cleaned by the manager of the facility. In particular, for mountain paths and amusement parks, large waste container bins and recyclable item containers are installed in easily accessible areas.

In public areas where VBWF is not administered, mayors or heads of local governments can require the visitors to take back the garbage they have generated or, in an inevitable case, place collection containers for recyclable and regular waste at a convenient location where it is easily accessible.

8) Bio-degradable Bags

Use of biodegradable bags is recommended to reduce adverse environmental impacts of the non-degradable polyvinyl bag. It is also recommended to use biodegradable vinyl in various packaging materials to reduce quantity of non-degradable polyvinyl wastes. A program to discount tipping fee for landfill to the municipalities, which use biodegradable VBWF bags is under consideration in order to expand the use of biodegradable bags.

9) Incentives for Reducing Waste

Various incentives are provided to the municipalities to further promote separation of recyclable wastes and reduction in waste generation, because recyclables are often found in regular trash bags from household and commercial sector. By measuring the changes in the quantity of wastes transported to landfill/treatment facilities, one can measure the performance of local municipalities in reducing waste and promoting recycling. The measurements are usually done by comparing the amount of the waste transported to the landfill in the current period with data from past periods (i.e, quarterly, half year, annually), while taking into consideration the changes in

the population, occurrence of natural disasters, etc.

Incentive schemes are usually overseen by managers of municipal landfills and incinerators in large municipalities. Rewards include reduction in tipping fee, commendation or other personnel and career benefit for the local municipality as a whole or the specific official or the citizen.



3. Enforcing the Volume-Based Waste Fee System

3.1 Sales and Consumption of VBWF Bag

The sales of the standard VBWF bags were 1,589,964 thousand sheets in 1995 and 988,770 thousand in 2001. The total amount of sales fell by 37.8 percent during the past 7 years, on an average of 6 percent per year. For the first 3 years, sales of VBWF bags decreased as much as 43 percent as shown by the yearly sales figure of 1,589,964 thousand sheets in 1995; 1,192,770 thousand in 1996; and 913,344 thousand in 1998. Sales of VBWF bags for 1999-2001

<Table 4> VBWF Bag Sales Trend

(unit : 1,000 sheets)

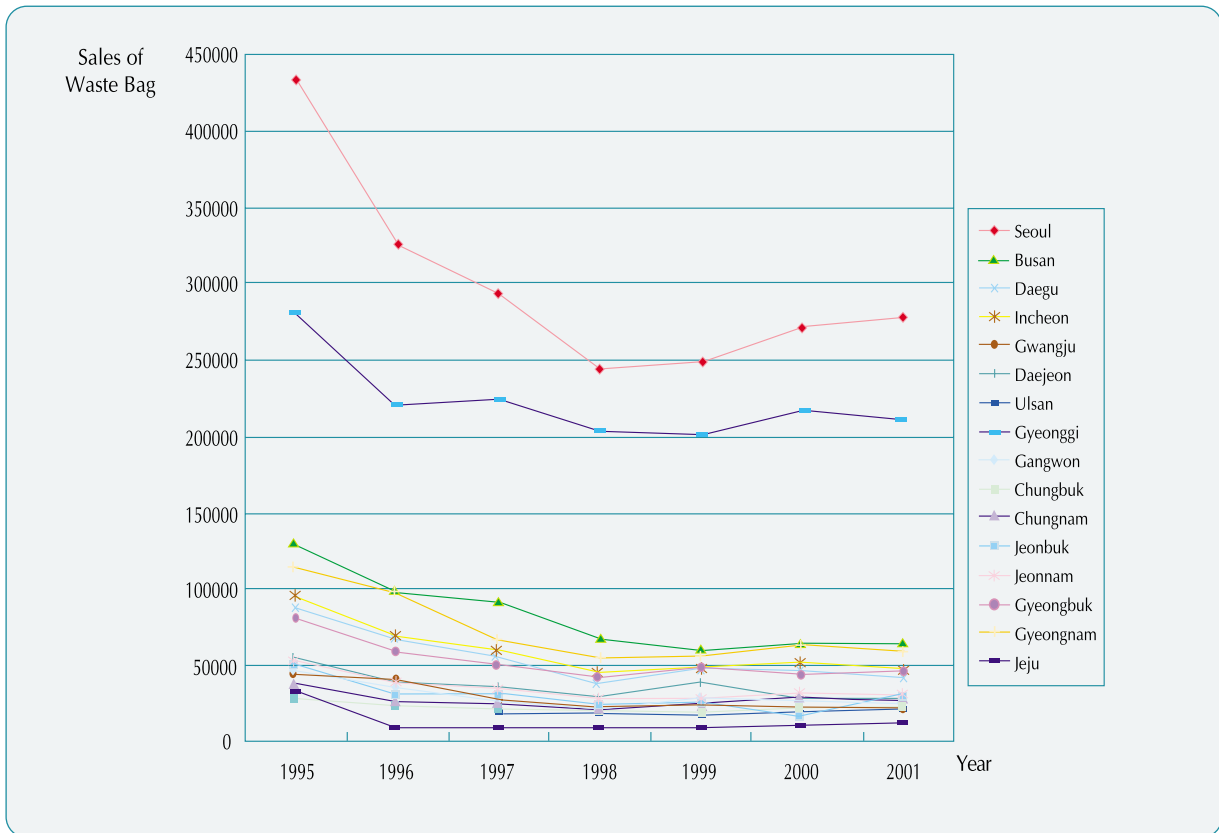
Year Region	1995	1996	1997	1998	1999	2000	2001	Changes (%. 95-2001)
Seoul	434,816	325,634	293,670	244,478	249,352	270,881	278,980	-35.8
Busan	131,226	97,360	91,235	66,583	60,166	64,668	60,571	-51.6
Daegu	87,865	68,875	57,691	41,422	47,748	45,108	43,464	-50.5
Incheon	96,806	70,411	60,739	45,529	48,650	50,785	47,707	-50.7
Gwangju	46,222	40,096	31,686	25,328	25,055	26,206	24,155	-47.7
Daejeon	55,769	39,285	36,076	29,224	38,239	28,782	30,239	-45.8
National Total	1,589,964	1,192,770	1,095,841	913,344	945,481	981,485	988,770	-37.8

<Table 5> Large and Small Size VBWF Bag Sales (2001)

(unit : 1,000 sheets)

	5 l (a)	10 l (b)	20 l (c)	50 l (d)	100 l (e)	Small size bag, %	Large size bag, %
Seoul	11,976	76,772	105,159	30,689	28,885	76.5	23.5
Busan	8,333	26,509	14,912	3,180	767	92.7	7.3
Daegu	1,667	14,783	15,250	4,255	1,952	83.6	16.4
Incheon	1,517	15,830	21,319	5,733	2,123	83.1	16.9
Gwangju	1,244	8,483	8,482	3,005	1,360	80.7	19.3
Daejeon	2,660	10,186	12,414	5,070	3,160	75.4	24.6
Ulsan	888	7,545	7,658	3,551	1,450	76.3	23.7
National Total	68,475	297,419	375,502	125,987	98,988	76.7%	23.3%

Note: Small size bag includes 5-20 liter bags and large size bag includes 50-100 liter bags.



<Figure 2> Trend of VBWF Bag Sales

increased by 5 percent and such sales record shows that the shock of the new system is more evidently observed in the beginning of the enforcement. Sales record of VBWF bags by district during the past 7 years indicate that sales in Jeju, Busan, Daegu, and Incheon fell by more than 50% whereas the sales in Gyeonggi province have dropped the least only by 25.5%.

The most popular size bag among VBWF bags is the 20-liter bag and the sales of 20-liter bags occupied 38 percent of total VBWF bags sold nationwide in 2001 as shown in table 4. According to the comparison between the sales of small size VBWF bags and the sales of large size bags (50 liter or larger), the numbers are 76.7 percent and 23.3 percent respectively. Sales by districts show that Gyeonggi and Gangwon Province use larger size bags more than the other provinces while Busan city uses the least with

7.3%.

Rate of VBWF bag consumption is 96 percent nationwide in 2001 and it varies from 93 percent to 99 percent among the 16 provinces and cities. Rate of VBWF bag consumption decreased a little but overall level is stable as seen from the VBWF bag consumption rate of 97.9 percent in 1997, 96.6 percent in 1998, 96.3 percent in 2000, and 96 percent in 2001. VBWF bag consumption rate is somewhat low in Jeolla buk, Jeolla nam, Gyeongsang buk and Gyeonggi province (see table A2 in the appendix).

3.2 Illegal Activities

The number of illegal activities disclosed is shown in table 6. The number of illegal activities was halved from 1,091,849 cases in 1995 to 546,901 cases in 1996 nationwide. Afterward,

<Table 6> Cases of Illegal Activities Nationwide

(unit: cases)

	1995	1996	1997	1998	1999	2000
Cases of Illegal Activities	1,091,849	546,901	638,660	549,277	579,021	364,855

the number of illegal cases continues to decrease from 638,660 cases in 1997; 549,277 cases in 1997; 579,021 cases in 1998 to 364,855 cases in 2000. 72,340 cases among 1,091,849 cases in 1995 are fined and other cases are settled with education, delayed collection of waste disposed.

In big cities, illegal dumping doesn't seem a problem because residential areas are very dense and illegal dumping can be found easily. People wouldn't take a risk of paying fine in order to avoid a little money (about 300 won per 20 liter-bag) . However, in agricultural areas and remote areas, there seem to be more cases of illegal dumping.

3.3 Changes in Bag Prices

The final price of the VBWF bag is decided by

municipalities and thus, the price differs by each district or county even within the same city or province. The average price of a 20 liter VBWF bag is 378 won (US\$ 0.34)/sheet in 2001. Price in Busan city is the highest with 750 won (US\$ 0.68)/sheet and price in Gyeongsangbuk province and Jeollabuk province are lowest with 236 won (US\$ 0.21) and 211 won (US\$ 0.19) respectively (figure 3). Price of a 10 liter VBWF bag is 192 won (US\$ 0.17) on a national average which is about half of the price of a 20 liter VBWF bag. So the price structure is proportional since price per liter is about the same. The price of 20 liter bags has risen by 69.3 percent during 1995-2001, a 10 percent annual increase.

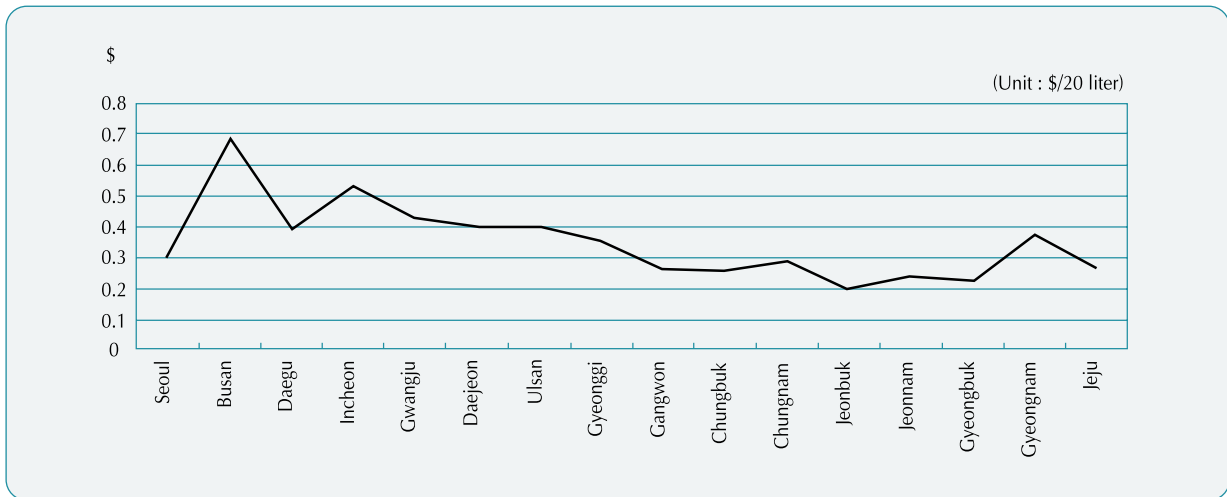
Average price of a VBWF bag has increased from 233 won (US\$ 0.20) in 1995 to 378 won

<Table 7> Trend in VBWF Bag Prices by Cities (20 liter bag comparison)

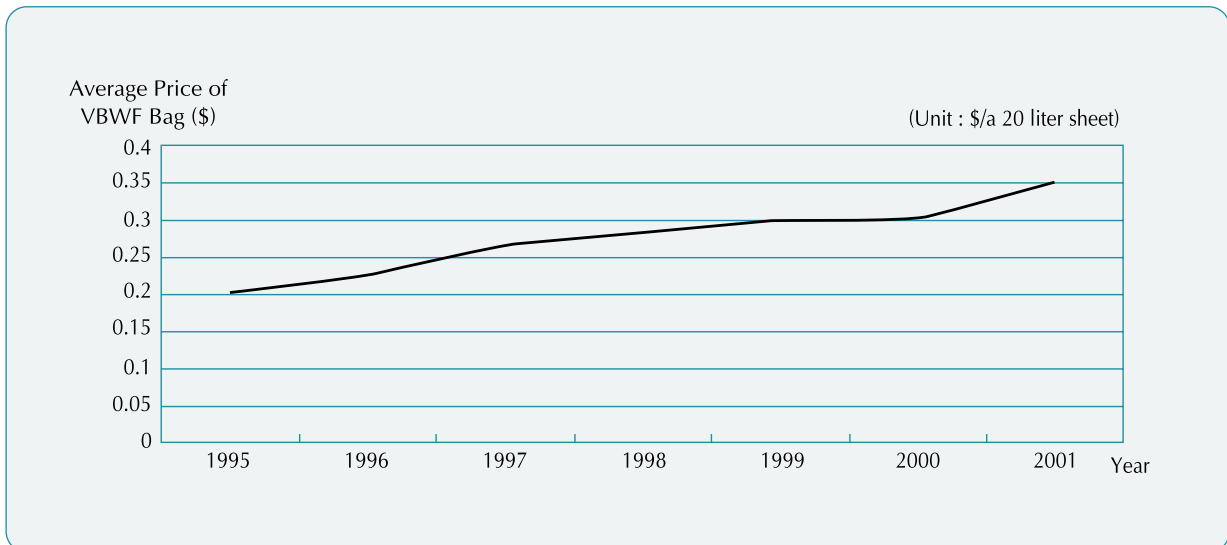
(unit: US\$/sheet)

	1995	1996	1997	1998	1999	2000	2001	Changes (%)
Seoul	0.24	0.27	0.31	0.30	0.30	0.30	0.31	27.55
Busan	0.25	0.29	0.36	0.62	0.57	0.63	0.68	168.82
Daegu	0.19	0.28	0.34	0.34	0.38	0.39	0.39	104.76
Incheon	0.19	0.25	0.33	0.34	0.39	0.45	0.53	170.09
Gwangju	0.18	0.22	0.30	0.30	0.30	0.43	0.43	135.00
Daejeon	0.19	0.22	0.27	0.27	0.37	0.39	0.39	103.74
Ulsan	0.23	0.23	0.34	0.34	0.33	0.33	0.39	70.64
Gyeonggi-do	0.23	0.26	0.28	0.30	0.31	0.33	0.35	48.05
Gangwon-do	0.17	0.19	0.21	0.19	0.23	0.24	0.26	51.61
Chungcheong buk-do	0.23	0.24	0.24	0.24	0.24	0.25	0.25	7.51
Chungcheong nam-do	0.17	0.17	0.18	0.18	0.19	0.23	0.28	62.23
Jeolla buk-do	0.15	0.17	0.18	0.18	0.19	0.19	0.19	24.85
Jeolla nam-do	0.14	0.15	0.17	0.19	0.20	0.21	0.23	61.04
Gyeongsang buk-do	0.15	0.16	0.17	0.17	0.18	0.21	0.21	47.50
Gyeongsang nam-do	0.25	0.26	0.29	0.29	0.31	0.38	0.36	45.79
Jeju-do	0.23	0.23	0.25	0.25	0.25	0.25	0.25	9.80

Note: Changes are calculated as a percentage change from 1995 to 2001.



<Figure 3> Price of VBWF Bag in 2001(City and Province)



<Figure 4> Trend of Average price(nationwide)

(US\$ 0.34) in 2001 as shown in table 7. Also, annual rate of increase was 10 percent in 1996; 17.9 percent in 1997; 4.8 percent in 1998; 6.6 percent in 1999; no changes in 2000 and 16.7 percent in 2001, indicating an upward trend of prices.

Price trend of city and province during the past 7 years shows that price in Busan and Incheon increased the most - as much as 170 percent, followed by Gwangju and Daegu - an increase of 105 percent.

Regions with the least increase in prices are Jeju province (9.8 percent) and Chungcheongbuk province (7.5 percent). Busan, Daegu, Incheon, Gwangju and Daejeon showed the highest rate of

increase among the 16 provinces. Prices of VBWF bags were similar among the cities and provinces during 1995 and 1996, but as the years progressed, the price gap among provinces became more evident. Difference between provinces with the highest and the lowest bag prices increased with 1.8 times in 1995, 3.1 times in 2000, 3.6 times in 2001 as shown in table 8.

During the past 7 years, the price of VBWF bags has shifted positively (increasing direction) as indicated by skewness in table 8. Skewness of price is increasing from 0.31 in 1995, 1.27 in 1998 to 1.30 in 2001. This indicates that the price is changing to the right-hand side, which is



<Figure 5> Trend of VBWF Bag Price by Year and by District (20 liter bag comparison)

<Table 8> Statistics on VBWF Bag Prices

	1995	1996	1997	1998	1999	2000	2001	change, % (95-2001)
Mean	223	246	290	304	324	324	378	69.5%
Mode	233	253.5	305.5	309	332	332	358.5	53.9%
Std. Deviation	42.5	49.20	71.1	98.2	107.8	107.8	140.94	2.3times
Skewness	-0.31	-0.28	-0.19	1.27	1.21	1.21	1.30	5.19times
Minimum	154	162	187	189	197	197	211	37%
Maximum	279	325	397	576	616	616	750	169%

the higher price.

Looking at the price trend by province, Busan, Incheon, Daegu and Gwangju have led the increase of bag prices nationwide. These cities have higher rate of consumption of small size VBWF bags than other province at 80 ~ 93 percent.

In summary, by analyzing the trend in bag price and the actual sales of the bag, one can conclude higher prices act as an incentive for consumers to use small bags more.



3.4 Other Policies that Support VBWF System

As stated before, VBWF policy aims at reducing waste at the source, promoting waste separation and recycling of waste that are inevitably generated.

Examples of other policies to reduce waste generation at the source are restriction on the use of disposable items and restriction on excessive packaging. Policies to promote recycling include the extended producer responsibility and the marking system for identifying raw materials.

Restriction on the use of disposable items is a

policy that promotes the use of re-usable and environment-friendly materials. This scheme bans the use of disposable knife, spoon and chopsticks, toothbrush and containers at specific businesses or locations, and restricts the free distribution of vinyl bags and disposable cheering tools. Especially, banning free distribution of disposable vinyl bag is effective in curbing the rapid growth in the use of vinyl bags in markets. Currently, disposable vinyl bags are sold in markets at 20-50 won (US\$ 0.02-0.04) per sheet in order to reduce its use and to promote the use of re-usable grocery basket.

Policy on restricting excessive packaging not only prevents unnecessary waste from being generated through the reduction in packaging layers but also promotes the gradual phase-out of polyvinyl packaging and the replacement with paper materials.

3.5 Future Challenges

1) Illegal Dumping

One of the biggest challenges to the successful implementation of VBWF is finding how to effectively monitor and prevent illegal dumping and other unlawful activities. Illegal dumping by rural residents and low-income population take diverse forms and monitoring these activities are difficult and expensive. In rural areas, illegal dumping is more problematic than in urban areas.

2) Financial Burden on the Local Government

With the decrease in the sales of VBWF bags, the revenue from sales of bags have decreased for most of the local governments and this, in turn,

has reduced their ability to self-support their waste treatment program. Furthermore, with the increase in recycling, expenditures on recycling and collection by the local government have increased.

Waste collection and treatment cost are not yet fully reflected in the price of VBWF bags, and degree of self-reliance of local governments on their budget for waste treatment is still low. Resident's share of the total cleaning cost remains at 50 percent of the total cost, mainly due to reluctance of the local governments to push up the price of VBWF bags. Main reason being, the heads of local municipalities are elected by popular vote and are sensitive to the voting behavior of the citizens.

3) Changes in Residents' Attitude

Sights of community activities such as cleaning the neighborhood area, sweeping snow during the winter season, and picking up garbages in public parks and other community areas are slowly disappearing. Although there are many reasons behind the disappearance of such community activities, difficulty in throwing away garbages could have contributed. Therefore, in order to promote community activities in cleaning up their neighborhood, local governments can distribute VBWF bags at free of charge when cleaning public areas or plowing away snow at community areas.

4. Policy Performance : Data and Analysis

4.1 Reduction in Municipal Solid Waste and Increase in Recycling

<Table 9> Trend in the Amount of MSW Generated

(unit: ton/day)

Categories	1994	1995	1996	1997	1998	1999	2000	2001
Total Generation	58,118	47,774	49,925	47,895	44,583	45,614	46,438	48,499
- recycled	8,927	11,306	13,085	13,907	15,566	17,394	19,167	20,922
- landfilled	47,116	34,546	34,116	30,579	25,074	23,545	21,831	21,000
per capita generation (kg/day/person)	1.30	1.06	1.10	1.04	0.96	0.97	0.98	1.01

After the implementation of VBWF in 1995, the generation of municipal solid waste (MSW) has declined dramatically. The quantity of MSW generated fell from 58,118 ton/day in 1994 to 47,774 ton/day in 1995 showing 17.8 percent reduction. Quantity of waste dropped by 4.1 percent in 1997 and 6.9 percent in 1998. During the period of 1994 ~ 2001, waste generated decreased by 16.6 percent total and 2.4 percent annually. The waste generation decreased more

in the first three-year period of the VBWF enforcement than the latter three-year period. Waste generation per person per day was 1.30 kg in 1994; 1.06 kg in 1995; 1.10kg in 1996; 0.96 kg in 1998; 0.98kg in 2000 and 1.01 kg/day in 2001.

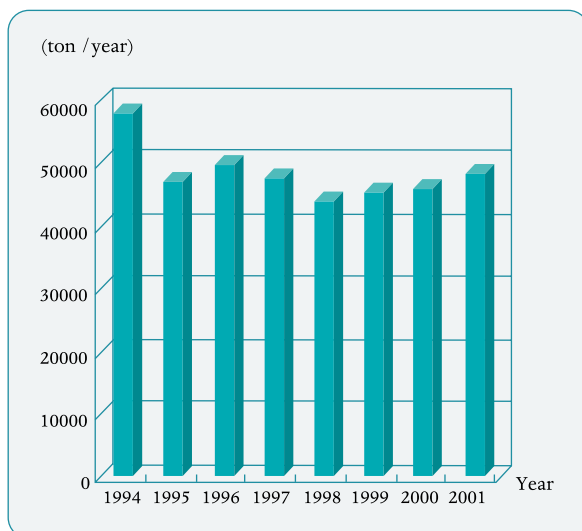
Quantity of recyclable waste was 8,927 ton/day in 1994 and increased to 11,306 ton/day in 1995 (27% increase). Recycling rate was 15.4 percent in 1994 and 23.7 percent in 1995. The quantity

<Table 10> MSW Generation and Recycling Trend

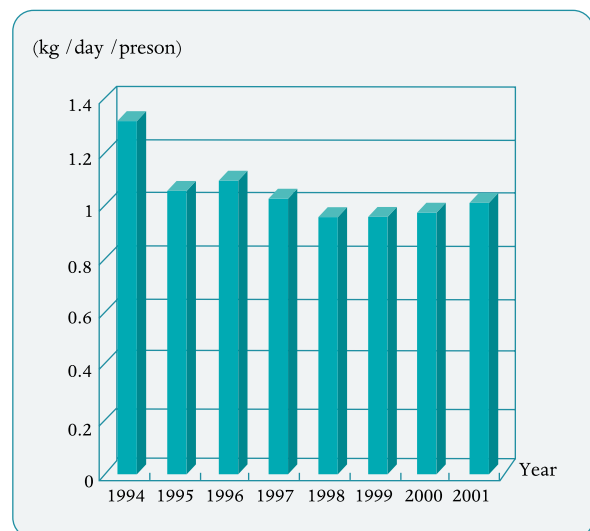
(unit: ton/day)

Year	Generation			Recycling	
	Quantity/Year (ton/year)	Change(%)	Quantity/person (kg/day/person)	Quantity/Year (ton/year)	Rate (%)
1994	58,118		1.30	8,927	15.4
1995	47,774	-17.8	1.06	11,306	23.7
1996	49,925	4.5	1.10	13,084	26.2
1997	47,895	-4.1	1.04	13,907	29.0
1998	44,583	-6.9	0.96	15,566	34.9
1999	45,614	2.3	0.97	17,394	38.1
2000	46,438	1.8	0.98	19,167	41.3
2001	48,499	4.4	1.01	20,922	43.1
94 ~2001	-9,619	-16.6%	-0.32	+ 11,995	+27.7 %

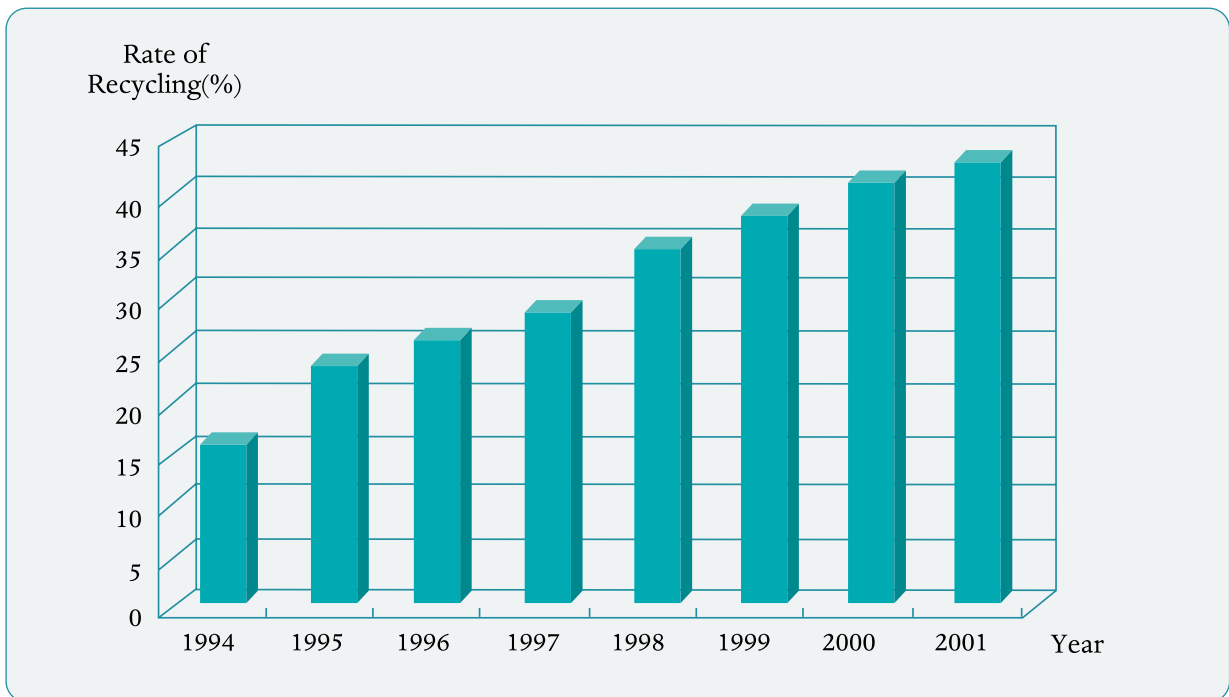
source: Ministry of Environment, 『National Waste Generation and Treatment Status』, 1994-2001



<Figure 6> MSW Generation Total



<Figure 7> MSW Generation Per Capita



<Figure 8> Trend of Recycling Rate by Year

of recyclable waste generated has increased as much as 11,995 ton/day (134%) during the past 7 years.

Food waste recycling has increased from 9.8 percent in 1997 to 56.8 percent in 2001 since the implementation of food waste separation requirement in 1997 (table 11). The number of households that dump food waste in food waste – only collection bins or plastic bags grew to 8.7 million (57%) in 2001. Recycling facilities were also expanded to process 5,347 tons of food waste per day.

4.2 Enhancement of Waste Collection Administration

Improvements in the administrative system for waste collection have occurred during the implementation of VBWF. In the past, the public was required to bring garbages to the garbage trucks, but now the public can only leave the garbage outside the home, increasing public convenience. Furthermore, waste collection time has become more diverse adding more convenience to the public. More improvements in waste collection administration are being

<Table 11> Changes in Food Waste Recycling

Categories	1997	1998	1999	2000	2001.3
Generated amount(ton/day)	13,063	11,798	11,577	11,434	11,237
Recycled amount (ton/day)	1,275	2,566	3,929	5,161	6,378
Recycling percentage (%)	9.8	21.7	33.9	45.1	56.8
Households that separate food waste (in 10,000)	-	188	489	770	870

developed by the local governments for their community.

4.3 Changes in Behavior

1) Consumer's Change in Behavior

With the implementation of VBWF, consumers are realizing more that "disposing waste costs money" and consumers' interest on reducing waste has grown. For example, consumers are showing more preference to refillable products, which generate less waste. They are also refraining from bulky packages and use of shopping basket has increased.

2) Producer's Change in Behavior

Producers have, in turn, become more environment-friendly. More producers are producing refillable goods and reducing the layer of packages in their product because they realize that consumers are more and more preferring these kinds of product. Moreover, recycling industries are being expanded and they are leading development of biodegradable vinyl bags and other environment-friendly technologies.

4.4 Economic Incentive Effects

1) Data

Economic incentive effect under VBWF system

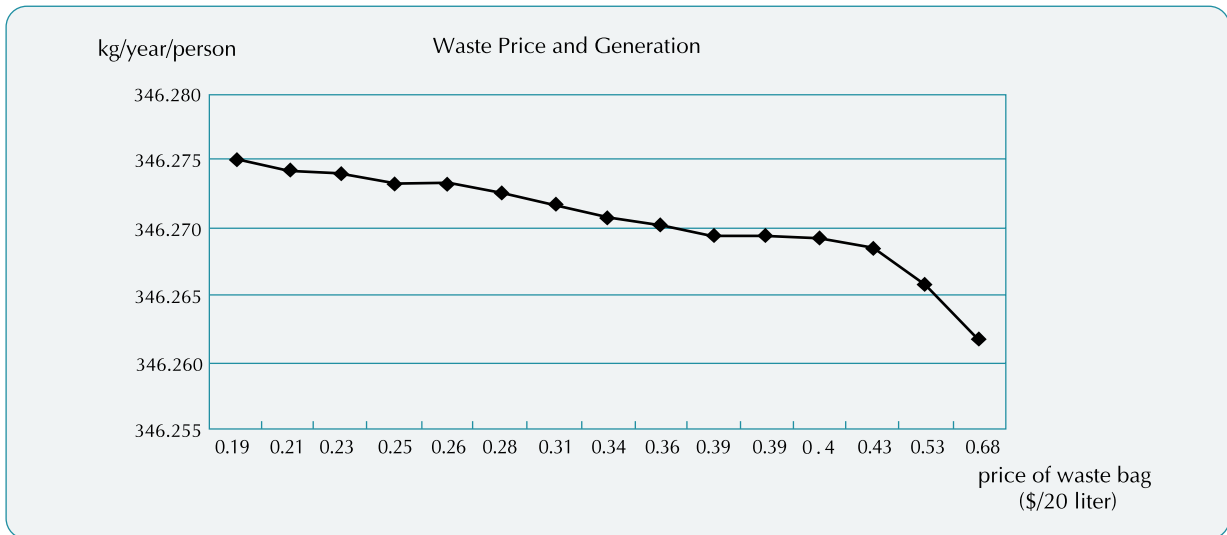
is analyzed using the past 7 year data. Quantity of municipal solid waste generation (kg/person/year) by province, the price of VBWF bag (won/20 liter bag) and the quantity of recyclable waste generated per year were used for the analysis. Data sources are "2001 national survey on waste statistic" and other statistics from the Ministry of Environment.

2) Analysis

In order to find the economic incentive effect of VBWF bag prices, regression analysis was made using data on the quantity of MSW and recyclable waste generated nationwide. The result showed that the higher price of the bag, the less waste is generated and, in reverse, more recyclable waste is generated. Therefore, the sign of price parameter is negative (-) and the sign of recyclable parameter is positive (+) as shown in table 12. It is significant to realize that the price of VBWF bags or the cost of disposing waste can have similar economic effect as any other market products, even though solid waste is a necessary by-product of every day life.

Next, regression was made to find the correlation between the price of the bags and the sales of VBWF bags according to sizes. The result showed that price has a negative impact on the sales of large size VBWF bag (table 13). In other words, if the price of VBWF bag increases, then the sales of large size VBWF bag decrease. This result also indicates that the price of bags has an economic incentive on consumer behavior because consumers are more reluctant





<Figure 9> Waste Price · Waste Generation · Waste Bag Use

<Table 12> Effect of Waste Price on Waste Generation

	MSW Generation	Recyclable Generation
Constant	346.28	88.7
Coefficient	-0.0264	0.0283

Note: Quantity data of MSW and recyclable waste is cross-section data for 16 cities and is from 2001 national survey on waste statistics.

<Table 13> Impact of Waste Price on Small Size VBWF Bag Use

	Parameter	Std. error	t-statistics
Constant	66.56	2.5882	25.72
Waste price (X)	0.03	0.0064	4.66

Note: Total sales of VBWF bags are classified into two - small size and large size bag - and rate (%) of small size bags out of total sales is used for dependent variable.

to buy large-size VBWF bags and more willing to decrease their waste generation when the price of bags increases.

3) Results and Policy Implications

Almost 9 years have passed since the introduction of VBWF in 1995 and empirical evidences clearly show that the VBWF program has positive economic incentive effect on the reduction of waste generation. More significant would be its clear incentive effect on waste separation and recycling. The recycling rate has

jumped from 15.7% in 1994, 23.7% in 1995 to 43% in 2001. Such a drastic increase in recycling will be difficult to achieve in the future, and other new approaches are needed to further accelerate recycling.

One possible area that needs further scrutiny will be the option of differentiating the price of bags. For example, the price of bags can be differentiated for households and for small businesses. Also, price can be differentiated according to the size of the bag to maximize the economic incentive effect of bag prices.

5. Conclusion

This publication introduced major features of VBWF system in Korea and evaluated its performance since its introduction in 1995. The VBWF program had a far-reaching effect on the reduction of waste generation and recycling in municipal solid waste sector. The system led to a 17.8 percent reduction in municipal solid waste generation and 21 percent increase in recyclable wastes in the first year 1995 only. During the period of 1994~2001, the system led to 16.6 percent reduction of generation of municipal solid waste and 134 percent increase in separation of recyclable waste. The System has been evaluated as being successful even though it has barriers such as illegal dumping and burning in rural area and increased recycling cost.

It has also changed the pattern of waste generation, awareness of the public toward waste disposal, as well as, the behavior of consumers and producers. Although the system still has room for improvement, especially on preventing

unlawful waste dumping in rural and remote areas and further promoting recycling through differentiated prices, VBWF program is an excellent example of a market-based environmental policy that can bring tangible results.

References

Ministry of Environment, 「2001 National Survey on Waste Statistics」, 2002
 Ministry of Environment, 「Environmental White Book」, 1995 ~2002
 Ministry of Environment, 「Statistics on Volume-Based Waste Fee System」, 1995~2001
 Korea Environment Institute, 「Evaluation and Enhancement of Volume-Based Waste Fee System」, 1998
 Kwang-yim Kim, "Effect of Waste Price on Waste Generation and Policy Recommendation", 「Environment Forum」, Korea Environment Institute, 2002

Appendix

< Table A1 > Sales of VBWF Bag

(unit : 1000 sheets)

Region \ Year	1995	1996	1997	1998	1999	2000	2001	Change (%)
Seoul	434,816	325,634	293,670	244,478	249,352	270,881	278,980	-35.8
Busan	131,226	97,360	91,235	66,583	60,166	64,668	60,571	-51.6
Daegu	87,865	68,875	57,691	41,422	47,748	45,108	43,464	-50.5
Incheon	96,806	70,411	60,739	45,529	48,650	50,785	47,707	-50.7
Gwangju	46,222	40,096	31,686	25,328	25,055	26,206	24,155	-47.7
Daejeon	55,769	39,285	36,076	29,224	38,239	28,782	30,239	-45.8
Ulsan	-	-	24,716	21,506	23,291	24,099	25,329	-
Gyeonggi-do	283,715	221,387	223,890	204,673	201,202	217,234	211,335	-25.5
Gangwon-do	47,845	36,909	28,478	24,163	25,987	25,752	28,858	-39.7
Chungcheong buk-do	33,699	26,652	26,701	23,283	24,352	24,699	24,658	-26.8
Chungcheong nam-do	37,385	28,950	28,778	24,047	29,987	30,494	29,194	-21.9
Jeolla buk-do	51,115	32,083	31,366	25,726	27,613	21,933	30,074	-41.2
Jeolla nam-do	52,251	38,559	34,516	29,235	29,507	33,516	31,113	-40.5
Gyeongsang buk-do	81,299	59,968	50,298	43,461	48,226	43,359	46,758	-42.5
Gyeongsang nam-do	114,872	97,022	65,945	55,557	56,274	63,620	59,870	-47.9
Jeju-do	35,079	9,579	10,056	9,129	9,832	10,349	11,466	-67.3
Total	1,589,964	1,192,770	1,095,841	913,344	945,481	981,485	988,770	-37.8

< Table A2 > Rate of VBWF Bag Consumption by Year and Municipalities

(unit: %)

Region/Year	1997	1998	1999	2000
Seoul	98.1	99.0	98.9	98.5
Busan	99.1	98.7	98.7	97.2
Daegu	98.2	96.3	96.0	94.8
Incheon	98.0	98.7	99.3	97.8
Gwangju	99.3	99.4	99.1	99.1
Daejeon	99.0	99.0	99.0	97.9
Ulsan	98.0	98.6	98.6	95.6
Gyeonggi-do	99.5	99.4	92.8	93.6
Gangwon-do	99.4	99.1	99.0	98.0
Chungcheong buk-do	99.0	98.0	98.6	98.6
Chungcheong nam-do	97.8	97.3	97.6	97.6
Jeolla buk-do	94.0	90.0	92.0	94.0
Jeolla nam-do	95.7	95.0	92.8	92.8
Gyeongsang buk-do	96.2	94.0	92.0	93.0
Gyeongsang nam-do	98.0	98.2	96.5	97.9
Jeju-do	97.0	98.0	94.0	94.3
Average	97.9	97.4	96.6	96.3

< Table A3 > Sales of Large and Small Size VBWF Bag (2001)

(unit: 1000 sheets)

Classification	5 liter	10 liter	20 liter	50 liter	100 liter	ratio of small size bag (%)	ratio of large size bag (%)
Seoul	11,976	76,772	105,159	30,689	28,885	76.5	23.5
Busan	8,333	26,509	14,912	3,180	767	92.7	7.3
Daegu	1,667	14,783	15,250	4,255	1,952	83.6	16.4
Incheon	1,517	15,830	21,319	5,733	2,123	83.1	16.9
Gwangju	1,244	8,483	8,482	3,005	1,360	80.7	19.3
Daejeon	2,660	10,186	12,414	5,070	3,160	75.4	24.6
Ulsan	888	7,545	7,658	3,551	1,450	76.3	23.7
Gyeonggi-do	23,204	55,636	82,655	21,543	43,836	71.2	28.8
Gangwon-do	940	6,564	13,893	5,655	2,680	71.9	28.1
Chungcheong buk-do	2,056	6,809	11,381	5,105	2,255	73.3	26.7
Chungcheong nam-do	2,988	7,220	11,385	6,122	1,811	73.1	26.9
Jeolla buk-do	2,404	8,769	13,004	7,145	1,238	74.3	25.7
Jeolla nam-do	3,208	10,691	11,415	6,843	401	77.8	22.2
Gyeongsang buk-do	1,378	15,518	20,216	7,673	3,484	76.9	23.1
Gyeongsang nam-do	3,981	21,455	23,379	8,881	3,163	80.2	19.8
Jeju-do	31	4,649	2,980	1,537	423	79.6	20.4

Note: Small size VBWF bag are 5-20 liter and large bags are 50-100 liter.

< Table A4 > Recyclable Waste Items and Disposal Guidelines

Classification	Items	Guide for disposal
1. Paper	- Newspaper	- dry newspaper (wet paper not accepted) - unfold straight, pile up neatly and tie it with string - avoid being mixed with advertisement sheets with vinyl coating, vinyl bags and other objects
	- book, note, paper shopping bag, calendar, packaging	- remove cover page with vinyl coating and springs for notebooks - avoid being mixed with plastic packaging
	- paper cups and containers	- empty the cup, wash in water and press and tie together
	- box (cookies, packaging, others)	- remove vinyl coating - remove tape, staple attached to the box, press and tie for easy transport.
2. Cans	- steel can, aluminum can (drink, food)	- empty and wash with water, press if possible - remove plastic cap or plastics attached - dispose in bags (vinyl bags accepted)
	- other can (butan gas, pesticide container)	- remove contents by making a hole in the container
3. Bottles	- potable water bottle, other bottle	- remove cap, empty and wash - not acceptable if other substances such as cigarette butts are contained - beer and soju (Korean spirit) bottle can be sold at grocery stores
4. Metal	- nonferrous metal (nickel silver, styrene, electric wire)	- same as above
5. Plastics	- Extended Polyestylene	- remove other substances, detach labels completely and dispose in clear plastic bags - for fruit and fish box, empty remainder and wash it with water - according to the MoE directive on reducing styro-foams for electronic products packaging (1995), producers have the responsibility to reduce and recover these materials
- PETE	1	- Drink bottle(coke, soda, juice), water bottle, soy sauce bottle, oil bottle
- HDPE	2	- Water bottle, shampoo and detergent container, white rice wine bottle
- V	3	- mainly used in industries, very few found among household waste
- LDPE	4	- milk bottle, rice wine bottle
- PP	5	- boxes (beer, coke, soju), garbage can, dustpan, water basket
- PS	6	- yogurt bottle, shawa bottle

< Table A5 > Korean Administrative Units

Larger Administration Unit	Lower Administration Units
Metropolitan Cities (Seoul, Busan, etc.)	gu → dong
Provinces (Gyeonggi, Gangwon, etc.)	city → gu → dong gun → eup/myeon → ri

Note: There are 16 larger administration unit in Korea. (7 metropolitan cities including Seoul and 9 provinces)



< Figure A1 > Administrative Map of Korea

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