Ministry of Environment KEI Korea Environment Institute

Two Decades in Effect: Volume-Based Waste Fee System in South Korea

No. 43

Korea Environmental Policy Bulletin

Vol. XIV Issue 3, 2016

Table of Contents

Summary

With rapid urbanization and rising income level, the total waste volume in Korea has increased at an unprecedented rate. As landfill and incineration could no longer handle all the wastes being generated, the Korean government finally introduced the Volume-Based Waste Fee(VBWF) system for garbage disposal in 1995, with the goals of reducing wastes and encouraging recycling. The VBWF system is a policy of providing an economic incentive for people to reduce the amounts of garbage they dispose of and increase the amounts of materials by making them pay fees in proportion to the amounts of garbage they generate.

This report introduces the histories, major features and characteristics, and accomplishments of the VBWF systems in Korea, which were introduced to minimize the amounts of wastes and encourage recycling. It has already been 22 years since the VBWF system became part of Koreans' daily lives. Over these years, the scope of the system's application has expanded to include not only general household garbage but also food wastes. The VBWF system for food wastes was introduced additionally in 2013.

Policy measures implemented are 1) Separation discharge of recyclable resources, 2) Reusable VBWF garbage disposal bags, 3) Crackdown on illegal garbage disposal, and 4) Administrative improvements to garbage handling.

The introduction of the VBWF system has greatly reduced the amounts of household wastes generated and increased recycling. The cumulative positive economic effect of the system was estimated to amount to KRW 21.4 trillion($ 19.5 billion) as of 2013. Neighborhoods near landfills no longer suffer from the stench and soil contamination caused by wet food wastes, while increasing amounts of wastes are recycled as valuable resources, helping the Korean society maximize energy efficiency and reduce greenhouse gas emissions.

The VBWF system is an effective policy that has induced positive changes in the attitude of consumers and producers alike, encouraging both to recycle as much as possible. It provides an exemplar of environmental policies providing economic incentives.

Ⅰ. Introduction

The economic development of South Korea, begun and guided by a series of 5 Year's Planning of Economic Development since the 1960s, has led to a dramatic transformation of the country into an industrial and urban society. The amounts and types of wastes generated in the process have increased and diversified at an astonishing pace. As landfill and incineration could no longer handle all the wastes being generated, the Korean government finally introduced the Volume-Based Waste Fee (VBWF) system for garbage disposal, with the goals of reducing wastes and encouraging recycling.

Prior to the introduction of the new fee system, the fees charged on garbage disposal were of flat rates based on the sizes of properties or property taxes reported, presenting little incentive for people to minimize the quantities of garbage they threw out. The VBWF system, on the other hand, charged fees in proportion to the amounts of garbage being thrown out.

Under the VBWF system, applied nationwide since 1995, all households and small businesses in Korea are required to put all their garbage in government-designated and fee-charging garbage bags. They can still recycle the traditional recyclable wastes free of charge.

The introduction of the VBWF system has drastically reduced the quantities of household wastes being generated. The system continues to reduce the amounts of garbage disposal and increase the quantities of materials being recycled effectively to this day. The principles of making people pay for the garbage they generate and encouraging them to recycle with greater diligence contribute significantly to the virtuous cycle of garbage minimization and recycling maximization.

It has already been 22 years since the VBWF system became part of Koreans' daily lives. Over these years, the scope of the system's application has expanded to include not only general household garbage but also food wastes. The VBWF system for food wastes was introduced additionally in 2013. This report introduces the backgrounds prompting the implementation of these measures, their major features and characteristics, and their accomplishments over the years.

Ⅱ. Background and Chronology

2.1 Background

The industrial and economic policy paradigm in Korea underwent a major shift in the 1990s, from export-oriented growth to greater focus on the domestic market and encouraging domestic consumption. The rising income level increased household spending and greatly boosted the domestic market. The rapid pace of economic growth, the abrupt rise in the living standard, and the growing demand for disposable goods and packing materials all contributed to dramatic increases in the amounts of wastes generated. More and more Korean consumers began to view shopping as a means to pleasure and for self-expression rather than a matter of necessity, prompting manufacturers to shorten life spans of their products.

The amounts of garbage multiplied at an unprecedented rate amid the march of urbanization, industrialization, and the rising income level. The number of landfills and incineration sites had to be multiplied accordingly, but the limited area of the national territories, concerns over environmental degradation, and the not-in-my-backyard (NIMBY) mentality presented major obstacles to increasing waste-processing facilities. Policymakers had to turn to the different approach of reducing the amounts of garbage generated at the root. The VBWF was finally introduced to make people pay for the garbage they disposed of.

2.2 Chronology

The necessity of demand management policy was raised in order to realize the establishment of resource recycling society and cope with the rapid increase of wastes. As a result, the policy study on the feasibility of introducing a VBWF system was launched in 1992.

The VBWF system then went into a trial phase, subjecting 1 to 3 cities, counties, or boroughs in 15 metropolitan cities and provinces nationwide, from April to December in 1994. With the system producing tangible effects even on such a limited trial basis, the number of cities, counties, and boroughs applying to participate began to grow. The number of participating municipalities thus grew from 33 in April to 89 by November that year.

In November 1994, a group of nongovernmental organization (NGO) representatives was also assembled to render a midterm evaluation of the VBWF system. Many on the nongovernmental evaluation group were initially skeptical about how effective the system could be, concerned with the risks of a severe public backlash and encouraging illegal garbage disposal. The trial application of the VBWF system, however, changed people's perception and attitude noticeably, encouraging the public to adopt positive lifestyle changes such as carrying reusable bags to markets instead of using disposable bags, reducing food wastes, and preferring products with fewer packing materials. Seeing how the VBWF system, even in the trial application, reduced garbage, increased recycling, and saved local governments' budgets for collecting and processing garbage, the evaluation group turned around and praised the new system's effectiveness.

In preparing to launch the VBWF system on a full scale nationwide, the Korean government actively tackled the issues that were raised during the trial phase, urged local governments to establish effective measures to handle sudden increases in recyclable wastes, increased the emergency garbage-collecting period and workforce in anticipation for the likely abrupt increase in the amounts of garbage disposal nationwide immediately before the new system took effect, and organized massive public campaigns.

The VBWF system finally took effect in all municipalities nationwide beginning in January 1995. Of course, the change did not make its way into people's daily lives without some resistance and obstacles. Some households were determined to get rid of all their garbage before the system took effect, leading the amount of garbage collected by municipalities to double for the time being. In just two months, however, almost all households and subject businesses nationwide were participating in the new system.

As of 2014, 3,495 (99.9%) of all 3,496 subject municipalities (eup, myeon, and dong-level neighborhoods) were participating in the VBWF system. With this, those municipalities that are not participating are extremely remote rural areas with 50 or fewer households, mostly inaccessible by municipal garbage collection vehicles.

Ⅲ. What is the VBWF System?

3.1 Overview

The VBWF system is a policy of providing an economic incentive for people to reduce the amounts of garbage they dispose of and increase the amounts of materials they recycle by making them pay fees in proportion to the amounts of garbage they generate.

Prior to the introduction of the VBWF system, households and small businesses in Korea had to pay only fixed amounts of fees, based on the sizes of their properties or their property tax reports, for the garbage they threw out. This older system presented few incentives for people to reduce the amounts of garbage they generated.

Now under the VBWF system, households and small businesses are required to use specific government–designated garbage disposal bags to throw out wastes. They can, however, still recycle various recyclable wastes free of charge.

3.2 Wastes subject to the VBWF system

The types of wastes subject to the VBWF system are household wastes, and general wastes from businesses that are similar to household wastes and that can therefore be collected, transported, stored, and processed in manners akin to those of household wastes.

Pursuant to the Wastes Control Act (1999), the VBWF system applies only to “areas in which municipalities handle and manage household wastes” such as residential neighborhoods. Waste fees, however, may exceptionally apply to certain popular public areas, such as mountain trekking trails and beaches, during busy seasons.

3.3 Waste and recyclable waste collection system

1) Disposal of household wastes

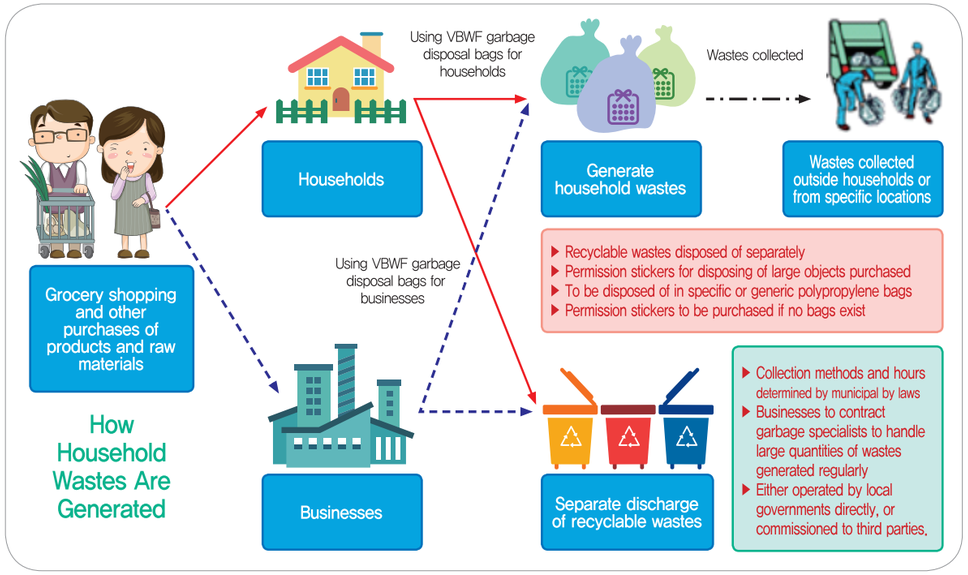
Household wastes are to be disposed of in volume–based garbage disposal bags specified and designated by the heads of municipalities (i.e., mayors, county magistrates, borough office heads). Recyclable materials are disposed of in manners pursuant to those specified in their bylaws that reflect the national government’s Guidelines on the Recycling of Recyclable Resources, depending on local municipalities’ situation. Large–sized wastes, such as furniture, can be disposed of and handled by municipalities only when they bear the stickers issued by local authorities upon payments of fees by households or businesses disposing of them.

Wastes that cannot be contained in the municipality–designated garbage disposal bags, such as broken pieces of porcelain and building material wastes weighing less than five tons in total, are to be disposed of in special polypropylene bags distributed by local municipalities. In areas where the municipal authorities do not provide such specially designed bags, such wastes are to be disposed of in the same manner as large–sized waste objects, which are contained in generic polypropylene bags bearing the disposal permission stickers issued by the local authorities.

The Korean law distinguishes between household wastes and business wastes. Much of wastes generated by small businesses, however, are similar to household wastes and are therefore disposed of, collected, transported, and processed in the same manner as household wastes under the current VBWF system.

Small businesses that generate less than 300 kilograms of household–type wastes a day are required to dispose of such wastes using the same garbage disposal bags as those required of households. Businesses that generate more than 300 kilograms of household–type wastes a day may still use the same garbage disposal bags, but usually resort to contracting the services of garbage disposal specialists.

〈Figure 1〉 Handling Household Wastes



Source: Ministry of Environment (2011), Assessment of the VBWF System and an Improvement Plan.

2) Collecting and processing household wastes

Municipalities collect household wastes of apartment housing and small businesses from designated locations at designated hours, distribute and post signboards that provide information where and when certain types of wastes are to be collected.

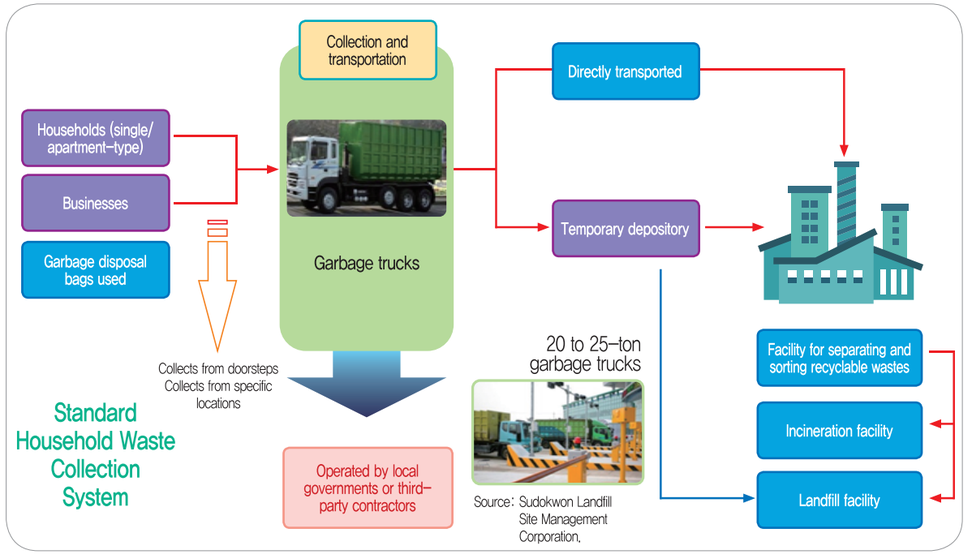
As for neighborhoods of single detached houses where it is difficult to designate a specific location for garbage disposal and collection, residents can leave their garbage bags outside their doors so that the municipal workforces can collect them. Households in remote rural areas not easily accessible to municipal garbage vehicles are to leave their garbage at certain public locations nearby such as schools, community service centers, and the open spaces in the areas. In 2014, 77.4% of household wastes were collected from individual households; 22.5% from designated locations; and 0.1% from residents themselves, who pile their garbage upon municipal vehicles.

Many municipalities collect different types of wastes and recyclable wastes on different days of the week to maximize the efficiency of garbage-collecting workforces and vehicles they employ. These municipal systems ensure that household wastes and recyclable wastes are collected on different days to prevent further contamination.

Wastes so collected are transported to either temporary depositories or straight to the recyclable wastes sorting facilities, incineration facilities, landfills, or other such sites of final treatment by garbage trucks and other such vehicles.

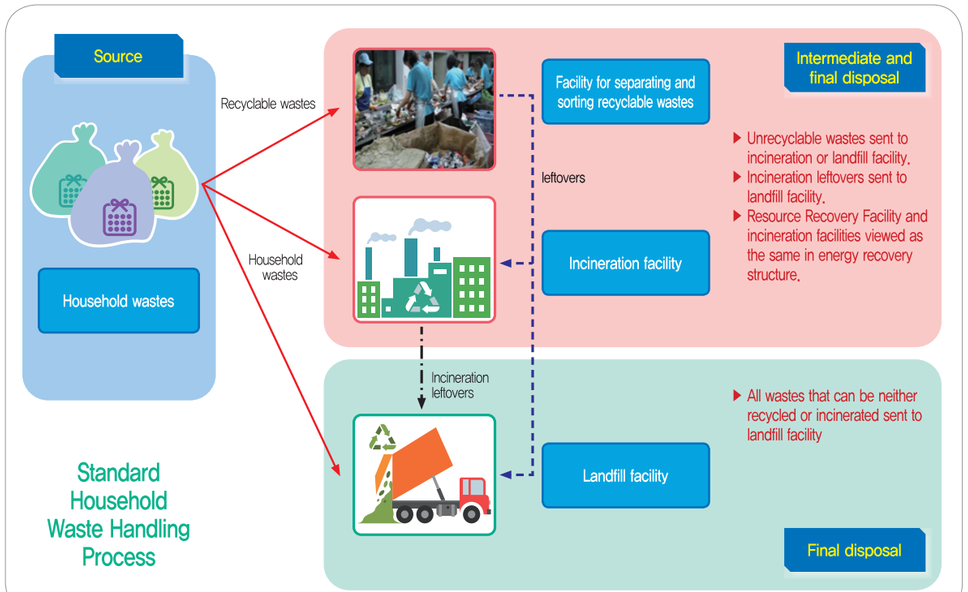
Recyclable wastes sorting facilities are where plastics, cans, glasses, and other such recyclable wastes contained in garbage disposal bags are removed from the rest of the wastes. Recyclable wastes so sorted are sent to recycling facilities. The rest of the wastes are transported to incineration facilities or landfills.

〈Figure 2〉 Household Waste Collection System



Source: Ministry of Environment (2011), Assessment of the VBWF System and an Improvement Plan.

〈Figure 3〉 Household Waste Processing System



Source: Ministry of Environment (2011), Assessment of the VBWF System and an Improvement Plan.

Ⅳ. VBWF Garbage Disposal Bags (standard waste bags)

4.1 Types and sizes

Volume-based waste control systems usually require the use of certain garbage disposal bags or vessels. In Korea, the VBWF system requires the use of plastic garbage disposal bags designated by local (municipal) governments for household wastes (except food wastes).

Municipal governments possess the right to decide the material and sizes of garbage disposal bags in consideration of the main types of wastes they handle as well as the convenience of the local public. All municipal governments, however, are required to use only environmentally sound common standard materials, of which there are six, including high-density polyethylene (HDPE). VBWF garbage disposal bags are divided into general disposal bags, reusable disposal bags, public-use bags, and specific disposable plastic bags by usage and they come in diverse volumes, such as 3 liters, 5 liters, and 100 liters.

〈Table 1〉 Types of VBWF Garbage Disposal Bags in Korea

Category	Types
Materials (common standard)	HDPE, LLDPE, calcium carbonate, biodegradable 1 (AP + starch/LLDPE), biodegradable 2 (AP + starch/HDPE), biodegradable 3.
Use/volume	■ General: 3ℓ, 5ℓ, 10ℓ, 20ℓ, 30ℓ, 50ℓ, 75ℓ, 100ℓ ■ Reusable: 3ℓ, 5ℓ, 10ℓ, 20ℓ, 30ℓ ■ Public-use: 30ℓ, 50ℓ, 100ℓ ■ Disposable: 3ℓ, 5ℓ

Source: Ministry of Environment (2016), Guidelines on Implementing the Volume-Based Waste Fee System.

Different colors are used for garbage disposal bags for household use and public use. Household garbage disposal bags are mostly semitranslucent white and in other colors decided by municipalities, while those for public use are light blue in color nationwide.

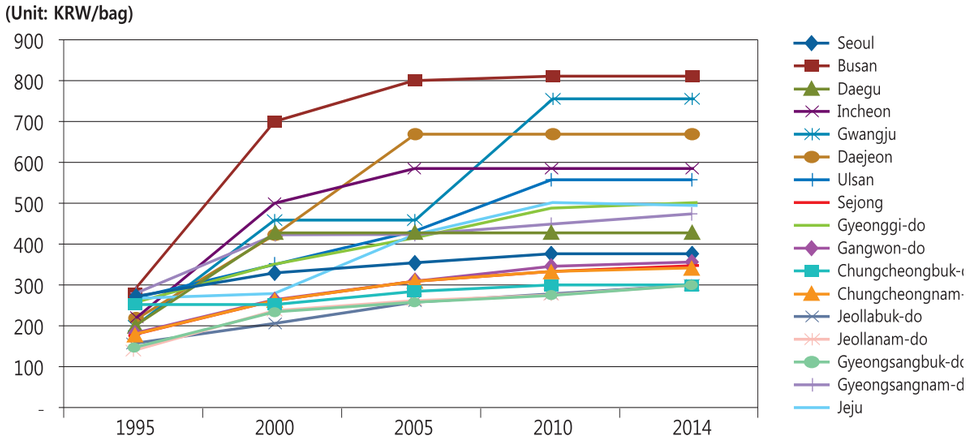
Garbage disposal bags are goods that all households in Korea are required to purchase for certain prices and use. Municipalities, therefore, ensure the quality and authenticity of their garbage disposal bags zealously with antiforgery programs.

4.2 Prices

Municipalities reserve discretion over the prices of garbage disposable bags. The prices of these bags differ even from borough to borough in a single city such as Seoul, and reflect the costs of processing each liter of garbage, of producing the bags, and of collecting, transporting, and storing garbage, as well as the sales transaction charges. In 2014, the nationwide average price of a 20-liter household garbage disposal bag was KRW 462, while that of a 20-liter business garbage disposal bag was KRW 766. The average price of the 20-liter household garbage disposal bag was the highest in Busan, at KRW 813, and the lowest in Jeollanam-do and Gyeongsangbuk-do, at KRW 299 in both.

Since 1995, the prices of these bags have been rising nationwide, but the price rise has almost stalled since 2010 (refer to Figure 4).

〈Figure 4〉 Prices of 20-Liter Household Garbage Disposal Bags by Year

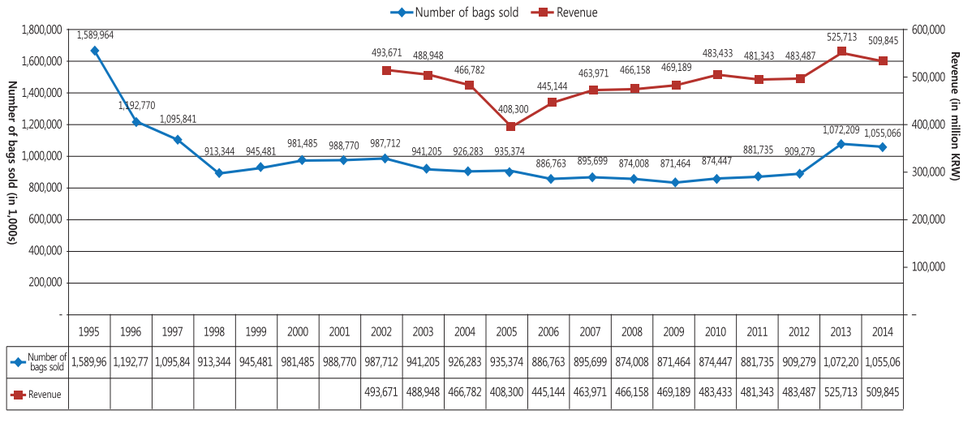


4.3 Sales and consumption

In 1995, a total of 1.59 billion household and business garbage bags were sold nationwide. The sales volume took a radical drop over the following four years, falling as low as to 913.34 million in 1998. While the number of bags sold annually increased or decreased somewhat from 1998 to 2014, it has remained more or less around the same yearly average of 939.18 million.

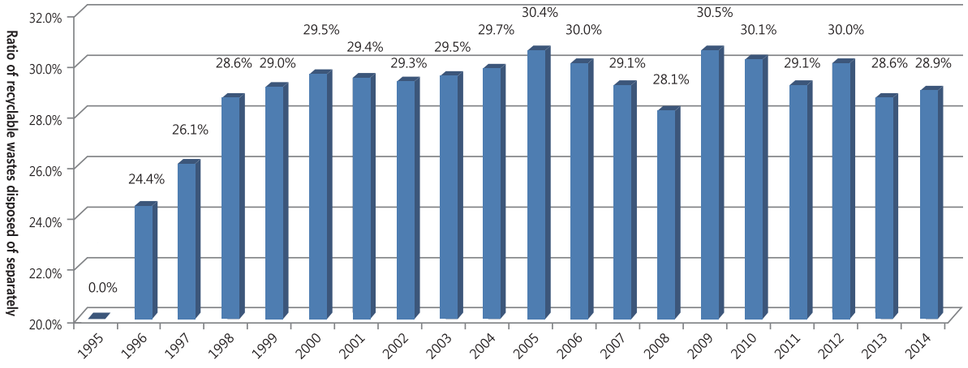
While the number of bags sold annually took a drastic 43% drop in the initial four years (1995-1998) of the VBWF system, the annual amount of household garbage generated managed to decrease by only 6%. In the meantime, the amount of recyclable wastes generated annually grew significantly. This is most likely because people kept throwing out recyclable wastes along with household wastes in the early days of the system. As people grew more accustomed to the VBWF system, however, the recycling rate began to rise noticeably, reaching 30% or so in 1998 and afterward.

〈Figure 5〉 Garbage Disposal Bag Sales Trend



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of bags sold	1,589,96	1,192,77	1,095,84	913,344	945,481	981,485	988,770	987,712	941,205	926,283	935,374	886,763	895,699	874,008	871,464	874,447	881,735	909,279	1,072,20	1,055,06
Revenue								493,671	488,948	466,782	408,300	445,144	463,971	466,158	469,189	483,433	481,343	483,487	525,713	509,845

〈Figure 6〉 Recycling Rate Trend



Ⅴ. Policy Measures Implemented

5.1 Separation discharge of recyclable resources

Recyclable resources are wastes that can be recycled or reused. Recycling promotes the efficient use of resource cycles and reduces the need to import expensive materials from abroad. The decrease in landfills and incineration also leads to decreases in pollutants and contamination, and serves to extend the life span of landfills.

The Korean government has prepared and distributed the Guidelines on the Separation Discharge pursuant to Article 13 of the Act on the Promotion of Saving and Recycling of Resources. The guidelines define the types of recyclable resources to be collected by municipalities, how they are to be recycled, the colors and specifications of recycling vessels to be used, how they are to be installed, and the recycling inspections to be carried out. The guidelines still leave room for municipalities to decide, at their discretion, the details of collecting and treating recyclable wastes.

Recyclable resources can be divided into a number of types, including the recyclable wastes (paper, glass bottles, cans, plastics, etc.), waste appliances and large waste objects, food wastes, and hazardous wastes.

〈Table 2〉 Scope and Separation Discharge of Recyclable Resources

<table>
<tr><th>Category</th><th>Type</th><th>Items</th><th>Separation discharge</th></tr>
<tr><td rowspan="7">Recyclable wastes</td><td>1. Paper</td><td>Newspapers, books, notebooks, cardboard boxes, etc.</td><td rowspan="7">To be collected using recycling vessels and/or to be disposed of in piles</td></tr>
<tr><td>2. Paper cartons and cups</td><td>Cartons and cups made of paper</td></tr>
<tr><td>3. Cans</td><td>Steel/aluminum cans, containers for butane gas and pesticides</td></tr>
<tr><td>4. Scrap metals</td><td>Scrap metals (ferrous and nonferrous)</td></tr>
<tr><td>5. Glass bottles</td><td>Bottles for beverages, etc
※ Note
1) The Empty Bottle Deposit Refund Program targets bottles of products whose prices reflect the glass bottle deposits, which consumers may receive upon returning the empty bottles to retailers. Examples include soju (distilled rice liquor) bottles, beer bottles, and soft drink bottles. They bear the “Reuse” label, instead of the “Recycle” label, on either their fronts or sides.
Bottles with deposits: When “Reuse” label is on either the front or the side of the bottle
Bottles to be recycled (nonrefundable): When “Recycle” label is shown
2) Heatproof food containers, ceramic containers, and other such brittle materials that are not glass bottles are to be disposed of according to the municipality’s policy on the disposal of nonflammable wastes.</td></tr>
<tr><td>6. Plastic containers</td><td>Plastic containers (PET bottles, etc.) and other plastics</td></tr>
</table>

Category	Type	Items	Separation discharge
Recyclable wastes	7. Plastic bags and films	Disposable plastic bags, etc.	To be collected using recycling vessels and/or to be disposed of in piles
	8. EPS/Styrofoam	EPS/Styrofoam used to pack and transport valuable objects (e.g., home appliances) or perishable products (e.g., farm product, meat)	
	9. Other	Apparel and fabrics, waste oil, agricultural wastes	
Waste appliances and large-sized waste objects		– Waste appliances such as refrigerators, air-conditioners, washing machines, etc.	To be collected for free
		– Large-sized waste objects: chests of drawers, dining tables, kitchen sinks, and other such objects that cannot be contained in garbage disposal bags	Follow the municipality's policy (e.g., permission stickers).
Hazardous wastes		Waste fluorescent light bulbs, battery cells, medicines, etc.	Use collection bins.
Inflammable and nonflammable wastes		– Inflammable wastes: Use garbage disposal bags. – Nonflammable wastes: Use special or generic polypropylene bags to contain them.	
Others		– Briquette ashes, etc.	Use polypropylene bags, etc.

※ Specifics of disposal and Separation discharge differ among municipalities.

1) Recyclable wastes

Municipalities may choose to collect the recyclable resources using either separate or integrated recycling vessels. Separate recycling vessels are used to collect at least four different types of materials (paper, glass bottles, cans, plastics, plastic bags and films, etc.). Koreans are required to sort these resources on their own and place them in the right recycling vessels or other special bins (e.g., those for used battery cells and light bulbs).

Residents of neighborhoods dominated by single detached houses and other such areas where separate recycling is not so easy may dispose of their recyclable wastes all in the integrated recycling vessels in their respective areas.

2) Waste home appliances and large-sized waste objects

Closets, dining tables, kitchen sinks, bed frames, mattresses, and the like are objects that cannot be contained in garbage disposal bags, and are, therefore, disposed of and treated as large-sized waste objects. Different municipalities have different rules regarding how such objects are to be disposed of, such as the requirement that they bear permission stickers, issued by local authorities upon payments, in order for the municipality to collect them.

The Ministry of Environment provides the service of visiting homes and collecting waste large home appliances, such as refrigerators and washing machines, free of charge. Anyone can apply for this service by telephone, text messaging, or the Internet. The Ministry of Environment will dispatch its specialists to the applicant's home to collect the appliances. Small appliances can be collected in the same way if they are five or more in number, or are disposed of along with large appliances.

3) Hazardous wastes

Hazardous wastes to be disposed of separately of household and recyclable wastes include used fluorescent light bulbs, battery cells, and medicines. Municipalities provide exclusive bins for collecting these items, except for waste medicines that are to be disposed of at nearby pharmacies or public health care centers. Materials that were used to wrap the medicines may be collected in exclusive bins. Secondary packing materials can be recycled along with other recyclable resources.

〈Table 3〉 Exclusive Bins for Collecting Hazardous Wastes

Fluorescent light bulbs	Battery cells	Medicines	
			

4) Others

Construction waste less than five tons in total (such as those generated by home renovation) and nonflammable materials like ceramics are to be disposed of using polypropylene bags and/or according to the municipalities' rules.

5.2 Reusable VBWF garbage disposal bags

The concept of reusable VBWF garbage disposal bags made its appearance in the government guidelines for the first time in 2003. It was introduced to discourage the public's dependency on the use of disposable plastic bags at retail stores. Consumers today can ask for these bags from cashiers at retail stores to use them to contain their purchases, and then reuse the bags later to throw out household wastes. Over 64 million of these bags were sold in 2006. The sales volume decreased slightly afterward until 2009. After the Ministry of Environment and five large grocery store chains in Korea agreed to replace individual grocery store plastic bags with these reusable bags in 2010, however, the sales volume began to rise at a steep pace again, growing by 37.4% in just a year to reach 84 million bags sold in 2010. The sales volume of these bags kept growing at an average of 37.2% a year between 2010 and 2014.

Source: Baronews

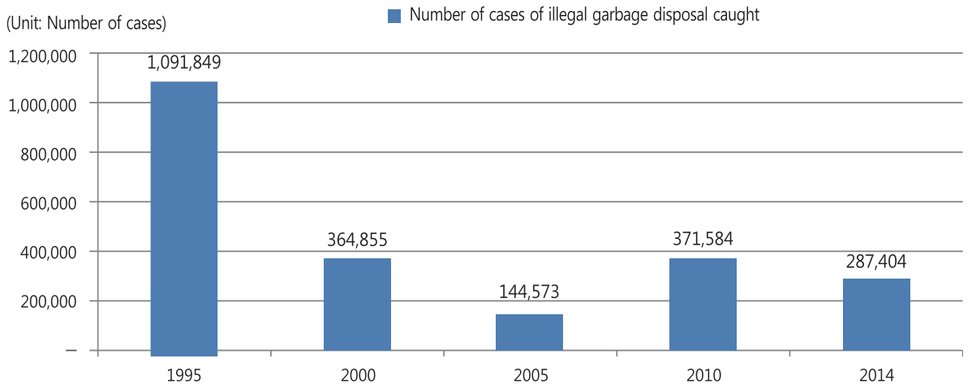
5.3 Crackdown on illegal garbage disposal

The authorities caught as many as 1.09 million cases of garbage disposal in unauthorized bags and illegal incineration of garbage in 1995. This number, however, has plummeted ever since, reaching only a quarter, or 0.28 million, in 2014.

The majority of municipalities across Korea have adopted laws rewarding reports on illegal garbage disposal and incineration. Of the cases caught in 2014, 11% (approximately 30,000) came about as results of neighbors' reports to the authorities.

While illegal garbage disposal and incineration are on a steady decline, they are still ongoing phenomena in certain areas. Some municipalities have even installed surveillance cameras to monitor illegal garbage-related activities.

〈Figure 7〉 Illegal Garbage Disposal and Incineration Trend by Year



Clean Guard Running on Solar Cells: An Innovative Answer to Illegal Garbage Disposal

While illegal garbage disposal is on a steady decline across Korea, it still continues in certain areas and hidden corners of the Korean society. Municipalities have been researching and devising diverse measures to put a stop to such illegal activities. Clean Guard, an automated system running on a solar cell, provides a good example.

Installed in the borough of Daedeok-gu in Daejeon, Clean Guard is equipped with a motion detector and a surveillance camera boasting 2 million pixels. Upon detecting the motion of an illegal garbage thrower in a five-meter radius, Clean Guard activates a warning LED display along with the prerecorded message: "You are under surveillance for illegal garbage disposal. Illegal garbage disposal is a crime punishable by a monetary fine of KRW 1 million or less. Stop throwing out garbage in that area." The camera inside the system then begins to film the scene. Clean Guard is even equipped with a luminosity sensor so that it would emit light upon detecting motions.

Illegal garbage disposal in the area plummeted by over 70% in just one month of installing Clean Guard.

(↑ Clean Guard in Daedeok-gu, Daejeon)

Source: Ministry of Environment (2015), Best Practices of Reducing Food Wastes.

5.4 Administrative improvements to garbage handling

1) Improvement to the collection service

In an effort to enhance the efficiency of collecting recyclable wastes, municipalities began, in 2015, to install Neighborhood Recycling Centers (locations for collecting neighborhood-wide recyclable wastes) in areas, such as remote rural areas and neighborhoods dominated by single detached houses, where recycling had been difficult. As of 2016, 27 municipalities installed 274 such centers, which have together increased the volume of recyclable wastes collected by 11%, while reducing the collection and transportation cost by 30%.

〈Table 4〉 Before and After Installing a Neighborhood Recycling Center

Before	After
	

2) Upgrading garbage vehicles

The garbage vehicles of earlier models were obsolete, and were prone to leaking the odor and the garbage content, causing much displeasure to the public. The Ministry of Environment will introduce new models of vehicles whose cargo boxes are completely sealed so as to prevent any leakages and odors in the first place. The Ministry of Environment continues to develop and distribute more functional, efficient, and safer garbage vehicles.

〈Table 5〉 Old Vehicles Vs. New Vehicles

Type	Household waste vehicles	Food waste vehicles	Wagons (electronic)
Old		 Source: Nocut News	 Source: The Yeongnam Ilbo.
New			

Ⅵ. Expanding the Scope of the VBWF System to Include Food Wastes

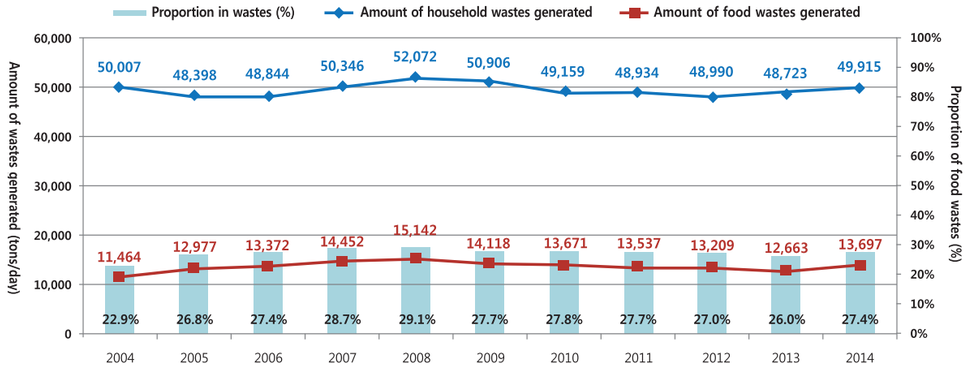
6.1 Overview

Since introducing the VBWF system, policymakers in Korea have also sought to devise policy measures to reduce the amounts of food wastes generated in the country. However, the nature of the Korean diet (involving many side dishes) and the rising income level of the Korean public seemed to pose great obstacles to such efforts. The government thus came to adopt a new approach—preventing food wastes rather than handling them—make people pay for the amounts of not only household wastes, but also food wastes they disposed of.

The Weight-Based Food Waste Fee (WBFWF) system applies exclusively to food wastes that are generated in areas subject to household waste management under the Wastes Control Act. Targets include apartments, single detached houses, and restaurants.

Municipalities began adopting the new system in 2000. The system has been in full force across the nation since 2013.

〈Figure 8〉 Food Waste Trend in Korea



6.2 Chronology

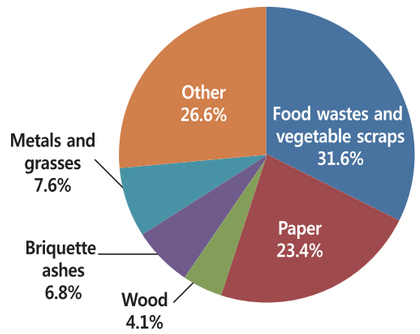
The nationwide introduction of the VBWF system in 1995 began to raise the issue of how to handle and reduce food wastes. In 1995, food wastes and vegetable scraps made up 31.6% of all household wastes disposed of in Korea.

Food wastes at the time were disposed of along with other types of household wastes, and 95% of such

wastes were buried in landfills. As these wastes began to decay, they generated odors, and the water content from them began to seep into the surrounding soil, polluting the landfills and neighboring areas.

A committee of locals living in areas near the landfills in the Seoul-Gyeonggi region thus set out to prevent wet food wastes from entering the landfills as of November 1996. Any garbage disposal bags containing household wastes and that are wet in appearance (whether from the content within or because of the contamination from other wet wastes in garbage vehicles) were prohibited from entering landfills.

〈Figure 9〉 Household Waste Composition ratio in Korea in 1995



Inspired by the action of the locals' committee, municipalities in the region and elsewhere across Korea began to introduce measures to reduce food wastes. The Environmental Preservation Commission introduced the Food Waste Mater Plan in December 1996, followed by the Master Plan for Turning Food Wastes into Resources in September 1998.

Cities nationwide also banned the direct burial of food wastes in landfills beginning in January 2005. The Master Plan for Reducing Food Wastes was introduced in 2010 to implement a comprehensive WBFWF system, which took effect nationwide in 2013.

6.3 How the fees are charged

Whereas household wastes are charged by volume, food wastes are charged by weight. This is because household wastes are relatively low in density, while food wastes, relatively higher in density (0.75 for food wastes, 0.19 for garbage disposal bags) should be charged by weight to provide a fair and effective incentive for reducing them.

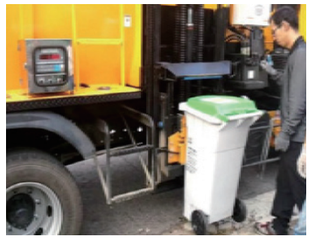
The weight-based system also encourages people to minimize the water content in food wastes before throwing them out, which helps to make the waste collection and storage process more hygienic. The number of food waste weighing meters distributed across Korea continues to increase, particularly in large apartment complexes.

6.4 Collecting food wastes

Food wastes are collected in Korea either using specific garbage disposal bags, plastic chips or stickers, or the radio-frequency identification (RFID) technology.

〈Table 6〉 Types of Food Waste Disposal

Food waste disposal bags	Magnetic chips/stickers	
	■ Plastic chips ■	■ Stickers ■
		

RFID		
■ Individual weighing ■	■ Vehicle weighing ■	■ Portable reader ■
		

Source: Ministry of Environment–Korea Environment Corporation (2012), Weight–Based Food Waste Fee Management Program Manual.

As for food waste disposal bags, individuals are to purchase these bags specified and designated by local governments, place food wastes in these bags, and leave them either outside their doors or at certain locations designated by municipalities. The prices of the bags are the fees that individuals pay for disposing of food wastes. The unit cost of producing these bags is KRW 150 per five–liter bag currently. While this is the least costly method of managing food wastes in Korea, food wastes disposed of thus also tend to contain other types of wastes as well, making processing and recycling difficult.

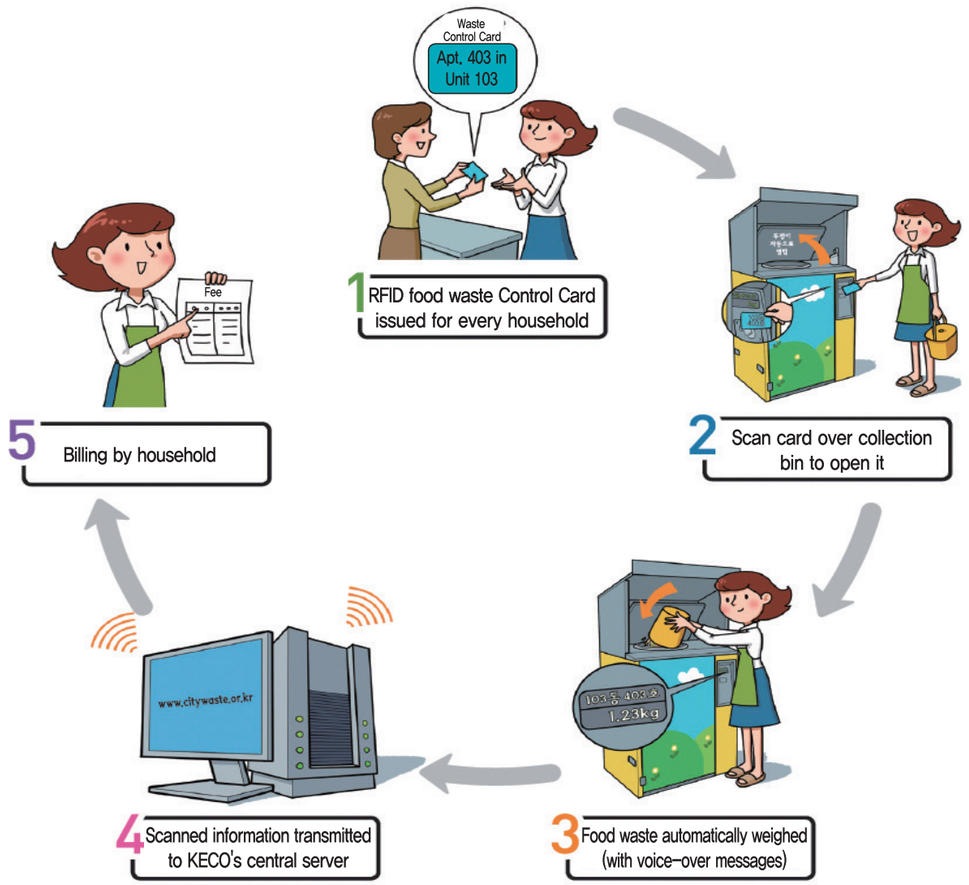
Plastic chips or stickers are what individuals are required to purchase, along with specific containers to which such chips or stickers are to be attached, in order to dispose of food wastes. This is less costly than the RFID system of food waste management, and is also more affordable to maintain as there is no use of electricity involved. Food wastes contained in these containers, however, are measured by volume than weight (while the fees are still charged on the weight basis), which leads to inaccuracies in weighing results. Individuals are also faced with the additional burden of having to purchase specific containers to use the chips/stickers.

The RFID technology, commonly used on public transit pass systems, is also used to manage food wastes by weighing food wastes and charging fees accordingly using special scanners that read the RFID tags on food waste containers. Korea Environment Corporation (KECO) develops and maintains the central IT system and database, while municipalities are responsible for installing and maintaining RFID devices in their jurisdictions.

The RFID system is used either by requiring individuals to weigh food wastes (using RFID–equipped collective food waste bins, installed in large apartment complexes), by weighing food wastes from garbage vehicles (provided for restaurants and other such businesses), or by weighing food wastes at the doors of individual households using portable RFID scanners (where collective bins cannot be installed and/or that are inaccessible to garbage vehicles).

Each RFID–equipped collective food waste bin costs KRW 1.75 million to produce, while the garbage vehicle weighing system costs KRW 15 million to produce each. RFID devices boast high precision in weighing results, and do not require individuals to purchase specific bags or containers to throw out food wastes. The RFID technology is also used to charge progressive fees on food wastes and facilitates statistical management. However, it is far more costly to install and maintain than other ways of food waste control.

〈Figure 10〉 RFID Technology for Food Waste Control



Source: Ministry of Environment (2014), Handbook on Reducing Food Waste!

〈Table 7〉 Types of Food Waste Control in Korea

Type		Cost	Pros and cons		Remark
			Pros	Cons	
RFID	Individual weighing	KRW 1,750,000 per device	■ High precision in weighing wastes ■ Ease of disposal ■ Ease of statistical management and progressive charging	■ More costly than other types to install and maintain	Charge by household
	Vehicle weighing	KRW 15,000,000 per vehicle	■ Relatively little initial investment required	■ Little effect on encouraging households to actually make an effort to reduce food wastes	Charge by area
Plastic chips/ stickers		KRW 100,000 per device	■ Less costly to adopt and maintain than RFID (no use of electricity)	■ Inaccurate readings (because of weight estimates based on volumes) ■ Inconvenience of purchasing containers	Charge by area
Disposal bags		KRW 150 per 5-liter bag	■ Least expensive	■ Difficulty of recycling	Charge by household

Source: Ministry of Environment (2016), 2016 White paper of environment.

The way food wastes are controlled and handled differs from municipality to municipality. The RFID system has been growing in popularity since 2012. Of the 146 eligible municipalities, 145 were participating in the WBFWF system in 2015, 119 of them having adopted the RFID technology.

Plastic chips and stickers are still the most common forms of food garbage disposal (49.1%) in Korea, with some municipalities opting for two or more ways of managing food wastes. The distribution of different types of food waste control by area type, as of February 2014, is summarized in the table 8.

〈Table 8〉 WBFWF System Types by Area (February 2014)

Area	Disposal bags	Plastic chips/stickers	RFID
Apartment complexes	43	91	77
Single detached houses	72	76	3
Restaurants	62	92	11
Total	177	259	91

Note: Areas using two or more types were counted twice or more.
Source: Environmental Administration Research Society (Korean Association for Public Administration, 2015) A Comparative Study on Food Waste Management in Korea and Abroad: Suggestions for Improvement.

Ⅶ. Outcomes

7.1 Environmental outcomes

1) Decrease in the amounts of household wastes generated

In 1994, one year prior to the national implementation of the VBWF system, almost 58,000 tons of household wastes were generated each day. Introduction of the VBWF system decreased the daily amount of household wastes by 18% to 47,000 tons in just a year. After slight fluctuations over the years, the daily amount of household wastes generated nationwide remained at 49,000 tons in 2014.

Similar patterns are noted in the amount of household wastes generated per capita per day, with the VBWF system reducing it from 1.33 kilograms in 1994 by 20% to 1.07 kilograms in 1995, and by 29% further to 0.95 kilograms in 2014.

〈Table 9〉 Household Waste Generation by Year

Quantity	1994	1995	1996	2000	2005	2010	2014
Per capita comparison (Kg/capita/day)	1.33	1.07	1.11	0.98	0.99	0.97	0.95
Total generation (ton/day)	58,118	47,774	49,925	46,438	48,398	49,159	49,915

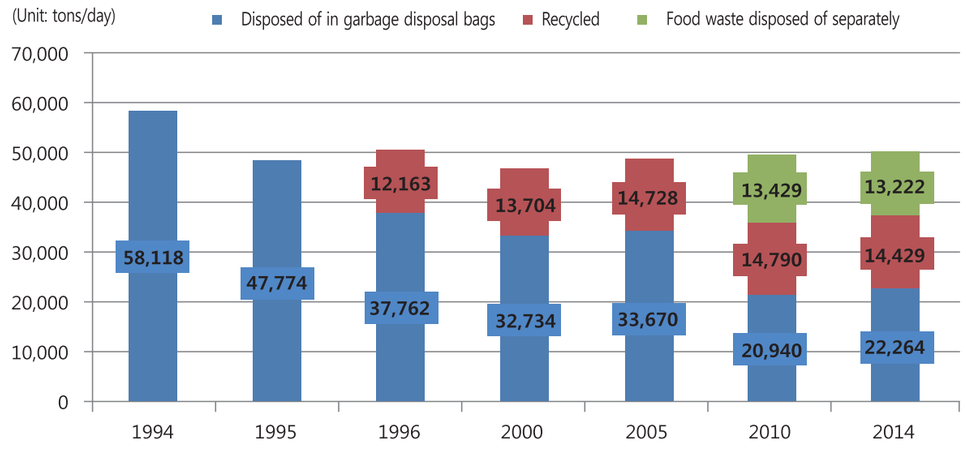
※ Total generation: VBWF garbage disopsal bags + recycled wastes + food wastes (separated from household wastes).

2) Increase in waste separation

In 1994 and 1995, much of the household wastes, including recyclable wastes and food wastes, were disposed of in disposable bags together. The water content from decaying food wastes seeping out of disposal bags raised complaints from residents of areas living near landfills, causing policymakers to introduce the WBFWF system subsequently.

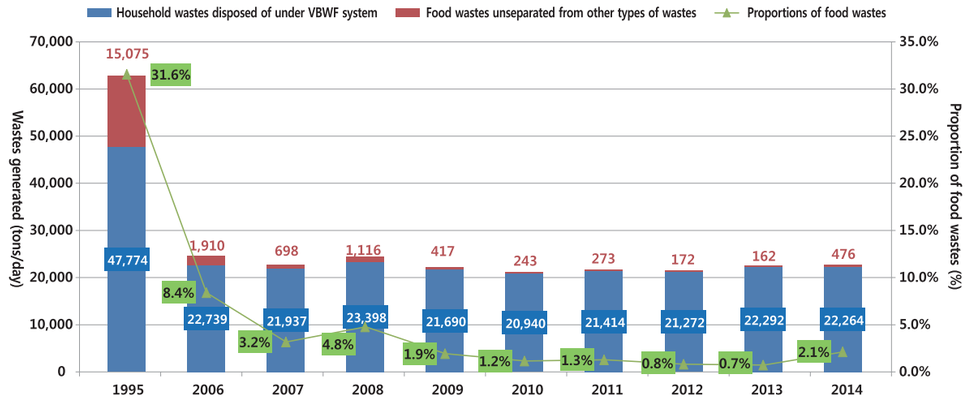
Recycling and separation of food wastes from household ones have been on the rise since 1996. In 2014, only 44.6% of all types of household wastes were disposed of using disposal bags, while the rest were recycled or disposed of separately as food wastes.

〈Figure 11〉 Household Waste Separation Trend



While food wastes made up 31.6% of all waste content in garbage disposal bags in the early days of the VBWF system, the proportion has since plummeted to 2.1% by 2014.

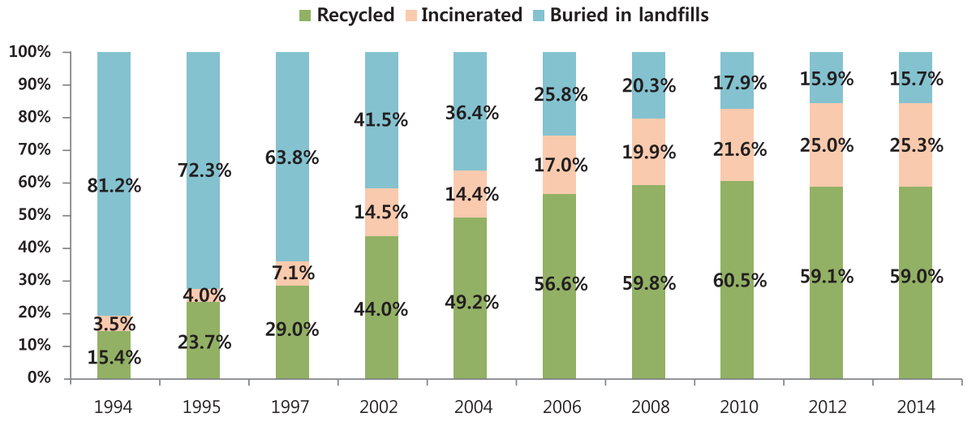
〈Figure 12〉 Food Wastes Mixed with Household Wastes in VBWF Garbage Disposal Bags



3) Increase in recycling

The increase in waste separation also led to the increase in recycling. Whereas the recycling rate was a meager 15.4%, pale in comparison to the landfill rate of 81.2%, in 1994, the recycling rate soared as high as to 59% by 2014, while only 15.7% of household wastes generated were buried in landfills.

〈Figure 13〉 Recycling Rate Trend by Year

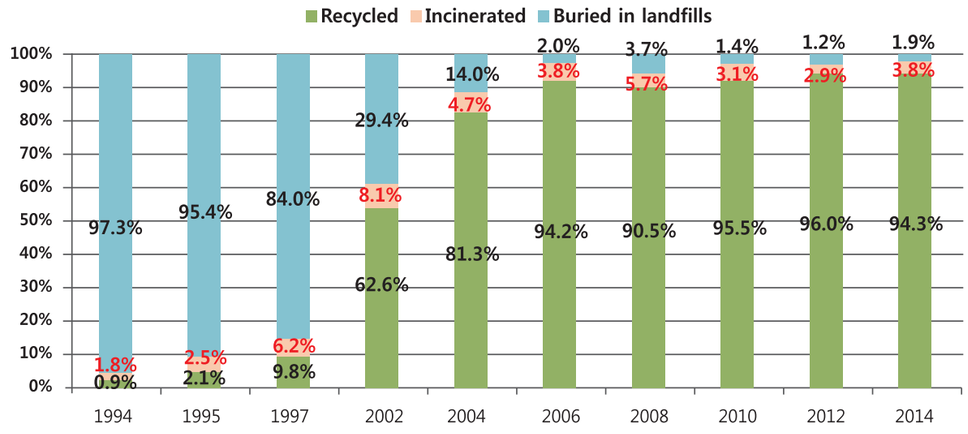


4) Increase in the recycling of food wastes

The increase in food waste separation has also led to the development and improvement of a system for recycling food wastes into new resources. As of 2014, 96.5% of all food wastes generated in Korea were disposed of separately from household wastes.

As early as in 1994, prior to the introduction of the VBWF system, 97.3% of food wastes were buried in landfills, and only 0.9% of food wastes were recycled. The trend was completely reversed by 2014, with only 1.9% of food wastes buried in landfills and 94.3% recycled.

〈Figure 14〉 Food Waste Recycling Rate Trend by Year



7.2 Economic outcomes

According to a recent analysis from the Ministry of Environment[1], the VBWF system helped to reduce the total amount of household wastes generated by 1.03 million tons between 1995 and 2012, which, when converted into a monetary value, is estimated to equal KRW 14.8 trillion($ 13.5 billion) in economic benefits. Moreover, the increase in the recycling of five major resources—paper, glass bottles, cans, plastics, and metals—is estimated to have produced another KRW 4.7 trillion($ 4.3 billion) in value.

In other words, the cumulative total economic effect of the VBWF system between 1995 and 2012 amounted to KRW 19.6 trillion($ 17.8 billion), and to KRW 21.4 trillion($ 19.5 billion) in 2013.

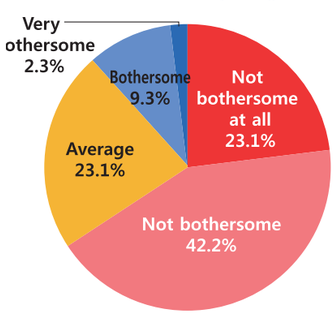
7.3 Social outcomes

1) Changing attitude of the producer and the consumer

In the past, Koreans hardly grasped the concept of paying money for throwing things out. Today, it is an accepted economic and environmental maxim that garbage costs money.

According to the Ministry of Environment's recent study, Two Decades of the Volume-Based Waste Fee System in Korea: Assessment and Future Improvements, the majority of Korean consumers answered, in an opinion poll, that they do not find recycling so bothersome or inconvenient. On the opinion poll, 23.1% and 42.2% of respondents found recycling "not bothersome at all" and "not so bothersome," respectively (a total of 65.3%). On the other hand, only 2.3% and 9.3% of respondents found recycling to be "very bothersome" and "bothersome," respectively (a total of 11.6%).

〈Figure 15〉 Opinion Poll on How Bothersome People Find Recycling



Now that the VBWF system is a well-established part of people's daily lives, Koreans increasingly prefer refill products to fully packaged ones, and also leave Styrofoam and other such unnecessary packing materials at stores and bring only the contents when they make purchases. There is also an increasing proportion of consumers who regularly bring reusable totes to grocery stores to avoid using plastic disposable bags. Consumers also increasingly make an effort to use personal tumblers instead of paper or plastic cups.

Manufacturers have responded in kind by increasing the output of their refill products, and developing and introducing more eco-friendly technology regarding compact packing materials, recycle enlargement methods, and biodegradable disposal bags.

1) Ministry of Environment (2014), Two Decades of the Volume-Based Waste Fee System in Korea: Assessment and Future Improvements.

2) A virtuous cycle of resource usage and recycling in Korea

The VBWF system has been playing a pivotal role in shaping and strengthening a virtuous cycle of resource usage and recycling in Korea, prompting people and businesses to reuse and recycle as much as possible and minimize garbage to be incinerated or buried in landfills.

The VBWF system has significantly increased the separation of food wastes from other types of household wastes and recycling, while minimizing the amounts of wastes in landfills.

Recycled wastes help make the Korean society more cost-effective and sustainable, helping to minimize the waste of resources.

VIII. Future Tasks

This report introduces the histories, major features and characteristics, and accomplishments of the VBWF and WBFWF systems in Korea, which were introduced to minimize the amounts of household wastes generated and encourage recycling.

Although the Korean government has introduced a number of policy measures for handling wastes, the VBWF system, which is now in its 22nd year, has proven to be the most enduring and effective policy system that has innovated waste management in the country.

The introduction of the VBWF system has greatly reduced the amounts of household wastes generated and increased recycling. The cumulative economic effect of the system was estimated to amount to KRW 21.4 trillion($ 19.5 billion) as of 2013. Neighborhoods near landfills no longer suffer from the stench and soil contamination caused by wet food wastes, while increasing amounts of wastes are recycled as valuable resources, helping the Korean society maximize energy efficiency and reduce greenhouse gas emissions.

The VBWF system is an effective policy that has induced positive changes in the attitude of consumers and producers alike, encouraging both to recycle as much as possible. It provides an exemplar of environmental policies providing economic incentives.

Nevertheless, a number of improvements should be made to the system in the coming years. First, the prices of the VBWF garbage disposal bags should be made more realistic in light of the costs involved. While, in principle, the collection, transportation, and processing of all garbage disposed of in those bags should be carried out with the proceeds from the bag sales alone, the utterly low retail prices of these bags make them a source of only 26% of the actual costs involved in handling garbage. It is, therefore, important to raise the prices of garbage disposal bags to incentivize the public to reduce garbage further, strengthen the fiscal soundness of local governments, and enhance the efficiency of administrative services for garbage cleaning and handling.

Second, policy measures are needed to prompt fast food franchises and other such businesses to separate food wastes and recycle with greater efficiency, as these businesses rely on the use of disposable products. Third, the VBWF garbage disposal bags should be made available in smaller and more diverse sizes to accommodate the increasing number of single- and two-person households. Fourth, the use of disposable plastic bags by small businesses and vendors should be discouraged.

Korea is transforming into a resource-recycling society today. The progress of the VBWF system should continue until the virtuous cycle of resource usage and recycling is perfected.

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9 771976 624002
ISSN 1976-6246