# **Current Status for Resources Recycling in Korea**

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## Abstract

In order to prospect current recycling status in Korea, legislative system and policies relating to recycling, wastes generation and recycling rate were reviewed. Approximately 303,000 ton/day of wastes was generated in 2003; 50,700 ton/day of household waste and 252,300 ton/day of industrial waste. During the last ten years, waste management laws such as waste disposal law, recycling law and environment friendly industry law were prepared. In this article, concerning over waste generation and recycling, recycling law, Extended Producer Responsibility System and the problems and technological developments associated with recycling were summarized.

**Keywords :** Waste Generation and Recycling, Recycling Law, Deposit-Refund System, Waste Treatment Charge System, Extended Producer Responsibility System, Industrial Waste Recycling.

# LEGISLATIVE SYSTEM AND POLICIES RELATING TO RECYCLING [1]

During the last 20 years, there has been a rapid increase by 8% annually in the amount of wastes generated in Korea. In accordance with this status, the legislative system and policies relating to recycling have been established or enforced as shown in figure 1.

The waste Clean up Law of 1961, which focuses on the treatment of night soil and other diverse wastes, was superseded in 1986 by the Waste Management Law, which stresses the minimization and recycling of wastes. In 1992, the Deposit-Refund System and the Waste Treatment Charge System for Waste Disposal were introduced with the enactment of The Law Relating to Promotion of Resources Saving and Reutilization (recycling law).

## The Deposit-Refund System [2]

The system has two objectives; to reduce the volume of waste by applying the Polluter-Pays principle, and to encourage retrieval of reusable items. Producers and importers of recyclable goods will be required to make cash deposits of set amounts, and they will be reimbursed according to their performance in retrieval and treatment.

This system went into effect in January 1992 in seven business areas. Originally 17 different items of seven types such as containers for food, insecticides, butane gas products, and toxic products were covered, but some of them were soon found to be unsuitable. As a result, the list was modified in June 1993 so that some items of the deposit system was transformed into a charge system, and the list of items was shortened to cover only paper packs, metal cans, glass bottles, batteries, tires, lubricants, TV sets, washing machines and refrigerators. Polyethylene bottles, medicine containers and air conditioners were later added to the list of the deposit and refund system; to make up a total of 11 items on the list being retrieved in five areas.

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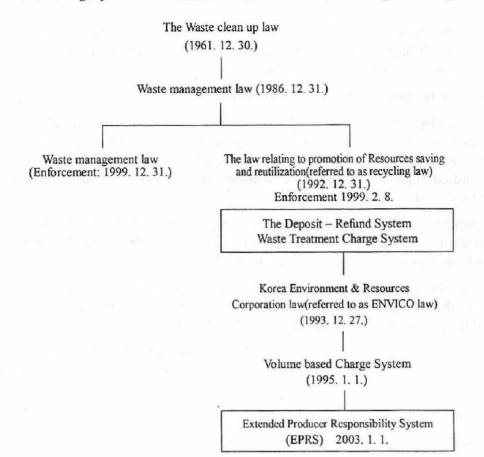


Fig. 1: The Flow of the Legislative System Relating to Recycling in Korea

#### Waste Treatment Charge System [3]

This charge system was established to curb consumption of products and containers which are difficult to collect, treat, or recycle, or likely to render waste management generally difficult. It imposes charges on firms that produce these types of products.

Charges are imposed on firms of nine business types producing 15 items. These items, include containers for insecticides or toxic substances. Firms manufacturing or importing products, materials, or containers for export purposes will be exempt from the charges, however.

## Korea Environment & Resources Corporation (Envico) [4]

ENVICO was established by Korean Government in September 11, 1980. The philosophy of ENVICO is contributing the environmental conservation through volume reduction and recycling of the wastes. At the very beginning, the major mission was collection of rural plastic films and the empty pesticide bottles. As of April, 1996, ENVICO has 82 regional points. Also 10 intermediate sorting plants for commingled plastics wastes as well as 4 recycling plants for HDPE from rural area. ENVICO has many activities that support the domestic recycling industry by both developing technologies and financing. Although ENVICO was initiated by waste management law at the beginning, independent ENVICO law was established in December 27, 1993. From January 2003, ENVICO operates the EPR system such as i) Decision on the total mandatory recycling amounts by item, ii) Decision on the mandatory recycling amounts by item, ii) Decision on the mandatory recycling amounts by item.

## Volume-Based Charge System for Household Wasted

This system came into force across the country on January 1. 1995. It does not apply to burnt coal briquettes, recyclable wastes or home appliances such as discarded refrigerators. The system was launched in order to reduce the volume of household and small business wastes and encourage

recycling. As of the April 1995, 99% of all household wastes were being discarded in the officially designated plastic trash bags. The system has led to a 37% reduction in the volume of household wastes and a 40% rise in the volume of recycled wastes.

## Extended Producer Responsibility System (Eprs) [5]

Under the Producer Deposit System of 1992, producers of home appliances, tires, lubricants, batteries, paper goods, and metal cans paid a certain deposit to the government, and received refunds proportional to the deposit when they recycled their products and product waste. This system, however, was limited in promoting recycling because it did not place enough recycling responsibility directly on the producers.

To further encourage recycling, the government will implement the Extended Producer Responsibility System(EPRS) starting January 1, 2003, which will impose waste recycling obligations on producers or importers of high waste-generating products and packaging materials.

The government sets the amount of waste that must be recycled by each producer of goods and packaging materials, taking into account the collection of recyclable resources and other recycling conditions, and the producers must reach their recycling target.

According to the system, producers must recycle home appliances like televisions, refrigerators, and washing machines, tires, lubricants, fluorescent lights(F.L.), and packaging materials such as cans, glass bottles, and plastic bottles.

## WASTE GENERATION [6]

## Waste Generation

Solid waste can be classified into either industrial or household wastes as shown in figure 2. However, the law defines waste as general or specified, depending on the characteristics and the hazards it poses.

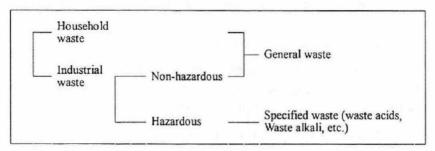


Fig. 2: Classification of Waste

Needless to say, specified waste, or hazardous waste, is subject to more rigorous control in regards to collection, transport, storage, and treatment.

During the last 20 years, there has been a rapid increase by 8% annually in the amount of wastes generated in Korea. Approximately 303,000tons/day wastes were generated in 2003 : 50,700tons/day of household waste and 252,300tons/day of industrial waste as shown in table 1. General wastes from industrial wastes are largely composed of slags, construction debris and sludge and the percentage of non-combustible waste is very high, which is shown in table 2.

## Waste Recycling

In general, the waste generated is treated with methods of reclamation, incineration and recycling. Korea still depends mostly on the reclamation although incineration and recycling portions increase gradually. In Korea, the recycling of industrial waste reaches 75.8% because industrial waste can be used as raw materials for other products. However, only 43.1% of the household waste in 2001 was

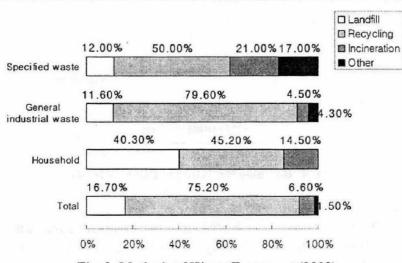
recovered and re-utilized due to the problems of collection, sorting and recycling systems. Waste disposal by processing method in 2003 is shown in figure 3.

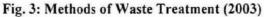
Classifie	Year	<b>'</b> 96	<b>'</b> 97	<b>'98</b>	<b>'</b> 99	2000	2001	2002	2003	Remarks (1,000tons/ year(2003))
Grand Total		180.8	194.7	188.6	219.4	234.1	260.4	277.5	303.	110,595
Household		49.9	47.9	44.6	45.6	46.4	48.4	49.9	50.7	18,505
Industr ial Waste	Sub Total	130.9	146.8	144.0	173.8	187.9	212.0	227.6	252.3	92,090
	General	125.4	141.3	138.7	166.1	180.2	204.4	219.6	244.3	89,170
	Specified	5.5	6.1	5.3	7.7	7.6	8.1	8.0	8.0	• 2,956

Table 1: Waste Generation by Type and Source in Korea

**Table 2: Composition of Industrial General Waste** 

	(Uni	it : 1,000to
Consul wests	200	2
General waste	Generation	Rate
Slags	9,571	11.9%
Incineration residue and dust	6,703	8.4%
Metal and glass	1,143	1.4%
Construction debris	43,851	54.7%
Waste paper, Waste wood	550	0.7%
Sludges	10,261	12.8%
Waste lime, Waste gypsum	1,756	2.2%
Waste synthetic high Polymer Compound	1,705	2.1%
Waste sand	1,337	1.7%
Waste body of animal and plant	783	1.0%
Others	2,512	3.1%
Total	80,172	100%



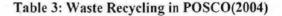


#### **RECYCLING OF INDUSTRIAL WASTE**

#### Waste Recycling in POSCO [7]

With the completion of the 5<sup>th</sup> Blast furnace of Kwangyang Works in 1999, it is anticipated that approximately 16 million tons of wastes will be generated both in Pohang and in Kwangyang Works of POSCO annually. By vigorous activities, POSCO's waste recycling rate reached to about 98% in 2004 from the 40% in early 1980's. Table 3 shows the wastes recycling in POSCO in 2004. A large portion of them is processed for re-utilization as resource for out house use. Utilization of Blast furnace slag in POSCO in 2004 is shown in figure 4.

		Genera-	Tun	Recycling	1	Recycling Rate 2002	Land fill	Incinera- tion
		tion	In —house Use	Others(Out - house use)	Total			
B.F.	Granulated	7,109	<pre>//image/ima //image</pre>	7,109	7,109	100.0%	0	0
Slag	Air cooled	1,490	21	1,469	1,490	100.0%	0	0
Steel slag		5,184	1,625	3,559	5,184	100.0%	0	0
Dust		1,422	1,189	183	1,372	96.5%	50	0
Sludge		1,493	720	643	1,363	91.3%	111	19,424
Waste oil		11	1	6	7	64.1%	0	3,882
Iron oxides		61	1	61	61	100.0%	0	0
Scale		543	543	0	543	100.0%	0	0
Waste brick		257	85	172	257	100.0%	0	0
Other		845	59	746	805	95.3%	29	11,189
Total 18,41		18,416	4,245	13,947	18,192	98.8%	190	34,496



(Unit : Ton)



Fig. 4: B.F. Slag Recycling in POSCO(2004)

## Fly Ash [8]

Fly ash generation from power plants in Korea and recycling situation was shown in table 4. Recycling rate was 65.3percent in 2004. Mostly, the finer size fly ash which is low content of unburned carbon from bituminous coal were recycled as concrete additive.

Power plant		Coal Consump tion (ton)	Fly ash Genera ted (ton)	Fly ash Rate (%)	Recycling (ton)	Recycling rate (%)	Field of recycling
	Yeongdong	560,151	224,000	40.0	218,000	97.3	Cement materials casting
Anthracite	Seocheon	730,595	259,000	35.5	164,000	63.3	Aggregate for construction Concrete additive
	Gunsan	-					Aggregate for construction
	Donghae	1,124,236	520,000	46.3	401,000	77.1	Cement materials
	Total	2,414,982	1,003,000	41.5	783,000	78.1	
	Samcheonpo	9,638,185	760,000	7.9	520,000	68.4	Concrete additive
	Boryung	9,081,175	965,000	10.6	554,000	57.4	Concrete additive
в	Taean	8,981,576	823,000	9.2	619,000	75.2	Concrete additive
itun	Hadong	8,684,997	984,000	11.3	602,000	61.2	Concrete additive
Bituminous	Dangjin	5,865,799	708,000	12.1	425,000	60.0	Concrete additive
us	Younghung	1,573,471	141,000	9.0	18,000	12.8	
	Honam	1,669,058	137,000	8.2	83,000	60.6	
	Total	45,494,261	4,518,000	9.9	2,821,000	62.4	6 T
Grand Total		47,909,243	5,521,000	11.5	3,604,000	65.3	
Grand Total in 2002		41,547,800	5,005,260	12.0	3,729,688	74.5	100 Sec. 12 13
Grand Total in 2001		39,411,749	4,775,679	12.1	3,108,697	65.1	
Grand Total in 2000		34,829,842	4,310,544	12.4	2,420,218	56.1	
Grand Total in 1999		29,911,995	3,874,874	13.0	1,676,£J8	43.3	

Table 4: Fly	Ash R	ecycling in	n Power	Plants(2004)
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## Waste Automobiles [9]

The Korean Auto industry has developed remarkably over the past 30 years. In 2004 alone, Korea produced 3.469 million vehicles, and the number of vehicles registered surpassed the 14 million marks. The rapid growth in registration, however, has given rise to problems of traffic congestion and environmental pollution.

As the number of vehicles registered in Korea has increased year after year, a rising number of cars have been scrapped. In 2004, a total of 509,308 automobiles were scrapped, up dramatically from only 100,000 in 1987. Table 5 shows number of vehicles registered, number of E.L.V. scrapped, number of E.L.V. abandoned and number of dismantlers.

The system for handling of ELVs in Korea is governed by the "Motor Vehicle Control Act". The Act places the responsibility for vehicle scrapping directly on the vehicle owners. A vehicle owner can only cancel a vehicle registration after he gets a certificate from an authorized vehicle dismantler showing that his vehicle was properly scrapped according to the law. The take-back rate of ELVs reaches nearly 100% in Korea.

Current Status for Resources Recycling in Korea

				(Unit : Numbe	
Year	No. of vehicles registered	No. of E.L.V. scrapped	No. of E.L.V. abandoned	No. of dismantler	
1993	6,274,008	308,252	31,623	86	
1994	7,404,347	352,582	26,997	104	
1995	8,468,901	406,055	27,514	141	
1996	9,553,092	489,178	32,453	160	
1997	10,413,427	585,641	19,411	185	
1998	10,469,599	562,168	45,934	227	
1999	11,164,319	456,191	52,524	259	
2000	12,059,861	455,592	59,180	277	
2001	12,914,115	461,621	45,969	291	
2002	13,949,440	462,996	37,952	300	
2003	14,586,795	549,250	59,263	310	
2004	14,934,092	509,308	56,659	. 324	

#### Table 5: The Number of Scrapped Vehicles in Korea

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