EPR Case Study: Japan

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Title: EPR-based Electronic Home Appliance Recycling System under Home Appliance Recycling Act of Japan

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Title of the EPR-related Legislation: Act for Recycling of Specified Kinds of Home Appliances ("Home Appliance Recycling Act")
Dates of the Enactment and Enforcement: Enacted in June 1998; came into full force in April 2001

1. Legal Aspects: Overview of the Home Appliance Recycling Act

Background to the enactment of the Home Appliance Recycling Act
In the late 1990s, Japan began its efforts to improve legislation concerning various kinds of waste and their recycling. These efforts were prompted by increases in the types and quantities of waste, which were driven by the increase in consumption and the permeation of the throwaway culture. These changes were due to changing lifestyles, which in turn were associated with (i) rapid economic growth and urbanization of Japan, and (ii) the advent of the consumer era that was made possible by the so-called "economic bubble" during the 1980s.

Until the Home Appliance Recycling Act came into force in 2001, the increase in both the types and quantities of waste electrical and electronic equipment (WEEE) was making it more and more difficult for municipalities alone to manage WEEE in environmentally sound manner. Due to its incombustibility, WEEE was shredded to recover some recyclables. And then, remaining residues (shredder dust) were disposed of in landfills. Because of the hazardous materials in shredder dust, these residues have to be disposed in controlled landfill sites. There was general consensus that this contributed to the increasing scarcity of final disposal sites. As larger appliances with a complex structure and composition were increasingly coming onto the market, the efficient collection and proper management of home appliances by municipalities was made even more difficult.

It was under these circumstances that the Home Appliance Recycling Act was enacted in June 1998 and came into force in April 2001.

Objective of the Act
The objective of the Home Appliance Recycling Act is defined by Article 1, which states: "This legislation shall have the objective of contributing to the maintenance of the living environment and the healthy development of the national economy, by taking steps to **secure the environmentally sound disposal of waste and effective utilization of resources** through the introduction of measures for proper and smooth collection, transportation, and recycling of specific household appliance waste by retail traders or manufacturers of specific household

appliances, with the aim of **achieving a reduction in the volume of general waste and sufficient utilization of recycled resources**." To achieve this objective, the Home Appliance Recycling Act is designed to solve the following problems:

- Environmentally sound disposal of wastes (hazardous wastes)
  WEEE that is disposed of as bulky waste contains hazardous materials and pollutants. These include chlorofluorocarbons as both greenhouse gas and ozone-depleting substance, oil in motors and compressors, and heavy metals used in making printed circuit boards. Illegal dumping of such products pauses even greater environmental risks. Thus, a system to manage WEEE in environmentally sound manner was expected to be built. In addition, since environmentally sound management of these wastes was often beyond the capacity of individual local governments, the manufacturers of these appliances were expected to participate in the process of managing these wastes.

- Effective use of recyclable materials
  WEEE contains large amounts of iron, aluminium, copper, and glass. These can be an effective source of materials if they can be recovered efficiently.

Targeted products
This act covers the following four categories of home appliances:

- Air conditioners
- TV sets (the cathode ray tube (CRT) and liquid crystal display (LCD) types, excluding those designed to be incorporated into a building and do not use primary batteries or storage batteries for their power source, as well as the plasma type)
- Electric refrigerators and freezers
- Electric washing machines and clothes dryers

(Flat-screen TV sets (the LCD and plasma types) and clothes dryers were added to the designated categories in April 2009.)

Among other typical WEEE, Personal Computers are managed under the different act called Act on the Promotion of Effective Utilization of Resources. Also, small electronic appliances such as mobile phones have been managed under a new law called Small Electrical and Electronic Equipment Recycling Act since 2013.

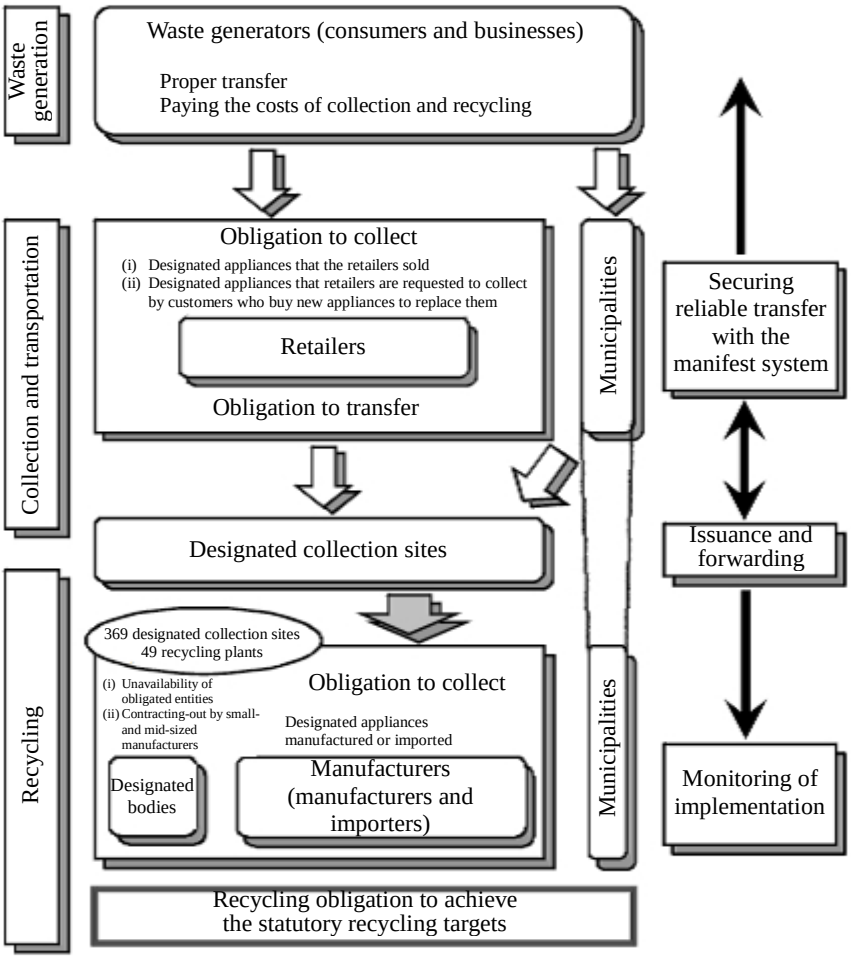


Figure 1 Waste flows and stakeholder roles under the Home Appliance Recycling Act
Source: Association for Electric Home Appliances (AEHA), Annual report on home appliance recycling for FY2012 [in Japanese]

Responsibilities under the Act
The Home Appliance Recycling Act defines the responsibilities of consumers, retailers, and manufacturers as follows:

- Consumers as Disposers [cost-bearing and transfer]:
  Consumers and businesses that wish to dispose of the waste home appliances are responsible for paying for both the collection/transportation fee and the recycling fee as well as for proper returning of them to the retailers from whom they were bought.

- Retailers [collection from disposers and transfer to manufacturers, etc.]:
  Retailers are responsible for collecting the home appliances that they sold or, at the request of customers who buy a replacement appliance from them, taking back the old appliances owned by these customers as well as transferring these end-of-life products to the responsible manufacturers, etc.

- Manufacturers and importers of home appliances (hereinafter referred to as "Manufacturers") [collection and recycling]:

Manufacturers have the obligation to collect and recycle the home appliances they manufactured or imported.

However, **small and medium-sized Manufacturers** can contract out this responsibility to other bodies designated under the Act ("designated bodies"). The act defines the size of small and medium-sized Manufacturers as having manufactured or imported less than the number of units shown below in the previous three years (for domestic shipments only):

- Less than 900,000 air conditioners
- Less than 900,000 TV sets (CRT, LCD and plasma types)
- Less than 450,000 electric refrigerators and freezers
- Less than 450,000 electric washing machines and clothes dryers

- Responsibilities of the national government
  The national government is responsible for supporting activities, which is necessary for proper and effective collection, transport and environmentally sound recycling, including promoting research and development, providing information, developing related facilities, providing technical assistance, conducting environmental education, and implementing information dissemination activities.

- Responsibilities of munisipalities
  Municipalities are responsible for managing municipal waste. They are therefore responsible for managing waste home appliances or WEEE outside the scope of the collection and management obligations of the producers under the Home Appliance Recycling Act. Municipalities can transfer the targeted household appliance waste under this act they have collected to Manufacturers who have the obligation to collect such waste. Or, if local governments wish, they can also recycle it themselves.

Cost-bearing mechanism

Consumers pay both the collection/transportation fee and the recycling fee when they dispose of their WEEE. The collection/transportation fee is set by the retailers, and the recycling fee by the Manufacturers. The act stipulates that the recycling fee shall not exceed the cost of recycling.

The collection/transportation fee represents the primary logistics fees. In the case of collection by a retailer, this consists of (i) the fee for collection of the waste home appliances from the consumer's home and its transportation to a retailer's shop; and (ii) the fee for transportation from the retailer's shop to a designated collection site. In the case of collection by a local government, the collection/transportation fee represents the fee for the collection of the waste home appliances from the consumer and its transportation to a designated collection site. Note that the collection/transportation fee does not include the fee for secondary logistics, i.e., transportation from a collection site designated by Manufactures to a recycling plant. Retailers and local governments set their own collection/transportation fees depending on the transportation distance as well as the type and size of the waste home appliances (Table 1). Some retailers charge only the second fee described above when customers buy a replacement appliance from them. Many major mass retailers charge 525 yen per unit regardless of the type and size of the waste home appliances.

Different Manufacturers charge different recycling fees, which are subject to regular review. However, leading manufacturers have been charging a uniform amount, as shown in Table 2.

Table 1: Average collection/transportation fees that retailers charge for collecting the four categories of waste home appliances (unit: JPY)

	Collection/transportation fees (Primary logistics)
Air conditioners	2,450
TV sets	2,000
Refrigerators and freezers	2,600
Washing machines	2,050

Note: Except for remote islands.

Source: Compiled from theAEHA, Annual report on home appliance recycling for FY2012 [in Japanese]

Table 2: Trends in the recycling fees for major manufacturers (unit: JPY)

FY		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Air conditioners		3,675						3,150	2,625			2,100		1,575
TV sets	16 inch~	2,835							2,835					
	~15 inch								1,785					
Refrigerators	171 L~	4,830							4,830					
	~170 L								3,780					
Washing machines		2,420												

Source: Compiled from theAEHA, Annual report on home appliance recycling for FY2012 [in Japanese]

When the recycling act was initially taken into force, the recycling fee was at a flat rate for each of the target items regardless of the size, for convenience. This, however, created a sense of unfairness among the consumers. In 2008, a joint advisory council between the Ministry of Economy, Trade and Industry (METI) and the Ministry of the Environment (MOE) stated that the Manufacturers should further explore the possibility of reducing the recycling fee. This statement was made in their “report on the evaluation and review of the process in the implementation of the home appliance recycling system” [in Japanese]. In the same year, leading manufacturers set different fees for different sizes of waste home appliances. Some manufacturers set up two categories of sizes for LCD and plasma televisions, which were newly added to the target items. The recycling fee for air conditioners has been reduced several times by some manufacturers.

Targets set under this act

Under the Act, plants that recycle the target products are required to achieve the statutory recycling targets (Table 3). The recycling target for each category is expressed as the percentage recovered from the WEEE for recycling (recyclables) of the total weight of the components and materials in the WEEE. The statutory recycling targets shown below exclude thermal recovery although this is considered a form of cyclical use under the Act.

Table 3: Statutory recycling targets

	Statutory recycling targets	
	FY2001-2008	FY2009-
Air conditioners	60%~	70%~
TV sets (CRT)	55%~	55%~
TV sets (flat screen)	-	50%~
Refrigerators and freezers	50%~	60%~
Washing machines	50%~	65%~

Source: Compiled from theAEHA, Annual report on home appliance recycling for FY2012 [in Japanese]

The statutory recycling targets were revised once effective in FY2009. The target for CRT televisions, however, has remained at 55% since the resource value of CRT glass has been declining significantly, as described later.

Penalties
Retailers and Manufacturers who neglect their obligations for collection and recycling as stipulated in this recycling act, provide false information, or impose unlawful charges are subject to corrective recommendations, corrective orders, or penalties. Monetary penalties range from a fine of up to 100,000 yen to a fine of up to 500,000 yen. Individuals who commit illegal dumping are subject to up to five years in prison or a fine of up to 10 million yen (or 300 million yen for corporations) under the Waste Management and Public Cleansing Act.

Transparency of the selection of the collectors
As far as the primary logistics are concerned, retailers do not have to obtain a license for waste collection and transportation for their collection and transportation of the waste home appliances. They can also contract out this operation, but only to operators with a license for the collection and transportation of municipal or industrial waste. Secondary logistics, i.e., transportation from a designated collection site to a recycling plant, however, requires certification by the competent ministry or a license for the collection and transportation of both municipal and industrial wastes. These license and certification systems ensure the transparency of the selection of the collectors.

Other related policies

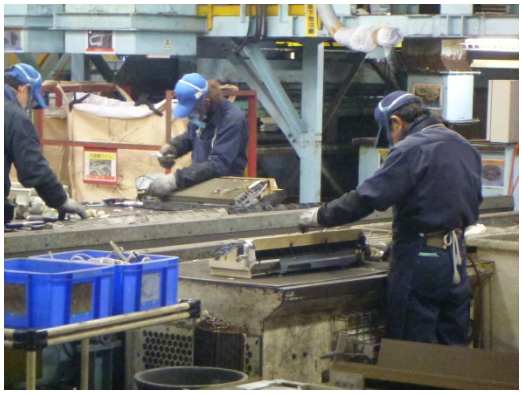
- AEHA's assistance projects for the collection of the waste home appliances from remote islands and the prevention of illegal dumping
  As described later, discussions were held in 2006 and 2007 to review the Home Appliance Recycling Act. These discussions culminated in a "report on the evaluation and review of the process in the implementation of the home appliance recycling system." The report, released in February 2008, pointed out two issues among other things. One was the need "to build a framework in which Manufacturers provide financial and other support to municipalities that take active measures to prevent illegal dumping." The other was the need "for Manufacturers to provide financial and other support to help improve the collection and transport of the waste home appliances from remote islands in relation to the cost of marine transport if certain conditions are met." To help meet these needs, AEHA launched two discrete projects in FY2009.

  In the first project, AEHA subsidizes the cost of the collection and transport of the waste home appliances , which tends to be higher on remote islands where the total amount of the waste home appliances generated is often much less. The idea is to reduce the financial burden on consumers in such areas. AEHA also offers related information and advice.

  In the second project, AEHA provides support to municipalities that implement projects designed to prevent the illegal dumping of the waste home appliances or those for collecting illegally dumped home appliances and transferring them to the Manufacturers. Such support takes the form of sharing good practices, offering information and advice, or providing subsidies.

- Eco Point policy
  From 2009 to 2011, the government introduced the Eco Point system designed to encourage consumers to replace their existing home appliances with new ones more energy efficient. This system, along with the contemporaneous shift to terrestrial digital television broadcasting, resulted in large amounts of waste home appliances handled in the collection and management systems under the Home Appliance Recycling Act.

- Guidance on the industrial health environment
  No guidance on the industrial health environment that is particular to the Home Appliance Recycling Act is offered at the recycling plant level. Special health check-ups are unnecessary for workers at recycling plants, who receive regular health check-ups as other workers do. Yet recycling plants work to improve and maintain the industrial health environment in an effort to avoid work-related accidents and injuries as well as health hazards (by, for example, promoting the use of face masks, goggles, and interlocks).



Workers in action in a recycling plant

2. Governance Aspects: Recycling System under the Home Appliance Recycling Act

Opportunities for dialogue among different stakeholders

A joint advisory council between the MOE and the METI evaluates processes in, reviews directions for, and identifying issues related to policy implementation, as well as giving advice to the government. This council is a joint council of the following two entities: (i) the Sub-Committee on the Evaluation and Review of the Home Appliance Recycling System of the Committee on a Recycling-based Society, the Central Environment Council, MOE, and (ii) the Working Group (WG) on Electrical and Electric Equipment Recycling, Waste and Recycling Subcommittee, Committee on Industrial Science and Technology Policy and Environment of the Industry Structure Council, METI ("the MOE-METI joint advisory council"). The members of the council include researchers and other experts, journalists, and representatives from the industrial associations of the manufacturers, consumer groups, and local governments, as well as retailers and recyclers. The minutes as well as reference materials are available on the website of MOE and METI, ensuring the transparency of governance.

There are other opportunities where Manufacturers and recyclers interact with each other to facilitate the recycling process. For example, Manufacturers second their employees to recyclers as researchers and recyclers submit written requests to the Manufacturers.

Ensuring competition among the recyclers

As discussed earlier, each home appliance Manufacturer has the obligation to take back and recycle their products when they become waste as a matter of principle. In the current recycling system, however, such Manufacturers are organized into two groups as shown below:

Group A: Panasonic (including Sanyo Electric), Toshiba, etc.
Group B: Sharp, Mitsubishi Electric, Sony, Hitachi, etc.

Group A developed a recycling system based on the effective use of the infrastructure owned and operated by existing waste management contractors. Group B developed another recycling system with construction of new facilities specifically designed for the recycling of home appliances as well as on a partnership with leading logistics companies. The two groups are almost equal in terms of the number of units manufactured, meaning that the number of units processed for recycling is also almost equal between the two groups. In fact, this grouping was designed to ensure that there would be competition in the home appliance recycling sector that has been developed under the Home Appliance Recycling Act. In recent years, manufacturers have been making efforts to reduce the fees in light of the recommendation to do so from the MOE-METI joint advisory council and other entities.

Group A and Group B have also set up their own designated collection sites. The problem with this was that retailers had to sort out the waste home appliances according to the manufacturer before carrying it to the collection sites of either Group A or Group B. The need to improve efficiency resulted in the phased sharing of designated collection sites starting in October 2008. Today, all designated collection sites take in products from both Group A and Group B.

These two groups have established their own joint recycling management companies: Ecology Net Co., Ltd for Group A and R Station Corporation for Group B. These two groups of companies are responsible for coordination among the Manufacturers, recyclers, and other related businesses; the management and distribution of recycling costs; the management and analysis of data on operations at the recycling plants; reporting; and advice on recycling systems and technologies; among other duties.

Issues regarding the transparency of the process of (basis for) setting recycling fees
Home appliance Manufacturers or recycling plants do not sufficiently make public the process of setting the fees There is no way of knowing these aspects. It is believed that the recycling management companies collect and analyse the necessary information and, based on their analyses, set the recycling fees at appropriate levels. The breakdown of these fees was estimated by the MOE-METI joint advisory council as part of its efforts to estimate recycling costs (Table 4). This estimation indicates that the total cost had decreased, most likely as a result of increased efficiency due to technological innovation and cost reductions in relation to recycling. It also shows the difference in revenues for each category of home appliances and each group of Manufacturers.

Table 4: Estimated recycling cost per unit under the Home Appliance Recycling Act (Unit:JPY)

2006	Group	Recycling fee revenues	Revenues from the sale of recovered materials	Total revenues	Administrative expenses	Expenses of secondary logistics	Expenses of designated collection sites	Expenses of home appliance recycling plants	Total expenses	Net income
Air conditioners	A	3,500	1,183	4,683	831	469	952	2,466	4,718	-35
	B	3,500	1,366	4,866	831	443	769	3,202	5,244	-378
TV sets	A	2,700	304	3,004	831	305	619	1,678	3,433	-429
	B	2,700	368	3,068	831	288	500	1,989	3,607	-539
Refrigerators and freezers	A	4,600	667	5,267	831	629	1,278	3,815	6,553	-1,286
	B	4,600	703	5,303	831	594	1,031	4,629	7,085	-1,782
Washing machines	A	2,400	394	2,794	831	342	695	2,026	3,893	-1,099
	B	2,400	419	2,819	831	323	561	2,152	3,866	-1,047

2012		Recycling fee revenues	Revenues from the sale of recovered materials	Total revenues	Administrative expenses	Expenses of secondary logistics	Expenses of designated collection sites	Expenses of home appliance recycling plants	Total expenses	Net income
Air conditioners	A	2,000	1,631	3,631	510	459	675	2,464	4,107	-476
	B	2,000	2,055	4,055	510	386	478	3,038	4,412	-357
TV sets (CRT)	A	2,436	346	2,782	510	294	432	1,566	2,802	-20
	B	2,436	403	2,839	510	248	306	1,902	2,965	-126
TV sets (flat screen)	A	2,475	245	2,720	510	170	249	2,092	3,021	-301
	B	2,475	314	2,789	510	143	177	2,416	3,245	-456
Refrigerators and freezers	A	4,301	1,003	5,304	510	682	1,003	3,863	6,058	-754
	B	4,301	1,370	5,671	510	575	710	4,571	6,365	-694
Washing machines	A	2,400	394	3,029	510	342	695	2,026	3,179	-150
	B	2,400	419	3,248	510	323	561	2,152	3,334	-86

Source: Compiled from the data provided at the 12th and 22nd meetings of the MOE-METI joint council.

Efforts and measures for quality maintenance at three levels: collection, transportation, and operations at designated collection sites

Collection: The collection method varies depending on retailer and municipality.

Transportation: How to transport waste home appliances to designated collection sites is up to municipalities and retailers, who generally seek to ensure efficient logistics by, for example, taking advantage of back-loading.

Operations at designated collection sites:

Unloaded waste home appliances at the designated collection sites is sorted out according to the type, size and manufacturer group before being stored in special containers. Workers there refrain from compacting the waste home appliances in the containers to ensure safety and prevent overloading.

Traceability is ensured by the use of home appliance recycling tickets (manifests) that are issued to consumers who have paid the recycling fee for the four categories of waste home appliances. This manifest system ensures that waste home appliances have been properly delivered to the Manufacturers responsible for recycling it. The system makes it possible to track each waste home appliance item throughout the recycling process, including the places to take back and the different phases of recycling (traceability). The record of this information must be retained for three years.

Comments of different stakeholders

From the beginning of discussion on how to set up this Act, various stakeholders have actively participated in the process of setting up and reviewing the implementation mechanism of this Act. Various challenges surrounding effective implementation of the Act

have been overcome by incorporating these opinions through this process. Thus, the mechanism of implementation of the Act has been reviewed and improved in a constant manner by assuring the cooperation from the stakeholders. This is one of the keys of effective implementation of the mechanism. In this section, the paper introduces examples of comments from stakeholders on various challenges faced by the Act. These are still on-going discussions for improving implementation of the Act.

The Home Appliance Recycling Act stipulates that the government has to review progress in implementing the Act five years after it comes into force and take measures as necessary. To this end, the MOE and the METI set up a joint advisory council. From June 2006 to December 2007, the council met a total of 16 times or almost once a month to evaluate and review the implementation of the Act.

The findings of this evaluation and review were compiled into a report in February 2008. Among the focus issues were (i) whether the responsibility of each stakeholder should be changed, and if so, how, (ii) whether the charging system should be changed from deferred payment to advance payment out of concern that the current system may be encouraging illegal dumping, and (iii) whether more home appliance item(s) should be added to the existing target categories.

Written opinions on these and other issues were submitted to the council by retailers, home appliance Manufacturers, local governments, and consumer groups. A summary of these opinions brings into sharp relief the different positions of the various stakeholders.

The opinions of home appliance Manufacturers, which were submitted through their industrial associations, can be summarized as follows: First, the clear division of responsibilities allows the Home Appliance Recycling Act to be implemented successfully. There is no need for any change to the current division of responsibilities. Second, there is a considerable incentive for manufacturers to introduce Design for the Environment (DfE). In fact, they have continued their efforts to do so. Third, the current payment system at the time of disposal is optimal; it does not encourage illegal dumping. Fourth, the items covered by the Act should be limited to those that are usually delivered by retailers to their customers since the collection system of waste home appliances in Japan is built largely on the appliance delivery service provided by the retailers.

Retailers, as represented by an industrial association of major mass retailers of home appliances, called for a number of actions, including (i) introducing advanced payment of the recycling fee; (ii) making logistics more efficient by, for example, sharing designated collection sites; (iii) setting an appropriate recycling fee and promoting information disclosure; and (iv) expanding the designated categories to include LCD and plasma televisions. Yet they were cautious about the idea of adding small products that consumers usually take home with them from the retailers. In addition, home appliance retailers also pointed out a legal loophole. They argued that some businesses buy WEEE as second-hand goods outside the collection routes as stipulated by the Home Appliance Recycling Act.

Local governments, especially their heads and departments in charge of solid waste management and collection, called for a number of actions, including (i) introducing an advance payment system out of concern that the current payment system at the time of disposal may be encouraging illegal dumping; (ii) making the industries concerned share some of the responsibilities for collecting and recycling designated items that have been

dumped illegally; (iii) adding items to the current designated categories of home appliances; and (iv) sharing designated collection sites, as called for by the major mass retailers of home appliances. Local governments also noted that the deferred payment system makes the collection and transportation of waste home appliances from remote islands seem expensive and troublesome. They said this problem may be peculiar to Japan as an archipelago nation with so many small islands.

The opinions of consumer groups, along with those of the public as gathered by local governments, can be summarized into three points. First, there is a problem with the transparency of the process of setting recycling fees; this problem may make it difficult to reduce them. Second, it is more convenient for consumers to pay the recycling fee at the time of purchase. Third, more home appliance items should be subjected to recycling under the Act.

Various stakeholders pointed out the loophole in the Home Appliance Recycling Act that allows for the illegal export and improper management of e-waste overseas.

An analysis of all these opinions puts the position of home appliance manufacturers in sharp contrast to those of other stakeholders. While the former want the current recycling system to be largely maintained, the latter are calling for a number of changes to it. These include the introduction of advance payment of the recycling fee, additions to the existing categories of home appliances covered by the Act, and the streamlining of the fee payment and waste collection mechanisms. Home appliance manufacturers, however, share the concerns about illegal dumping as well as illegal exports and the improper management of WEEE overseas. They admitted that there are some problems with the current system, including the deferred payment system.

However, the joint council failed to adopt the proposal to introduce an advance payment system for two reasons. One was that the council had not had enough discussions about what kind of advance system should be introduced. The other was that the rationale for fundamentally changing the current system was not convincing enough. The joint council, however, decided to strengthen measures against illegal dumping and improper exports. Following this decision, the council established a set of guidelines on recycling and reuse in 2008. Based on these guidelines, the MOE issued a ministerial notice entitled “On identifying used home appliances as waste” on March 19, 2012, to the prefectures and ordinance-designated cities. This notice provided criteria by which municipalities can identify used home appliances as waste. The idea was to strengthen measures against illicit management routes. In addition, efforts were made for greater transparency of how the recycling fee revenue is used, lower recycling fees, and the integration of designated collection sites for easier collection. The designated categories of home appliances were also expanded to include LCD and plasma televisions as well as washing machines with built-in dryers (integrated washer-dryers).

Similar discussions are now being held in 2013, the year that marks the second period of the review. Home appliance retailers, including the industrial association of major mass retailers, continue to make six major requests, some of which are similar to the ones they made in the first period of the review. The first request is to continue exploring the possibility of making the shift to a “point-of-purchase payment system” whereby consumers pay a recycling fee as well as a collection/transportation fee when they buy a home appliance. The second request is to “reduce the financial burden on consumers through greater transparency and optimization

of both recycling accounting concerning home appliances and the fee setting process." The idea is to minimize the possibility that consumers consider the recycling and other fees to be too high, as well as to avoid hampering proper waste disposal. The third request is for the authorities to "provide strict administrative and operational guidance to ensure that the stakeholders in the implementation of the Home Appliance Recycling Act can always identify and remove any obstacles to proper recycling." The fourth request is to make a clearer distinction between the 3R activities, including reuse, and streamline them. The fifth request is to review the current license qualifications in relation to collection and transportation as well as recycling plants for greater participation. The sixth request is to review the situation after the designated collection sites came to be shared. Associations of reuse businesses stress that not only recycling, but also reuse provides an important tool for the cyclical use of resources. They are calling for strict observance of the guidelines on recycling and reuse mentioned earlier. In addition, many stakeholders call for stricter regulations and measures against the flow of WEEE to other countries. The council will likely come up with some kind of measures to solve these problems.

Ensuring the transparency of recycling performance
The MOE and METI publish data on the annual recycling performance under the Home Appliance Recycling Act, including the number of units collected (including figures by prefecture), the amount of materials recovered, and the recycling rates. These figures are available on the Internet. More detailed data on the recycling performance of the recycling chain under the Act is published every year by the AEHA, the industrial association of home appliance manufacturers. This data is included in its annual reports, which are available on its website.

The annual reports of the AEHA contain various information, ranging from an overview of the Home Appliance Recycling Act, an explanation of the recycling system under the Act, and developments in the review of the Act, to the number of units collected after the Act came into force, the amount of materials recovered, and the recycled amounts and recycling rates for each material and type of product, including the trends over time, and further describe the technologies used in recycling plants and good practices towards greater efficiency.

Mechanism for the inspection of recyclers by the Manufacturers
The two recycling management companies—one for Group A and the other for Group B as described earlier—make regular on-site inspections of the recycling plants under their respective umbrellas to see if they are properly recycling WEEE. For their part, the recycling plants submit information on the material flows—including the output destinations—as well as performance indicators.

Under the recommendations of the management companies, these plants also check the output destinations both in Japan and abroad to ensure that the recovered materials are properly recycled.

Efforts to promote the understanding of consumers regarding EPR-related information
AEHA has developed webpages and a pamphlet on the Home Appliance Recycling Act for consumers. These are available from the following URLs:

Webpages
http://www.aeha.or.jp/action_of_recycling/
http://www.kaden-recycle.net/
Pamphlet for consumers

http://www.aeha.or.jp/project/environment/pdf/3R.pdf

METI also has a webpage that provides an easy-to-understand explanation about the Home Appliance Recycling Act for consumers. Interactive learning materials are also available.

http://www.meti.go.jp/policy/kaden_recycle/ekade00j.html

It is worth noting that more and more people, mostly consumers, visit recycling plants for educational purposes. According to the AEHA, a total of 479,455 people made such a tour of inspection of a recycling plant over the 13 years from 2001 to 2012. In fact, recycling plants constitute a popular destination for educational visits by schoolchildren, contributing to heightened awareness among consumers.

3. Environmental effects and performance

Over a period of 12 years since the enforcement of the Home Appliance Recycling Act, the number of units received by the designated collection sites has been on the rise, and so has the number of units processed for recycling. The recycling rate for each category of home appliances has remained high, although it has varied slightly depending on the category. In 2012, the recycling rate was higher than the recycling target as stipulated by the Act for each of all the designated categories of home appliances. More precisely, it stood at 91% for air conditioners, 82% for CRT televisions, 87% for LCD and plasma televisions, 80% for refrigerators and freezers, and 86% for washing machines and clothes dryers.

The Act also calls for the recovery and processing of the chlorofluorocarbon (CFC) refrigerants used in air conditioners, refrigerators, and freezers, as well as the CFCs in insulation foam from refrigerators and freezers. In recent years CFCs must also be recovered from electric washing machines and clothes dryers (of the heat pump type) which use CFCs. The act also calls for keeping records of the amount by weight of the CFCs recovered, those shipped to CFC destruction operators and those destroyed.

Performance indicators under the Home Appliance Recycling Act
The following performance indicators under the Home Appliance Recycling Act are published every year.

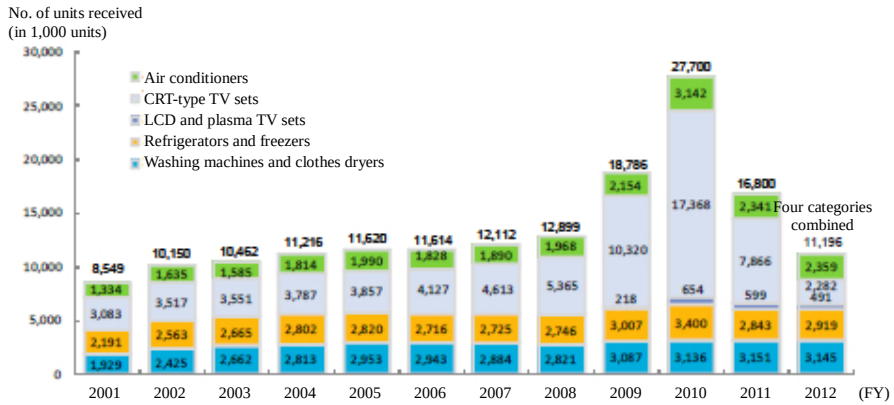


Figure 2: Number of units received by designated collection sites after the enforcement of the Home Appliance Recycling Act

Source: AEHA, Annual report on home appliance recycling for FY2012 [in Japanese]

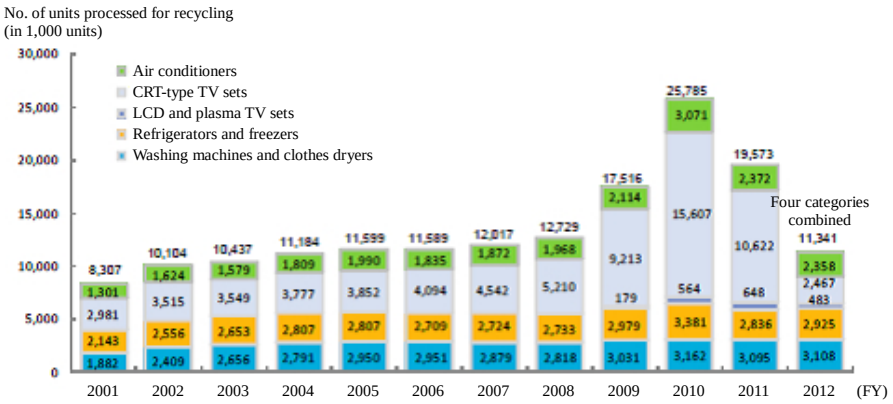


Figure 3: Number of units processed for recycling
Source: AEHA, Annual report on home appliance recycling for FY2012 [in Japanese]

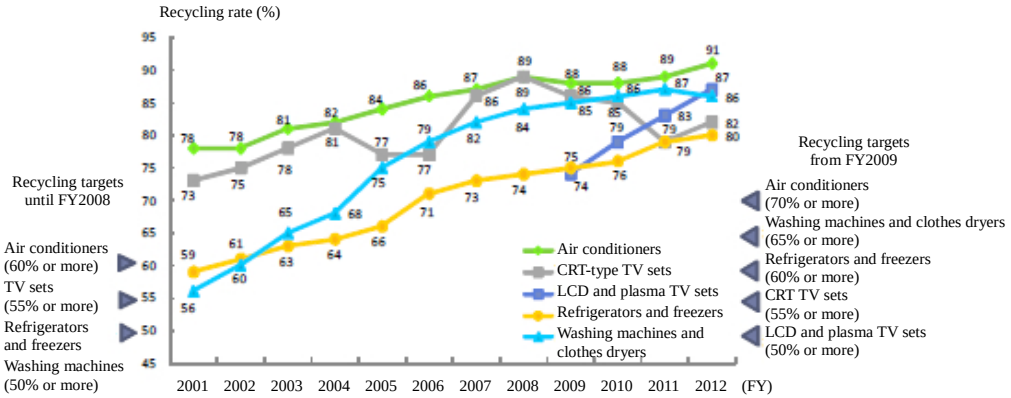
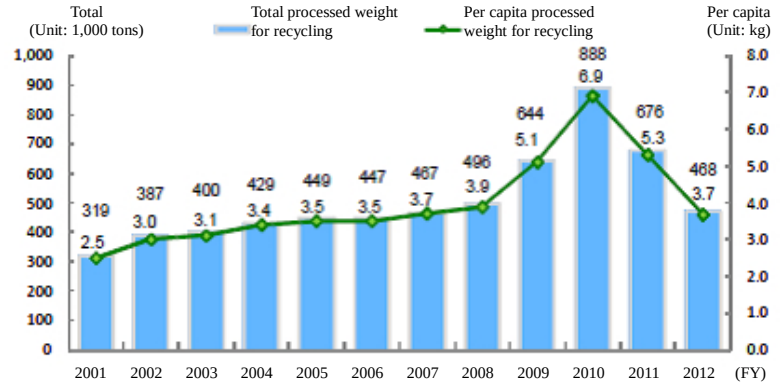
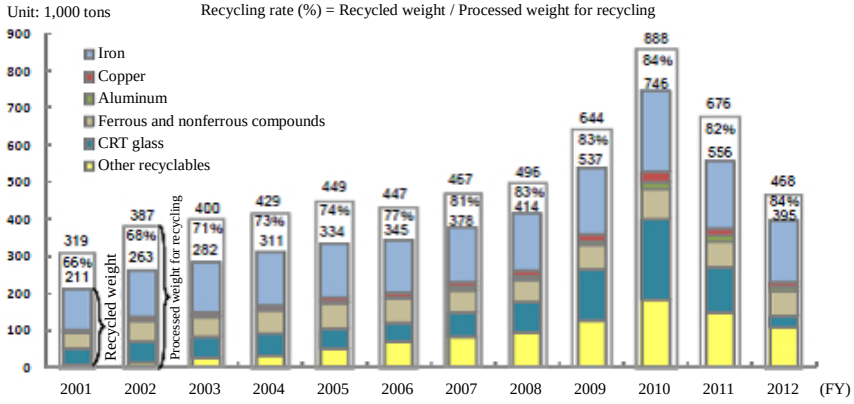


Figure 4: Trends in the recycling rates under the Home Appliance Recycling Act
Source: AEHA, Annual report on home appliance recycling for FY2012 [in Japanese]



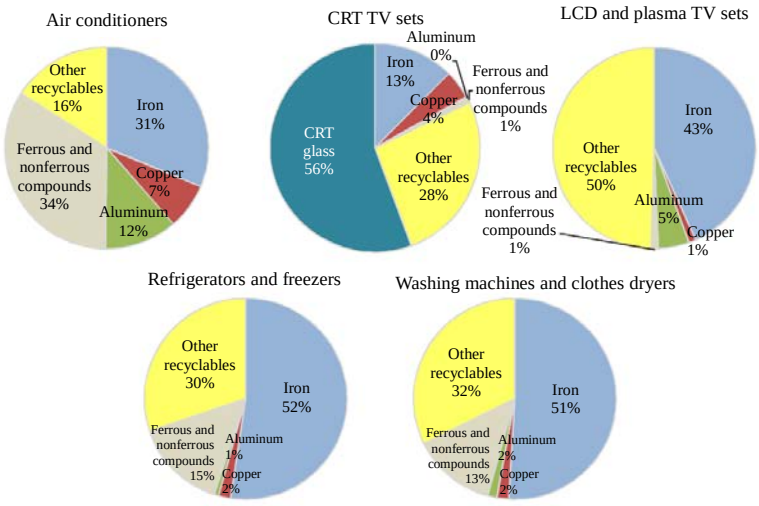
Processed weight for recycling: Total weight of waste specific household appliances that Manufacturers have taken back

Figure 5: Processed weight for recycling (total and per capita)
Source: AEHA, Annual report on home appliance recycling for FY2012 [in Japanese]



Recycled weight: Total weight of the components and materials that have been recovered from waste specific household appliances and then actually recycled
Recycling rate: Percentage of the weight that is recycled of the total weight of the appliances processed for recycling

Figure 6: Trends in the processed weight for recycling, the recycled weight, and the recycling rate (FY2012)
Source: AEHA, Annual report on home appliance recycling for FY2012 [in Japanese]



Source: AEHA, Annual report on home appliance recycling for FY2012 [in Japanese]
Figure 7: Percentage of the component materials recovered from waste home appliances

Social benefits

A 2005 analysis of social costs and benefits resulting from the introduction of the home appliance recycling system (Figure 8) suggests that the enforcement of the Act has resulted in a total net benefit of 54 billion yen. This is due to a reduction of 38.1 billion yen in costs and an increase of 15.8 billion yen in benefits. The gain of 38.1 billion yen on the cost side comes from a reduction of 44.5 billion yen in the costs borne by local governments (mostly for collection and final disposal) and an increase of 6.3 billion yen in the costs borne by the private sector. The gain of 15.8 billion yen on the benefit side comes from a reduction of 1.6 billion yen in benefits for the local governments and an increase of 17.5 billion yen in benefits for the private sector. (This analysis does not take into account the benefits that the society as a whole enjoys from the resultant environmental gains.)

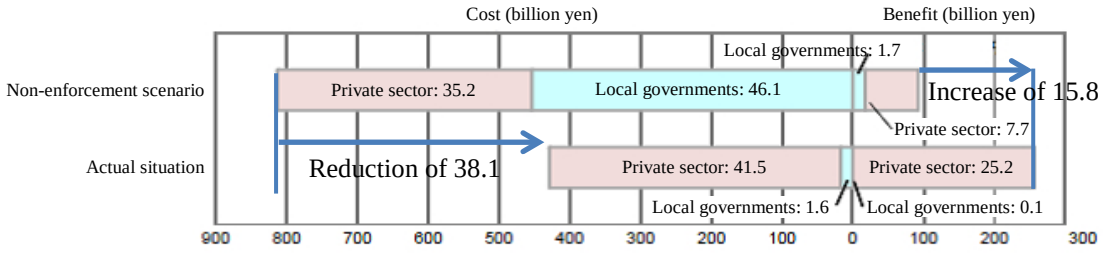


Figure 8: Analysis of the social costs and benefits resulting from the enforcement of the Home Appliance Recycling Act
Source: Compiled from the reference materials for the 11th meeting of the MOE-METI joint council.

Problem of hidden flows

The problem, however, is that there are hidden flows outside the recycling chain under the Home Appliance Recycling Act. Some waste home appliances are unaccounted for, and so are some materials recovered from WEEE. This problem is a source of grave concern. Tasaki (2006) estimated that the volumes of such hidden flows according to each category of designated home appliances before and after the Act came into force. Building on these estimates, the MOE has made their own estimates since 2007. (The first estimation was made for hidden flows in 2005.) The findings are summarized in Figure 93. It is estimated that 51% of the WEEE from households and businesses is recycled by Manufacturers under the Act.

It is also estimated that 33.7% is eventually exported to foreign countries as scrap, second-hand goods, or resources. In short, almost half of the waste home appliances covered by the Act is not subject to the collection mechanisms stipulated by the Act and is traded as second-hand goods or metal scrap. Such items are collected through trading of second-hand goods and from consumers by traders who typically travel around residential areas in a lightweight truck to collect items directly from the consumer's home (the latter traders walk a fine line between legal and illegal operations by buying waste home appliances or collecting them free of charge from the consumers). Apart from these flows, 0.6-0.7% of waste home appliances is illegally dumped.

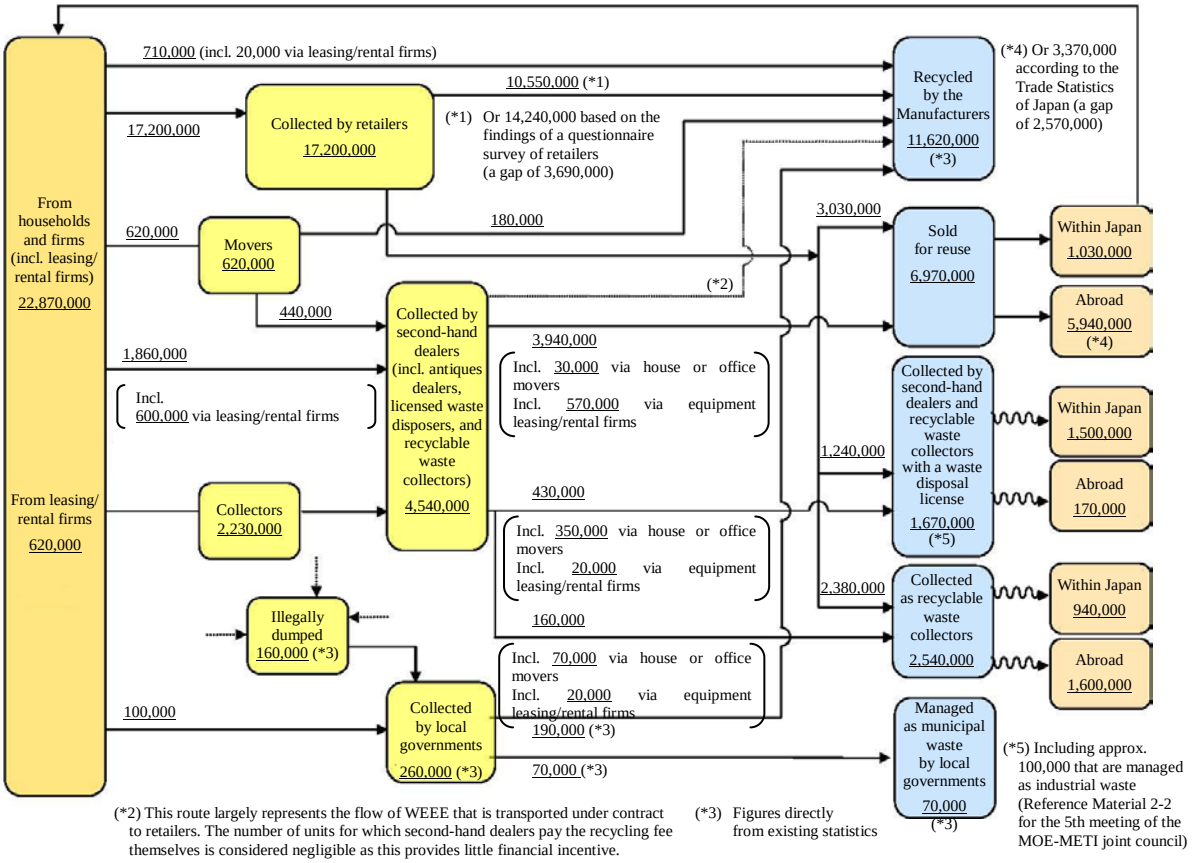


Figure 9: Estimated waste home appliance flows

Source: MOE-METI joint advisory council. Report on the evaluation and review of the process in the implementation of the home appliance recycling system [in Japanese], February 2008.

Promoting Design for the Environment
AEHA makes a Product Assessment Manual for Electric Home Appliances available as a guide for the design of products with a lower environmental load. This manual, which is regularly updated and upgraded, allows Manufacturers to evaluate progress in the Design for the Environment made by their new products.

Table 5: Key considerations for environmentally-conscious design

Category	Steps to be taken
Reducing weight/volume	• Making the products lighter with a thinner casing with the help of CAE (computer-aided engineering) • Making the product construction more compact to save natural resources • Reducing the use of rare materials • Reducing the number of parts
Facilitating manual disassembly and separate processing	• Unifying materials (using fewer types of materials) • Reducing the number of parts; organizing the parts into units • Improving the structure of the product and its parts • Labeling parts according to the type of material • Putting a recycling symbol on the product and its parts
Using the recovered materials	• Using recycled plastics
Extending the product life	• Improving the durability of parts and materials; improving the exchangeability of consumables • Facilitating maintenance and repairs
Improving packaging	• Reducing the volume of packaging; simplifying packaging • Using recovered materials • Labeling packaging to identify the types of materials used

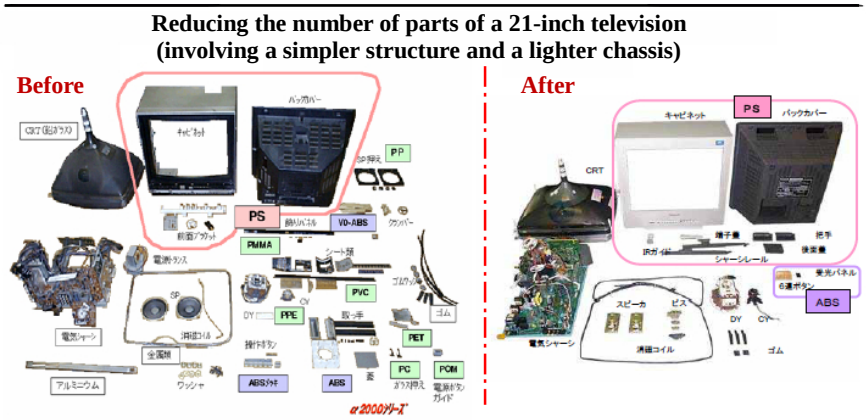
Source: AEHA, Annual report on home appliance recycling for FY2012 [in Japanese]

Home appliance manufacturers are working to improve the recyclability (disassemblability) of their products. Information sharing between recycling plants and manufacturers has been instrumental in improving such disassemblability. Specific examples are available on the following websites:

Design for the Environment ⇒ http://www.aeha.or.jp/project/environment/
Case studies of product assessment ⇒ http://www.aeha.or.jp/assessment/
Efforts to promote home appliance recycling
⇒ http://www.aeha.or.jp/action_of_recycling/index.html

AEHA's Product Assessment Expert Committee develops guidelines and reports that help Manufacturers to work on Design for the Environment. To this end, the committee exchanges views with officials at recycling plants to identify specific improvements they want to see in product design. It also conducts a questionnaire survey on waste management procedures at these plants. In FY2012, the committee issued the third edition of the "Guidelines on the labelling and recycle symbols on plastic parts of home appliances" [in Japanese] to promote product designs that facilitate recycling. The focus is placed on the following aspects:
- Fewer types of plastic materials
- Fewer parts
- Product structure designed to facilitate disassembly

Labelling of parts with the type of material, the indication of the positions of screws, etc.



Resources	Before	➡	After
No. of plastic parts	39	➡	13
No. of types of plastic materials	13	➡	2
Product disassembly time (calculated by the manufacturer)	140 seconds	➡	103 seconds

Figure 10: An example of successfully reducing the product disassembly time with fewer parts and types of plastic materials

Source: Compiled from the reference materials for the 16th meeting of the MOE-METI joint council.

Impact on waste reduction

The Institute for Global Environmental Strategies (IGES) has calculated the annual total recycled volume (the saving in volume made possible by recycling; Table 6) based on the number and type of units recycled and their bulk specific gravity. According to this calculation, a total of 38.4 million m^3 of home appliances were recycled over a period of 11 years from 2001 to 2011, meaning that this volume did not go to final disposal sites. The annual recycled volume on average during this period ranges from 2.2 million m^3 to 5.5 million m^3.

Table 6: Estimated total weight and volume recycled for the four designated categories of home appliances

4 appliances Total

FY	unit	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
No. of units recycled	1,000 units	8307	10104	10437	11184	11599	11589	12017	12729	17516	25785	19573	150,840
Recycled weight	1,000 tons	320	387	400	429	449	448	467	496	644.6	888	676	5,605
Recycled volume	1,000 m^3	2247	22778	2931	3122	3257	3240	3281	3372	4188	5527	4458	38,400

Source: IGES (2013). Policy research on environmental economics for FY2012: Promotion of global resources recycling through both the development of an EIA method associated with materials use that encompasses the total life cycle from resource extraction to recycling in Japan and the analysis of the environmental, economic, and social aspects of the physical distribution and use of recycled resources in the recycling system in Japan [in Japanese].

The saving of natural resources resulting from the recycling of home appliances and its impact on reducing GHG emissions

IGES has also calculated the saving of natural resources that has resulted from the collection and recycling of home appliances under the Act and its impact on reducing the emissions of greenhouse gases (IGES 2013). Figure 11 compares the two factors. One is the estimated GHG emissions from the recycling of materials that are recovered from the four designated types of home appliances. The other factor is the estimated GHG emissions that would result from producing the same amount of materials from natural resources. Each figure represents the amount per unit. This comparative analysis suggests that the enforcement of the Act may have resulted in avoiding more than 50% of the potential GHG emissions from using virgin materials.

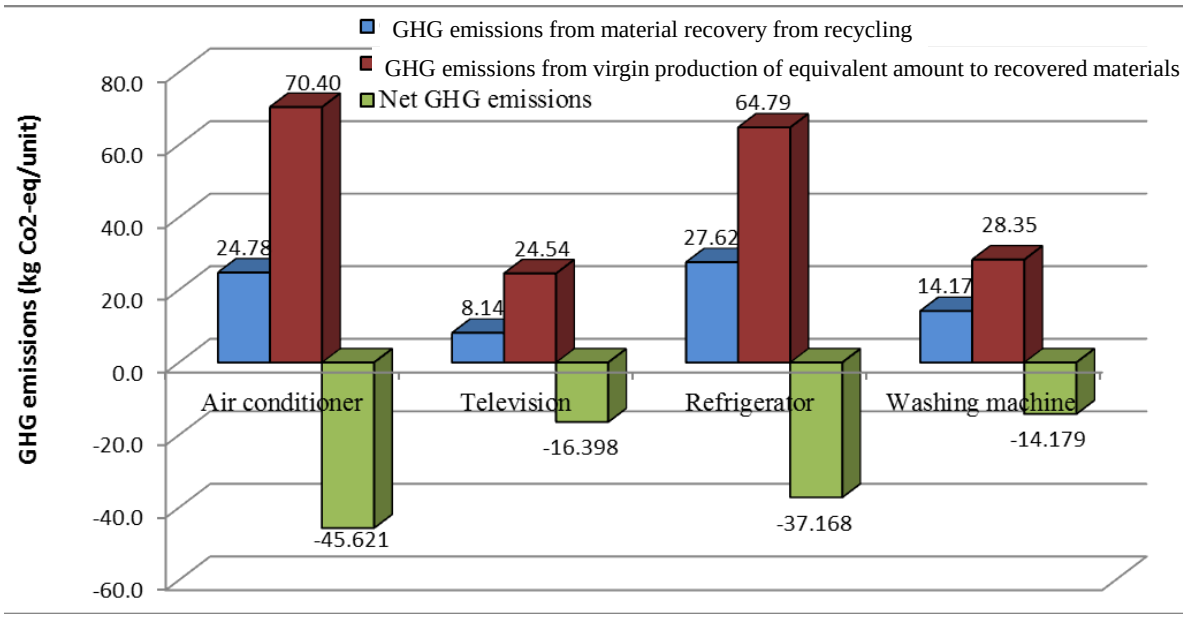


Figure 11: Estimated contribution of the enforcement of the Home Appliance Recycling Act in reducing potential GHG emissions

Source: IGES (2013). Policy research on environmental economics for FY2012: Promotion of global resources recycling through both the development of an EIA method associated with materials use that encompasses the total life cycle from resource extraction to recycling in Japan and the analysis of the environmental, economic, and social aspects of the physical distribution and use of recycled resources in the recycling system in Japan [in Japanese].

4. Scope and quality of the collection

The collection and processing system under the Home Appliance Recycling Act is estimated to collect 50-60% of the target waste home appliances generated throughout Japan. The remaining portion is most likely traded as second-hand goods or collected by traders who typically travel around residential areas in a lightweight truck and trade in these appliances as second-hand goods or metal scrap.

The amount of residues

The remainder after subtracting the recycling rate from 100% represents the percentage of materials that had not been sold as recycled materials. A portion of this waste home

appliances may have been actually recycled for some use (for example, thermal recycle). Data on the amount of the rest (residue) that goes to final disposal sites is unavailable.

The issue of CRT glass

The recycling rate for CRT televisions began to decline in 2008. Earlier, funnel glass in CRTs, which contains lead, had been exported to Malaysia and other countries as a valuable material. It effectively lost its value as a resource altogether, however, after the production of CRT televisions dropped around the world, which led to the lower recycling rate. Technical difficulties and poor economic viability associated with extracting the lead from the CRT funnel glass means that this glass is now mostly disposed of in landfills after being stabilized, although a small portion is used as a sub-base course material. In 2010, the MOE set up a "technical study group on the recycling and disposal of CRT glass cullet."

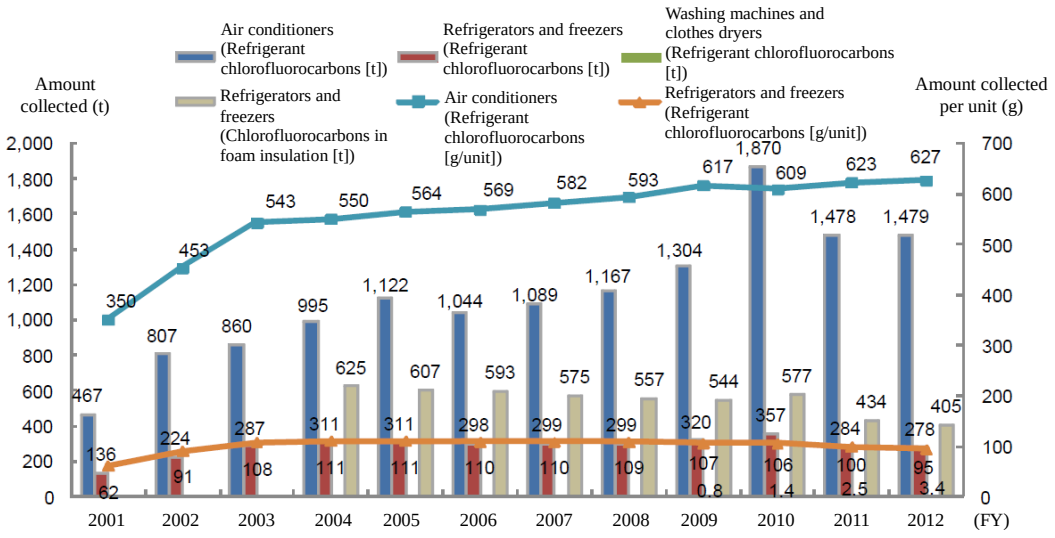
Impact on removing hazardous waste

The Home Appliance Recycling Act assumes that hazardous materials in home appliances must be managed in environmentally sound manner. These include CFCs used in the production of heat insulation foam and as refrigerants, oils in compressors, and heavy metals in circuit boards and glass parts.

(1) Recovery and processing of chlorofluorocarbons (CFCs)

The Act also calls for the recovery and processing of CFCs used as refrigerants in air conditioners, refrigerators, and freezers, as well as CFCs contained in insulation foam from refrigerators and freezers. The act also calls for keeping records of the amount by weight of the CFCs recovered, those shipped to CFC destruction operators, and those destroyed.

The total amount of CFC refrigerants that were recovered during FY2012 stands at 1,479 tons for air conditioners and 278 tons for refrigerators and freezers. The amount recovered per unit is 627 grams for air conditioners and 95 grams for refrigerators and freezers. During the same year, 405 tons of CFCs in foam insulation were recovered under the Act.



Source: AEHA, Annual report on home appliance recycling for FY2012 [in Japanese]

Figure 12: Trends in the recovered amounts of both refrigerant chlorofluorocarbons and chlorofluorocarbons in insulation foam

(2) Management of oils
Oils in compressors are extracted at the time of disassembly. The extracted oils were used for thermal recovery or managed properly as industrial waste.

(3) Recovery of heavy metals
Heavy metals in circuit boards (gold, copper, lead, etc.) are collected by metal recyclers as mixed metals for recycling. Lead glass is collected with a waste management fee for the reason described earlier.

Illegal dumping
Some people dump waste home appliances illegally to dodge the obligation to pay the fees for home appliance recycling. Illegal dumping was practiced even before the Home Appliance Recycling Act went into effect in 2001. In 2000, a total of 122 thousand units were dumped illegally. The number jumped 40% for a period of a few years following the enforcement of the Act to reach 175thousand. In recent years (up to FY2010), however, it has been at a level slightly higher than the pre-enforcement level. However, throughout these years, rate of illegal dumping compared to total generation of used home appliances is very small. Rate of illegal dumping in total used home appliance generation are 0.68% for 2005, 0.47% for 2009, 0.34% for 2010 and 0.51% for 2011.

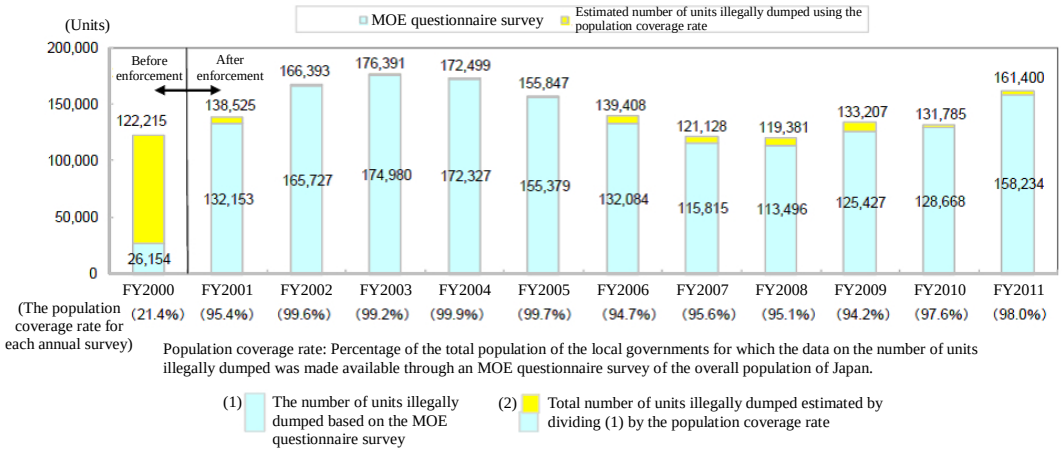


Figure 13: Illegal dumping of waste home appliances
Source: MOE. "On the state of the illegal dumping of waste home appliances in FY2011" [in Japanese]

Illicit exports
What is considered more serious than the problem of illegal dumping is the illicit practice of exporting WEEE as second-hand goods or metal scrap. As discussed earlier, it is estimated that 50-60% of the designated waste home appliances that has been generated in Japan is collected and managed in the recycling route under the Home Appliance Recycling Act. The percentage of the waste home appliances that eventually makes its way overseas as second-hand goods or metal scrap is estimated at about 30%.

Behind this practice is the desire to evade the obligation to pay a recycling fee. It is extremely difficult to accurately classify discarded home appliances into second-hand goods, recyclable resources, and waste. For example, the same item may be traded as metal scrap when the metal price is high on the market or second-hand goods when the metal price is low (Terazono et. al. 2011 and Nanbu 2011).

There is concern that such exported items may be managed improperly in the developing countries without taking account of environmental considerations.

Closing legal loopholes
The government has taken the following steps to close the loopholes in the home appliance recycling system.

- Establishing a set of guidelines on recycling and reuse and issuing ministerial notices

In March 2012, MOE issued a ministerial notice that provides the following two criteria and accordingly takes strict measures:

Criterion (1): WEEE that lacks marketability as second-hand goods (due to such reasons as being outdated, unable to be powered, damaged or subject to a recall) or has been handled too roughly to be suitable for recycling (e.g., carried on the open deck of a truck in the rain, stored outdoors, or roughly placed on top of other items) shall be regarded as waste.

Criterion (2): WEEE that has been destroyed or disassembled in a way that is inconsistent with waste management standards shall be regarded as waste even though the owner claims otherwise, because such processing is judged to be designed to evade the law.

Moreover, the notice states that WEEE that is not designated by the Act should not be automatically regarded as a valuable even if it is collected free of charge or bought at a low price. Such a judgment should be made from a broader perspective and in the context of strict law enforcement. (In this context, a recycler was arrested in Gifu Prefecture.)

- Strict enforcement of the Waste Management Act and the Basel Act

The government has made it clear that the collection, transportation, and disposal by businesses outside the formal route of collection and recycling as stipulated by the Home Appliance Recycling Act shall be subject to regulations by the Waste Management and Public Cleansing Act. It has also made it clear that any violation of the Waste Management and Public Cleansing Act shall be strictly punished.

The government also continues to do all it can to prevent WEEE that is unsuitable for second-hand use from being exported to the developing countries on the pretext of being traded as second-hand goods and causing environmental pollution due to the hazardous materials it contains. Such actions by the government include (i) developing clearer criteria for second-hand use in relation to exports; (ii) improving the preliminary consultation system; (iii) strengthening preventive measures through closer partnership with the customs authorities; and (iv) promoting cooperation with trading partners.

In January 2008, the government divided the four categories of home appliances into two sub-categories—one for new products and the other for used ones—in the HS Code, which is a classification code in trade statistics (Export Statistical Schedule). This has made it easier to keep track of the export of second-hand goods in the four categories in trade statistics.

Furthermore, the government supports a number of international initiatives concerning the Basel Convention, including an international project and development of operational guidelines. As part of its efforts to contribute to the proper management of hazardous waste,

Japan is serving as the chair in the process of developing a framework and guidelines on the environmentally sound management (ESM) of waste in relation to the Basel Convention.

5. Cost-benefit aspects

Cost estimations by the MOE-METI joint advisory council are shown in Table 4. These estimations were made in March 2007 for each category of home appliances and for two recycling flows: (i) the flow based on the existing contractors (largely corresponding to Group A) and, (ii) the flow based on newly-built facilities (largely corresponding to Group B). (Note that the recycling fee for air conditioners was different at that time. See Table 4)

Breakdown of the administrative costs

The administrative costs include the cost of issuing and managing recycling tickets, the operating costs and the R&D costs on the part of manufacturers, the costs incurred by the two management companies for Group A and Group B (see Table 4). The secondary logistics costs and the costs of the designated collection sites are largely proportional to their size. The ratio of the costs of recycling plants to the costs of administration, logistics and designated collection sites is largely 6 to 4. Revenues from the sale of recovered materials represent only 10-30% of the total costs (excluding the primary logistics costs). This is a tight situation in light of the comparison between the recycling costs and the value of the recovered materials. (Note, however, that there are non-monetary benefits, including the value associated with the extension of the life of recyclables and the prevention of the outflow of hazardous materials.)

Revenues from the sale of recovered materials

- Revenues from air conditioners are high.
  This is because the proportion of copper and aluminium content is high at 19%. (It is low at around 5% for other product categories.)
- Revenues from the sale of recovered materials are higher in Group B than in Group A.
  This is likely due to the greater efficiency in sorting out the different materials since the facilities have been newly built as recycling plants specializing in home appliances.

Cost of home appliance recycling plants

- The cost is generally higher in Group B than in Group A.
  This is likely due to the higher costs associated with the strict separation of materials, the depreciation costs associated with the construction of new plants and other costs.
- The costs are lower than in 2006 for most categories in both Group A and Group B.
  This may be due to greater efficiency in the overall recycling process (including recycling plants, the recycling management companies, logistics, and designated collection sites).
- Yet the total costs exceeded the total revenues in both FY2006 and FY2012.

The recycling system as a whole has brought significant benefits, as shown in the social cost-benefit analysis (Figure 8). Under the current legal framework, however, the costs exceed the revenues as far as the private sector is concerned.

6. Promoting competition

The two-group structure is designed to prevent a monopoly regarding costs and put the principle of competition to work. The result has been a decline in recycling costs (for air conditioners) as shown in Table 2. Air conditioners are highly recyclable. The development of

sorting and separation technologies has made it possible to recycle air conditioners at a low cost, resulting in a decrease in the recycling costs, which are paid for by the consumers. As a matter of principle, the recycling fee is set by individual manufacturers, which regularly review the level of the fee. The reality, however, is that the recycling fee tends to be uniform among most manufacturers. This raises the question of whether the principle of competition is working. Outside the framework of EPR, the guiding principle of the Home Appliance Recycling Act is that the existing waste management contractors are granted a license under the Waste Management Act. These contractors are not subject to standardized management in terms of recycling fees and recycling rate, unlike the two groups organized based on the concept of EPR. They manage the waste in their own way, which raises concerns in terms of fair competition between the two types of operation.

7. Conclusion

- The Home Appliance Recycling Act has proved successful in terms of the original goals of both the proper management of hazardous materials in the targeted home appliances and proper resource recycling, as well as technological innovation.

- By introducing EPR (Extended Producer Responsibility) principle, this policy has successfully clarified the role sharing and cost burden sharing among stakeholders. The physical responsibilities, i.e., the responsibilities for managing targeted home appliances borne by local governments, have successfully been transferred to the producers.

- This has facilitated the flow of information from the downstream industries back to the Manufacturers, contributing to better Design for the Environment (DfE). The system design centering on physical responsibilities can provide useful lessons about the relationship between EPR and DfE for other countries.

- As for financial responsibilities, it is safe to conclude that the principle of the responsibility of the waste generators has been extended further. Even before the implementation of the Home Appliance Recycling Act, consumers in effect financed part of the cost of recycling. At that time, WEEE was classified as bulky waste, and most local governments collected bulky waste for a fee. Yet consumers now pay more for the waste home appliances that they generate.

- It is worth noting that **more than 50% of the total generation** of the targeted waste home appliances is estimated to be collected for recycling under this system, even though consumers have to pay the recycling fee at the time of disposal.

- The issues that remain to be addressed include how to increase the recovery rate even further and reduce the amount of WEEE that is being managed improperly, as well as how to impose stricter controls over improper management and recycling outside the system.
- In addition, there remains a transparency problem regarding the issue of how the recycling fee revenues are being used. Greater transparency is needed in order to gain the trust of consumers.

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