History and Current State of Waste Management in Japan

Ministry of the Environment

Minister's Secretariat, Waste Management and Recycling Department

Policy Planning Division, Office of Sound Material-Cycle Society

In order to protect the environments of rapidly developing countries, we present the history and current state of waste management in Japan.

As a result of economic development and population growth, the contemporary world is faced with a global increase not only in the amount of waste, but also in the diversity of its quality. Improperly managed waste deteriorates the living environment as well as public health, sometimes causing serious health problems. Sustainable development requires properly dealing with waste issues.

This pamphlet was compiled for policy makers of countries that are faced with waste management problems. To provide support for such policy makers, we present the history and current legal system of waste management in Japan. At present, Japan has a solid system for waste management and recycling. However, Japan also experienced problems similar to those facing today's developing countries. We hope this pamphlet will help you understand the problems Japan encountered in the past, as well as the measures developed and the technologies introduced to cope with the problems.

If you are interested in Japan's waste administration described in this pamphlet, the next step would be to visit Japan in order to see how waste is actually managed and recycled in Japan with your own eyes.

Ministry of the Environment

Contents

1 Problems and Measures Regarding Waste Management and 3R

In an effort to cope with waste problems that have evolved over the years, the Japanese government has enacted and revised laws and worked in cooperation with local governments, private business operators, and residents in order to promote proper waste management, the effective use of resources, as well as the steady development of a sound material-cycle society.

In this pamphlet, we present waste problems that Japan has faced since the beginning of its modernization until today and show how we have coped with and solved such problems by focusing on the following aspects: 1. public health; 2. pollution prevention and environmental protection; 3. establishment of a sound material-cycle society; and high priority issues in different periods.

History of legal systems regarding the development of a sound material-cycle society (post-war period to the present)

Period	Major issues	Laws enacted
Post-war period to the 1950s	• Waste management for environmental sanitation • Maintenance of a healthy and comfortable living environment	• Public Cleansing Act (1954)
1960s to 1970s	• Increase in the amount of industrial waste and emergence of pollution problems as a result of rapid economic growth • Waste management for environmental protection	• Act on Emergency Measures concerning the Development of Living Environment Facilities (1963) • Waste Management Act (1970) • Revision of the Waste Management Act (1976)
1980s	• Promotion of the development of waste management facilities • Environmental protection required for waste management	• Wide-area Coastal Environment Development Center Act (1981) • Private Sewerage System Act (Johkasoh Law) (1983)
1990s	• Waste generation control and recycling • Establishment of various recycling systems • Management of hazardous substances (including dioxins) • Introduction of a proper waste management system to cope with diversification in the type and nature of waste	• Revision of the Waste Management Act (1991) • Act to Promote the Development of Specified Facilities for the Disposal of Industrial Waste (1992) • Japanese Basel Act (1992) • Basic Environment Act (1993) • Containers and Packaging Recycling Act (1995) • Revision of the Waste Management Act (1997) • Home Appliance Recycling Act (1998) • Act on Special Measures against Dioxins (1999)
2000–	• Promotion of 3R measures aimed at the establishment of a sound material-cycle society • Enhancement of industrial waste management • Enhancement of illegal dumping regulations	• Basic Act for Establishing a Sound Material-CycleSociety (2000) • Construction Recycling Act (2000) • Food Recycling Act (2000) • Revision of the Waste Management Act (2000) • Act on Special Measures concerning Promotion of Proper Treatment of PCB Wastes (2001) • Automobile Recycling Act (2002) • Act on Special Measures concerning Removal of Environmental Problems Caused by Specified Industrial Wastes (2003) • Revision of the Waste Management Act (2003 to 2006, 2010) • Small Home Appliance Recycling Act (2013)

Public health improvement

Pollution problems and living environment protection

Establishment of a sound material-cycle society

Era of public health improvement

1 Situation subsequent to the Meiji Restoration (late 19th to early 20th centuries)

Domestic situation during this period

In Japan at the beginning of modernization, waste was treated by waste generators themselves or by private waste treatment operators who collected waste and selected valuables to sell them for profit. Waste was often discarded by waste treatment operators on roadsides or vacant lots and was piled up in unsanitary conditions. In addition, as a result of increasing contact between humans and objects, various infectious diseases spread. Consequently, it became important to maintain the cleanliness of entire towns, including waste dump sites that provided breeding grounds for flies, mosquitoes and rats that carried infectious diseases—in other words, the improvement of public health was gaining attention.

Measures implemented to solve problems

The Waste Cleaning Act was enacted in 1900 in order to improve public health. The Waste Cleaning Act defined the collection and disposal of waste as the obligation of municipalities and placed waste treatment operators under the supervision of government organizations to establish a waste administration system. The act stated that waste should be incinerated if possible. Since waste incineration facilities were not generally available, waste materials were piled up out in the open and continuously burned with more materials added all the time.

Era of public health improvement

2 Post-war period (1945 to 1950s)

Domestic situation during this period

During the post-war period, Japan faced the need to deal with urban waste the amount of which continued to increase rapidly as a result of economic development and urban population concentration. At the time, waste was dumped into rivers and the ocean or piled up in the open, causing public health problems such as plagues of flies and mosquitoes and the spread of infectious diseases. Waste was manually collected from homes by carts, and due to the limits of human power, including the narrow range of action, it became more and more difficult to cope with the rapid increase in the amount of waste by using manual collection methods. Furthermore, transporting waste to incineration sites or landfills required reloading from carts to automobiles, and since reloading operations were undertaken on the streets, they created public health problems, including the scattering of waste. In addition, although waste management was already defined as the obligation of municipalities at the time, there was no well-developed system of collaboration with national and prefectural governments, or with residents. As a result, municipalities found themselves in a deadlock against the spread of urban waste problems, which called for a reform in waste administration.

A cart used to collect waste from homes. Collected waste was reloaded onto special automobiles or vessels at waste collection sites or on the streets to be transported to incineration sites or landfills.

Waste being transported in a river by a waste carrier.

Landfill on Dream Island in Tokyo Bay. Most of the waste was not incinerated or covered with soil, generating problems such as spontaneous combustion caused by garbage fermentation gases, as well as foul odors and plagues of flies.

Source: One Hundred Years of Waste Management in Tokyo

Measures implemented to solve problems

In order to develop systems for the division of roles and collaboration between different entities in waste management (national and local governments, and consumers) and to effectively solve problems of urban waste, the Japanese government enacted the Public Cleansing Act in 1954. In addition to the conventional system of waste collection and disposal by municipalities, this act also defined the obligation of national and prefectural governments to provide financial and technological support to municipalities as well as the obligation of residents to cooperate with municipalities in collecting and disposing of waste.

Also, with a view to improving the living environment and public health by promoting the planned development of urgently needed living environment facilities, the Act on Emergency Measures concerning the Development of Living Environment Facilities was enacted in 1963. In this act, the Japanese government formulated a Five-Year Plan for the Development of Living Environment Facilities in order to establish policies for the development of waste management facilities, including incineration facilities, thereby promoting the introduction of waste incineration facilities in cities. The plan also helped promote the automation of waste collection through the collaboration of local governments and private companies for efficient and clean waste collection and transportation.

While there was progress in the development of systems for household waste management, waste generated by industries was still processed within municipalities' waste management systems. However, in terms of technology, finance, and management, there was no well-developed system for the proper management of industrial waste.

The Fifth Waste Treatment Plant constructed in Tokyo in 1958 was equipped with six large incineration furnaces and was built based on new design concepts. The plant was designed to dry garbage and other waste containing large amounts of moisture and was equipped with a system that transported waste incineration ash by using belt conveyors. It also provided hot water supply services to local communities using residual heat.

Test introduction of load packer trucks

Source: One Hundred Years of Waste Management in Tokyo

Era of pollution problems and living environment protection

3 Rapid economic growth period (1960s to 1970s)

Domestic situation during this period

Rapid increase in waste generation resulting from income increases and an increase in industrial waste generation

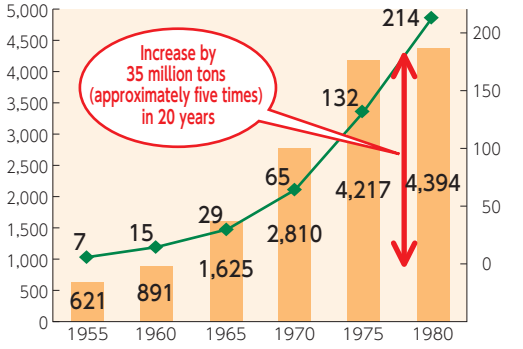
As a result of income increases resulting from rapid economic growth, as well as the widespread use of home appliances and the emergence of supermarkets and convenience stores in Japan, marketing systems and consumption behavior changed considerably during the 1960s and 1970s. Due to such changes, an economy based on mass production and mass consumption developed, causing a rapid increase in the amount and diversity of urban waste.

Meanwhile, various types of waste were generated by factories as a result of active production, such as sludge, synthetic resin waste, and waste oil that were discharged from manufacturing processes. Some of such waste was discarded or otherwise disposed of without proper treatment.

Also, construction waste (soil and debris) was generated in large amounts due to urban development resulting from the concentration of population and businesses in cities. The management of such waste was left to construction companies in most cities. However, companies that did not have waste disposal sites illegally discarded waste in vacant lots, on the streets, or in riverbeds.

Against this background, it became more and more difficult for the municipal waste management system specified in the Public Cleansing Act to cope with industrial waste problems.

Changes in the total amount of waste generated



Source: Compiled from MOE, Waste Management in Japan (annual editions) and Cabinet Office, National Accounts Statistics (annual editions)

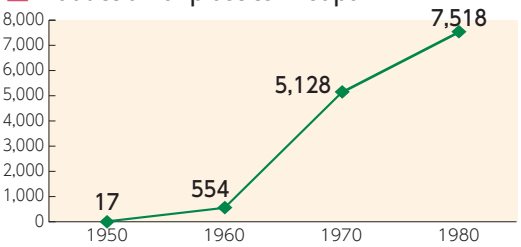
Domestic situation during this period

Emergence of pollution problems

Rapid industrialization resulting from high economic growth generated pollution by hazardous waste discharged from factories, such as organic mercury and cadmium, seriously damaging the health of residents in surrounding areas.

Also, products made of plastics and other materials became widely used and were discarded in large amounts. Made of plastics that do not deteriorate, such products did not return to the soil even when they were buried underground. When burned, they caused temperatures high enough to damage the furnaces. Some plastics generated soot dust, acidic gases, and other hazardous substances during incineration, becoming a cause of air and water pollution.

Production of plastics in Japan (Units: 1,000 tons)



Source: Website of the Japan Plastics Industry Federation

Column

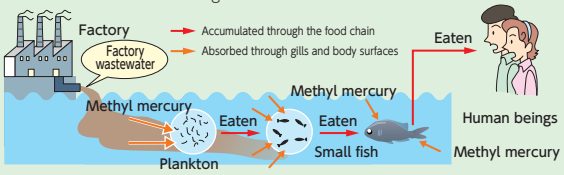
Minamata disease

Chisso Corporation Minamata Factory during the 1950s
Photo courtesy of the Minamata Disease Municipal Museum

The occurrence of Minamata disease was first confirmed in 1956. The disease was caused by methyl mercury discharged from a chemical factory (Chisso Corporation Minamata Factory) in Kumamoto Prefecture's Minamata City. Methyl mercury discharged into the sea was bioconcentrated in fish and shellfish through the food chain, damaging the health of those who ate contaminated seafood. Major symptoms of Minamata disease include sensory impairment of limbs, ataxia, constriction of the visual field, hearing impairment, and speech disorders. Some patients with severe symptoms became comatose and died.

Also, methyl mercury absorbed into a pregnant mother's body was sometimes incorporated through the umbilical cord into the fetus in her womb, resulting in the birth of a baby with congenital symptoms of Minamata disease (fetal Minamata disease patient). The total number of patients certified as suffering from Minamata disease was 2,275 as of October 2013. Similar health damage was also caused by organic mercury compounds discharged from Showa Denko's factory in the Agano River Basin in Niigata Prefecture (Niigata Minamata disease).

Source: Figure compiled from Kumamoto Prefecture, Knowledge of Minamata Disease for Beginners

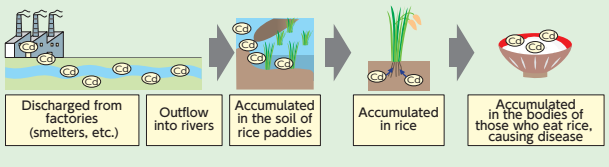


Itai-Itai disease

Cadmium discharged from the Kamioka Mine in Gifu Prefecture (Mitsui Mining & Smelting Co., Ltd.'s Kamioka Plant) contaminated rice paddies in the lower basin of the Jinzu River, causing disease among those who ate rice grown in the area. Itai-Itai disease is believed to have started around the Taisho period; it attracted public attention in 1955, when it was first reported in a newspaper.

Itai-Itai disease is caused by chronic cadmium poisoning, which initially damages kidneys and then causes osteomalacia (a disease that creates a defect in the system that hardens bones, preventing normal bone development). Symptoms of the disease include pain in the waist, shoulders, or knees. As the disease becomes more severe, the patient repeatedly breaks bones; eventually, the patient becomes incapable of moving around on his own due to pain felt throughout his entire body. The name of the disease is said to derive from the cry of pain ("Itai itai," meaning "It hurts" in Japanese) raised by the patient suffering from unendurable pain. A total of 196 patients were certified as suffering from Itai-itai disease between 1967, when the first Itai-itai disease patient was certified as such, and the end of 2011.

Source: Compiled from a figure on the website of the Toyama Prefectural Itai-Itai Disease Museum

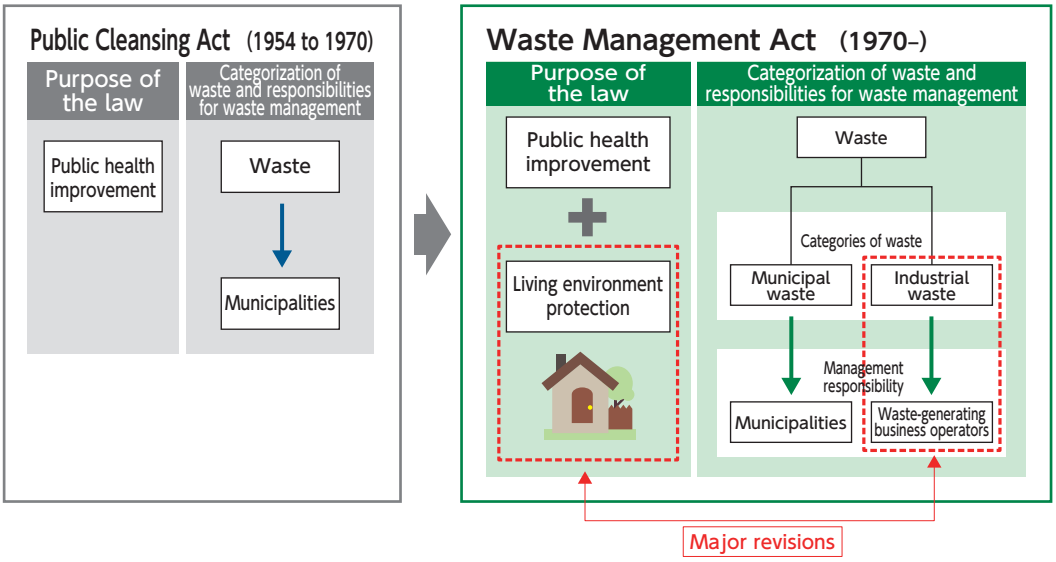


Measures implemented to solve problems

Development of basic systems for waste management

In order to specify responsibilities and standards for the management of all waste, including industrial waste, and to develop basic systems for waste management, the Japanese government made extensive revisions to the Public Cleansing Act in the 64th extraordinary Diet session (commonly known as the "Pollution Session") in 1970 and enacted the Waste Management and Public Cleansing Act (Waste Management Act). Distinguishing between two types of waste (industrial waste and municipal waste), the Waste Management Act defined the responsibility of municipalities to manage municipal waste as had been done previously, while at the same time newly defining the responsibility of waste-generating business operators to manage industrial waste.

The Waste Management Act also clearly defined living environment protection, including pollution control, as a purpose of the law in addition to waste management for public health improvement.



Measures implemented to solve problems

Basic principles of pollution prevention and regulations on the discharge of hazardous substances

With a view to comprehensively and systematically promoting pollution control measures, the Basic Act for Environmental Pollution Control was enacted in 1967. In addition to the responsibility of business operators to prevent pollution by the proper treatment of soot, wastewater, and waste, the Basic Act for Environmental Pollution Control defined the responsibilities of different entities as well: the responsibility of the national government to protect the health of the people and the living environment; the responsibility of local governments to prevent pollution in accordance with the natural and social conditions of local communities; and the responsibility of residents to cooperate in implementing pollution control measures.

For the purpose of protecting the health of the people and the living environment, the Japanese government also established emission control standards regarding air and water pollution in the enforcement regulations for related laws. Regulation values for soot, acidic gases, etc. were defined in the Air Pollution Control Act (enacted in 1968), and regulation values for mercury, cadmium, etc. in the Water Pollution Control Act (enacted in 1970). In an effort to create a centralized system for environmental administration, the Japanese government also established the Environment Agency in 1971 in order to systematically promote and implement pollution-related laws.

＊Although the Basic Act for Environmental Pollution Control was repealed in 1993 as a result of the establishment of the Basic Environment Act, the bulk of its content has been passed onto the latter law. The Basic Act for Environmental Pollution Control and the Nature Conservation Act played fundamental roles in the Japanese government's environmental policies. However, since the 1980s, environmental problems have differed considerably from conventional environmental issues in terms of their causes as well as structures. Solving these problems required comprehensive and systematic strategies focused on the environment. To that end, the Basic Act for Environmental Pollution Control and the Nature Conservation Act were integrated into the Basic Environment Act to provide a new legal framework for comprehensively and systematically promoting a variety of strategies aimed at protecting the environment, including the socio-economic activities and life styles of the Japanese people.

Regulation values in the Air Pollution Control Act

Soot dust

Soot and other particulate matter

1968～1971

Type of facility	Emission standard (g/Nm³)
Sewage incineration furnace	0.7

Soot dust

1971～1982

Type of facility	Size of facility (amount of exhaust gas)	Emission standard (g/Nm³)	
		General	Special
Continuous furnace	40,000 Nm³ or more	0.2	0.1
	Less than 40,000 Nm³	0.7	0.2
Other furnaces	—	0.7	0.4

Sulfur oxides

1968～

Emission standards for individual designated areas defined in enforcement regulations based on the K value

Hazardous substances

Hydrogen chloride

1977～

Type of facility	Emission standard (mg/Nm³)
Waste incineration furnace	700 (O^2=12%Converted value)

Nitrogen oxides

1977～1979

Type of facility	Size of facility (amount of exhaust gas)	Emission standard (ppm)
Waste incineration furnace	40,000 Nm³ or more	250

＊O^2=12%Converted value

＊For soot dust, the emission standards specify the standard amount (concentration) of soot dust per cubic meter of exhaust gas for each type and size of soot-emitting facility (in addition to general emission standards, there are special standards applied to facilities that are newly installed in areas with serious pollution or with a risk of serious pollution); for sulfur oxides, the standard amount (concentration) of sulfur oxides generated at soot-generating facilities that are emitted from outlets into the atmosphere (determined based on values calculated from K values specified for each area category defined in enforcement regulations and the heights of outlets); and for hazardous waste (hydrogen chloride and nitrogen oxides), the standard amount (concentration) of hazardous substances per cubic meter of exhaust gas for different types of hazardous substances and types of facilities. The Air Pollution Control Act enacted in 1968 defined standards only for soot and other particulate matter (soot dust) and sulfur dioxides, and hydrogen sulfide and nitrogen oxides were later added to the list in 1977.

Source: Masaaki Osawa, Waste in Japan Based on Figures and Tables, website of the Japan Environmental Sanitation Center

Measures implemented to solve problems

Promotion of proper waste management

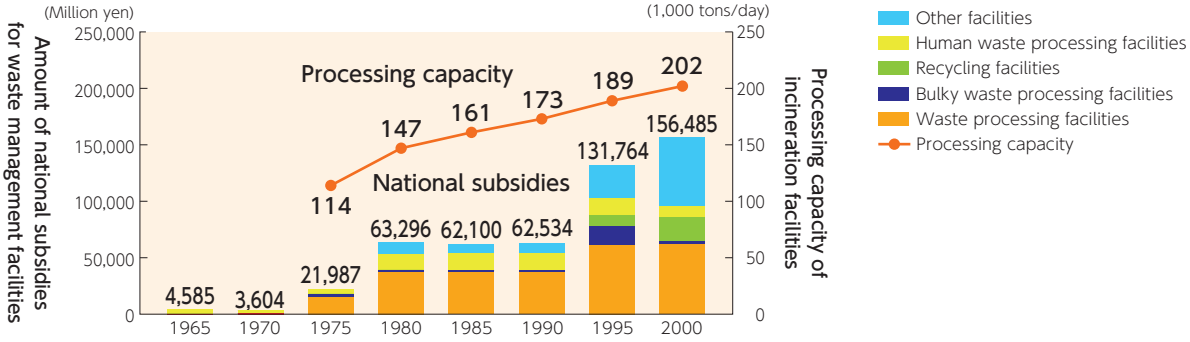
For the purpose of coping with an increase in the amount of waste and promoting the proper management of hazardous waste (industrial waste, which includes mercury and cadmium), the Japanese government strived to raise the general level of waste management by supporting the construction of waste management facilities in areas across Japan. More specifically, the government clearly defined architectural standards for municipal waste management facilities (1971) and architectural standards for final landfill sites for municipal and industrial waste (1977) in the enforcement regulations for the Waste Management Act. And by using the national subsidy system for supporting waste management facilities that meet these architectural standards, the government promoted the development of facilities for proper waste management. The government also cultivated individuals with advanced knowledge and skills who were certified as engineering managers for waste management facilities and pollution prevention in order to ensure the efficient maintenance of facilities for proper waste management. Through these measures, the government promoted the construction of well-performing waste management facilities that meet legal standards in areas across Japan and contributed to improving the capabilities of such facilities.

In order to prevent pollution, increase incineration efficiency, and promote effective waste treatment and disposal, the government established rules for sorting waste in the process of waste collection (combustible waste, non-combustible waste, and plastics and rubber scrap, for example) in waste management plans formulated by local governments based on the law, thereby promoting sorted waste collection.

Constructed in Tokyo in 1973, the Oi Waste Processing Factory contributed to solving waste problems as a large factory equipped with bulky waste crushers and waste reloading devices. The factory supported the design of incineration furnaces and the improvement of facilities required to cope with changes in the quality of waste as well as with the collection of bulky waste.

Source: One Hundred Years of Waste Management in Tokyo

National subsidies for waste management facilities and changes in the processing capability of incineration facilities



Source: Compiled from MOE, Waste Management in Japan (annual editions) and Japan Waste Management Association, FY2005 Manual for Waste Management Facility Development Operations

Measures implemented to solve problems

Proper landfilling of hazardous waste

In 1973, in the enforcement regulations for the Waste Management Act, the Japanese government established assessment standards regarding hazardous waste, including hazardous heavy metals (such as mercury and cadmium) and organic pollutants (such as PCB).

In 1977, to ensure the safe final disposal of waste in accordance with its nature, the Japanese government established architectural and maintenance standards for final landfill sites in the enforcement regulations for the Waste Management Act. The government also defined three types of final landfill sites for industrial waste: closed landfills, controlled landfills, and open landfills.

With regard to industrial waste that has the potential to damage human health based on elution tests conducted using the assessment standards for hazardous waste, the government strived to provide solutions to pollution and environmental contamination issues from such waste by promoting the proper landfilling in closed landfills designed to prevent the inflow of rainwater and outflow of leachate so as to avoid the leakage of hazardous substances to the outside.

Controlled landfills are landfills equipped with seepage control structures and leachate collection/treatment systems; controlled landfills are designed for the landfilling of non-hazardous waste that may contaminate public waters or groundwater and produce negative effects on the living environment of human beings by generating landfill gases, foul odors, and harmful insects. Waste plastics, glass, ceramics and other waste materials that have a low risk of causing environmental pollution are landfilled in open landfills that are not equipped with seepage control structures or leachate collection/treatment systems.

Column

War against waste

During Japan's rapid economic growth period, Tokyo was faced with the deterioration of the environment in areas around landfills. This was due to the fact that large amounts of waste were landfilled without proper treatment as a result of a rapid increase in the amount of waste that occurred when the construction of waste incineration facilities was bogged down by residents' opposition in surrounding areas. The situation was particularly serious in the Koto Ward, which accepted the bulk of waste generated in the 23 wards of Tokyo. In the Koto Ward, the living environment of residents in areas around landfills was seriously compromised by foul odors and plagues of flies and mosquitoes from the landfills as well as by waste trucks that littered residential roads in the ward with waste. Under these circumstances, the Koto Ward adopted the resolution at a ward assembly meeting to oppose accepting waste from other wards. Also, in opposition to an active movement against the construction of a waste incineration facility in the Suginami Ward, the residents of the Koto Ward interrupted the transportation of waste from the Suginami Ward. These developments were widely reported in newspapers and TV news. Feeling a strong sense of crisis about these developments, the Tokyo Metropolitan Governor declared a "War against Waste" in September 1971, stating that the impending waste crisis was threatening the lives of the residents of Tokyo. The Governor made a statement that the Metropolitan government would implement effective waste management measures, including promoting the construction of waste processing factories and landfills. Things eventually started to move toward resolution as a result of the implementation of such strategies.

Interruption of the transportation of waste into the Koto Ward

Source: One Hundred Years of Waste Management in Tokyo

The War against Waste heightened the awareness that waste is a serious issue for daily life. As a result, people recognized the importance of government organizations and residents working together to promote waste management and strategies were implemented to promote the development of waste management facilities that are friendly to the surrounding environment.

Era of the establishment of a sound material-cycle society

4 Rapid economic growth period to the bubble economy period (1980s to early 1990s)

Domestic situation during this period

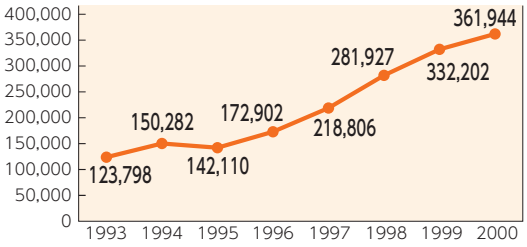
Expansion of waste problems in terms of both quality and quantity as a result of the bubble economy

As a result of an increase in consumption and the further expansion of production activities due to the bubble economy (late 1980s to early 1990s), the amount of waste continued to increase.

In addition, there was also an increase in the variety of waste, which included large-sized home appliances and other waste objects that were difficult to process properly, as well as an expansion of the use of containers and packaging materials. Plastic bottles also came to be widely used during this period.

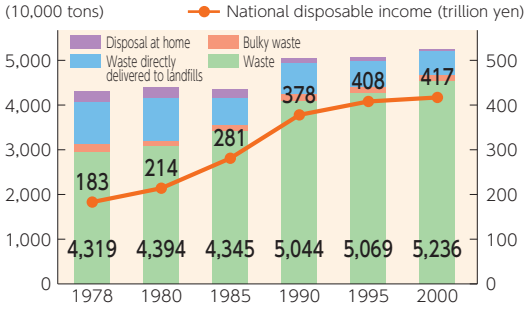
Piles of bulky waste
Photo courtesy of Tokyo Metropolis

Production of plastic bottles (Units: tons)



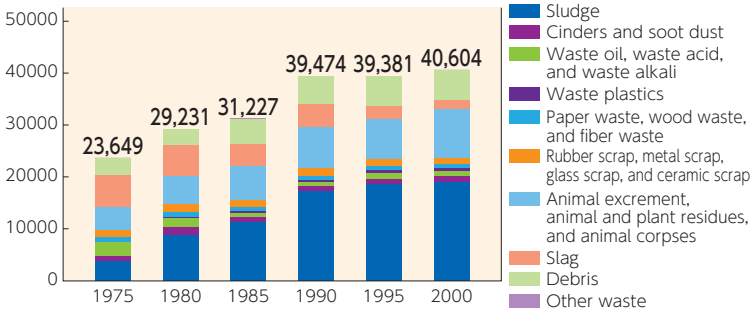
Source: Compiled based on figures on the website of the Council for PET Bottle Recycling

Changes in the total amount of municipal waste



Source: Compiled from MOE, Waste Management in Japan (annual editions) and Cabinet Office, National Accounts Statistics (annual editions)

Changes in the amount of industrial waste by type of waste (10,000 tons)



Source: MOE, Survey on the Discharge and Disposal of Industrial Waste (annual editions)

Domestic situation during this period

Serious shortage of landfills

Due to a rapid increase in the amount of waste, it became difficult to prevent combustible waste from being landfilled without being incinerated. This resulted in an increase in the amount of waste delivered to landfills, thereby reducing the residual capacity and time of existing landfills.

Data on the residual time of landfills during this period (see the figure on the right) shows that the residual time of municipal waste landfills was less than ten years in most years. The residual time of industrial waste landfills remained at an even lower level of one to three years. These figures reveal the serious capacity shortage of landfills at the time.

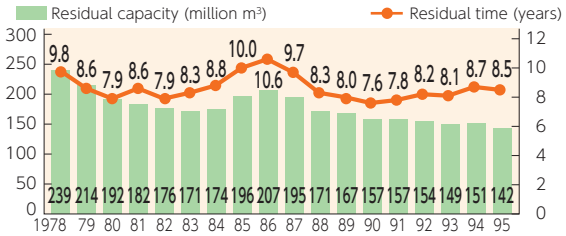
＊Residual time

Residual time is an estimate of the remaining time until the existing landfills are filled to capacity. It is an indicator calculated from a comparison between the current landfilling capacity (remaining capacity) and the annual amount of landfilled waste (final disposal amount) for relevant years.

Also, due mainly to difficulty in obtaining the agreement of residents regarding the construction of new landfills, there was a shortage of landfills especially in large cities. This made it more important than ever to reduce the amount of landfilled waste.

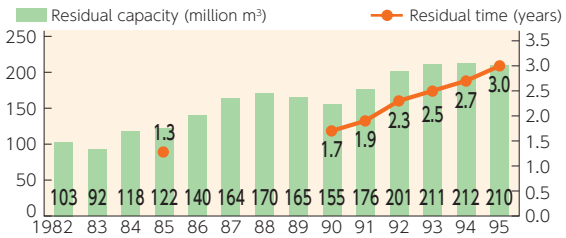
One of the factors that made it difficult to construct new landfills was the opposition movements organized by residents who were concerned about the environmental pollution caused by landfills. Since the movement against landfilling at the Hinode-machi Yatozawa Landfill in Tokyo was widely reported in the media in 1992, movements against the construction of landfills have attracted public attention in areas around Japan. The results of a survey conducted in 1995 to study conflicts concerning waste management facilities (see the table on conflicts concerning waste management) show that a total of 368 conflicts occurred in most of the prefectures in Japan; an overwhelming majority (279) of the conflicts were conflicts concerning landfills, which account for 73% of the total.

Residual capacity and time of landfills (municipal waste)



Source: MOE, Waste Management in Japan (annual editions)

Residual capacity and time of landfills (industrial waste)



Source: Compiled from MOE, Survey on the Discharge and Disposal of Industrial Waste, and Ministry of Welfare, Survey on Government Organizations for Industrial Waste Management

Conflicts concerning waste management

	Number of municipalities	Number of conflicts	Landfills	Intermediate processing facilities	Human waste processing facilities
National total	3,268	368	279	97	5

Source: Masami Taguchi, Development of the War against Waste and Conflicts: Survey Research and Case Reports, Hon no Izumi Sha

Domestic situation during this period

Emergence of large-scale illegal dumping and other problems

The Waste Management Act placed the responsibility for industrial waste management on waste-generating business operators. However, there were business operators that lacked the sense of responsibility for covering the appropriate costs required for waste management. Such business operators outsourced waste management to waste treatment operators who were willing to undertake the management of the waste at low prices without checking whether they could properly process the waste. As a result, illegal waste dumping and other unlawful operations were undertaken by many unethical or unauthorized operators for making excessive profits, causing serious environmental pollution. Restoring contaminated soil and surrounding environments required large amounts of funds. Problems such as these also created a deep distrust over industrial waste and waste management facilities among residents.

Also, illegal dumping of industrial waste and other unlawful operations were greatly affected by large-scale illegal dumping; there was even a case where a single dumping produced an amount of illegally discarded waste equivalent to the usual amount illegally discarded in one year. Such cases of large-scale illegal dumping highlighted the need to prevent illegal waste dumping and to stop the spread of unlawful practices.

Built-in problems regarding industrial waste management

Waste = Unneeded objects

↓

Lack of a sense of responsibility for covering management costs

↓

Preference for lower processing costs over processing quality among waste-generating business operators

↓

Presence of unethical or unauthorized operators who undertake the management of waste without covering appropriate costs

↓

Spread of unlawful practices such as illegal dumping and improper treatment of waste

↓

Negative effects on the environment, etc.

↓

Spread of distrust over industrial waste management among residents

↓

Collapse of the waste management system

Column

Illegal dumping of industrial waste on Teshima Island in Kagawa Prefecture

Industrial waste treatment operators illegally dumped approximately 620,000 m³ of industrial waste on Kagawa Prefecture's Teshima Island. The industrial waste contained hazardous substances, including heavy metals such as lead, chromium, and cadmium. Since the treatment of the industrial waste required enormous costs, the Japanese government provided funds based on the Act on Special Measures concerning Removal of Environmental Problems Caused by Specified Industrial Wastes (enacted in 2003) in order to support Kagawa Prefecture, which assumed the responsibility for the waste treatment. Waste, including contaminated soil, is currently being transported by ship from Teshima Island to the neighboring Naoshima Island to be melted or otherwise processed.

Illegally dumped waste

Teshima landfill immediately after the exposure of the illegal practice
Photo courtesy of Kagawa Prefecture

Domestic situation during this period

Emergence of problems regarding dioxins generated by waste incineration facilities

Dioxins are considered to have negative effects on the human body based on case studies conducted overseas. They were reported to have been detected from fly ash of waste incineration facilities in Japan. As a result of such reports, public attention was directed to measures to control dioxin emissions in waste incineration facilities around the end of 1983. Subsequently, effects of dioxins on mothers' milk were reported at an international conference held in Kyoto in 1994; and high-concentration soil contamination in areas around waste incineration facilities was reported in and around Saitama Prefecture's Tokorozawa City. Incidents such as these raised serious public concern over the dioxin issue.

Anxiety about dioxins generated by waste incineration facilities increased residents' concern over incineration facilities, providing impetus to opposition movements against the construction of incineration facilities. The lawsuit demanding that the incineration facility in Ibaraki Prefecture's Shintone Town be closed down and the lawsuit regarding high-concentration dioxin pollution at an incineration facility in Osaka Prefecture's Nose Town are examples of such movements.

*Dioxins

Dioxins are substances (by-products) that are naturally generated in incineration processes. Out of approximately 200 dioxins, 29 are regarded as being toxic. Currently, dioxins are generated by a variety of sources, such as electric furnaces for steel production, cigarette smoke, and automobile exhaust gas, but the major source is waste incineration.

Era of the establishment of a sound material-cycle society

5 1990s to 2000s

Measures implemented to solve problems

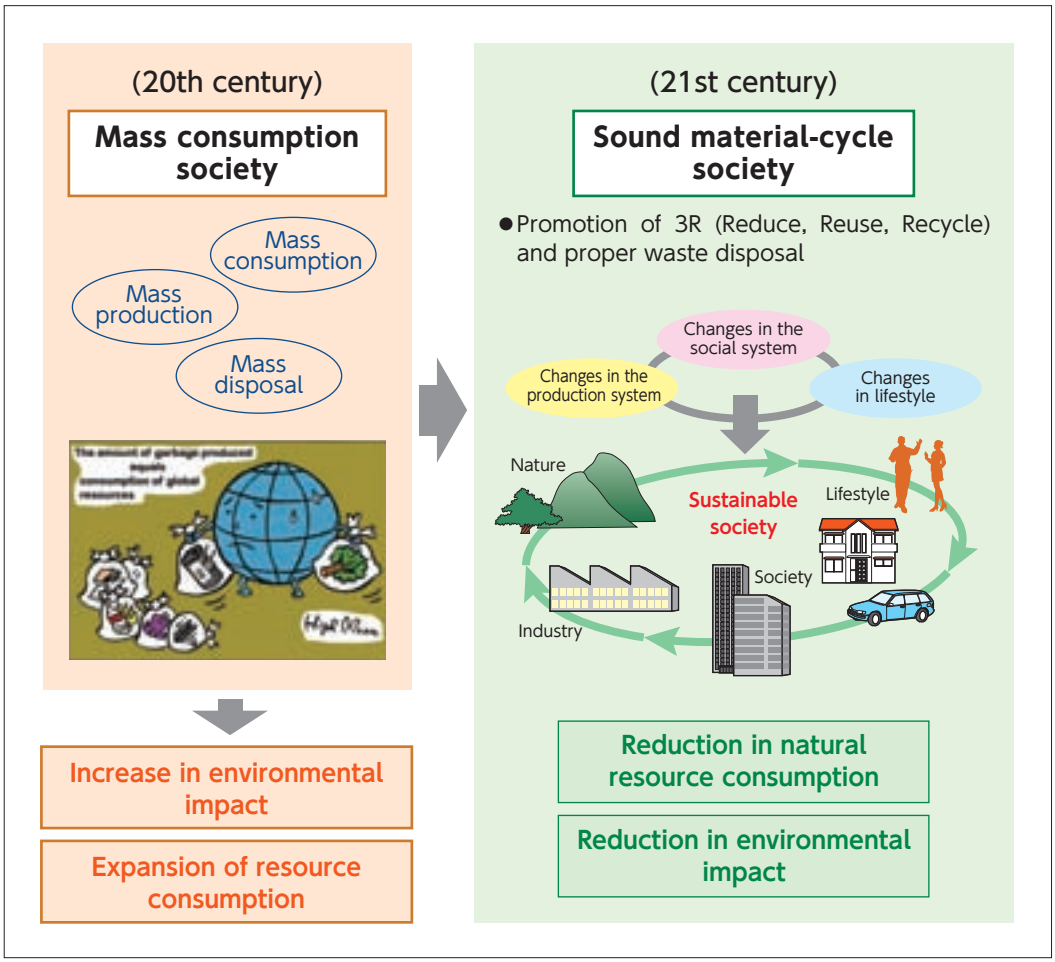
Promotion of the establishment of a sound material-cycle society

There had been significant progress in the proper management of waste by the 1980s. However, some problems were still left unresolved, including the continuing increase in waste generation and the resulting shortage of landfills. In order to provide comprehensive solutions to such problems, the Japanese government shifted the focus of its policies to reducing waste generation itself.

In the 1991 revision of the Waste Management Act, waste generation reduction was added as a purpose of the act, along with sorted collection and recycling of waste.

In the Act on the Promotion of Effective Utilization of Resources (Effective Resource Utilization Promotion Act), which was also enacted in 1991, the government also established basic rules for waste management, such as environmental considerations in product designing and manufacturing stages and the development of systems for independent waste collection and recycling by business operators. The aim of these rules was to ensure the effective use of resources, to reduce waste generation, and to protect the environment. In addition, the government established a variety of recycling acts to further promote waste recycling. Under the system supported by these laws, the Japanese government cooperated with private business operators to advance recycling initiatives by enhancing the development of recycling technologies.

Furthermore, in order to move away from the current economic system based on mass production, mass consumption, and mass disposal and to promote the establishment of a sound material-cycle society designed to ensure the implementation of the 3R (Reduce, Reuse, and Recycle) and proper waste management, the government established the Basic Act for Establishing a Sound Material-Cycle Society (Basic Recycling Act) in 2000. This law provides a clear vision for a sound material-cycle society, which is designed to reduce natural resource consumption as well as environmental impact; it also presents basic principles for the establishment of a sound material-cycle society, including legally determining the order of priority for resource recycling and waste management (1. generation reduction; 2. reuse; 3. recycling; 4. thermal recovery; and 5. proper disposal). In the Fundamental Plan for Establishing a Sound Material-Cycle Society (Fundamental Recycling Plan), which was stipulated to be formulated in the Basic Recycling Act, the government explicitly set numerical targets for resource productivity (entrance), the recycling rate (circulation), and the final waste disposal amount (exit), to promote the full-scale development of a sound material-cycle society.



Source for the illustration: Website of the Miyako Ecology Center

Measures implemented to solve problems

Promotion of understanding among consumers

Government initiatives: Waste Reduction Promotion National Conference and a comprehensive waste reduction strategy

With a view to strongly promoting waste reduction initiatives in cooperation with consumers and business operators, the Japanese government held the First Waste Reduction Promotion National Conference in September 1992 to compare notes regarding waste reduction. In 1993, the government specified the week starting on May 30 as the Waste Reduction Promotion Week and took an active part in developing a variety of awareness-raising programs through TV broadcasting and other events (the week was renamed the Waste Reduction and Recycling Promotion Week in 1997).

In addition, the government launched a comprehensive waste reduction strategy in 1993 to promote local community-wide waste reduction and recycling by subsidizing sorted waste collection and group collection by resident groups (see p.12) in municipalities, and it provided subsidies for facilities that repair end-of-life products and put recycled products on display (recycling plazas, see below) to encourage the development of such facilities. In an effort to promote waste reduction in local communities, the government also commended advanced municipalities engaged in developing social systems for waste generation reduction and recycling as "clean recycling towns."

Local government initiatives: Awareness-raising programs for waste reduction

Around the time when the Waste Management Act was revised in 1991, local governments also launched active programs to promote waste recycling in collaboration with residents and private business operators. Below, we present programs that were implemented in Tokyo Metropolis.

In order to deepen residents' understanding of increasingly serious waste problems and encourage their active participation in waste reduction and recycling activities, Tokyo Metropolis started a campaign entitled "TOKYO SLIM" in June 1989.

The "TOKYO SLIM" campaign started with posting campaign posters at major JR and other railroad company stations, followed by a talk event and a campaign tour across Tokyo. In March 1990, an event entitled "TOKYO SLIM IN DOME" was held at the Tokyo Dome Stadium to climax the campaign. The event was attended by more than 50,000 visitors. With the support of the mass media, the campaign grew in scale and helped spread the concept of recycling not only among those who participated in the event, but also among other residents of Tokyo. In 1991, as a successor to the "TOKYO SLIM" campaign, the Tokyo metropolitan government started the annual Tokyo Waste Meeting. With the participation of many private business operators and consumer groups, the meeting was attended by several tens of thousands of visitors each year.

In January 1991, the Tokyo Waste Council was organized to promote waste reduction and recycling as well as to support collaboration and cooperation between residents, business operators, and government organizations. Organized by 11 resident representatives, 24 business representatives, and 7 representatives of administration authorities, the council formulated waste reduction action plans and developed a variety of activities, including recycling bazars and the personal shopping bag campaign with the slogan "Shopping with your own bag," with the aim of helping 3R practices to take root in the lifestyle of the residents of Tokyo.

TOKYO SLIM IN DOME

Source: One Hundred Years of Waste Management in Tokyo

Recycling bazar at the Clean Tokyo Festival

Photo courtesy of Tokyo Metropolis

1997 Tokyo Waste Meeting

Photo courtesy of Tokyo Metropolis

Tokyo Waste Council

Photo courtesy of Tokyo Metropolis

Local government initiatives: Recycling programs rooted in local communities

As part of efforts to raise residents' recycling awareness, a number of municipalities have established recycling centers and recycling plazas rooted in respective local communities. The recycling center and plaza shown below repair, exhibit, and offer recyclable end-of-life products, including bulky waste, and also provide information on end-of-life product exchanges.

The recycling center and plaza provided a system for regular exchange of end-of-life products as well as a base for raising residents' recycling awareness, thereby helping to promote recycling activities rooted in the local community.

Exhibition hall on the first floor of the Nakano Environment and Recycling Plaza

Photo courtesy of Tokyo Metropolis

Recycling basket for old cloths and clothes installed at the Nakano Environment and Recycling Plaza

Photo courtesy of Tokyo Metropolis

Machida Recycling Culture Center

Photo courtesy of Tokyo Metropolis

Measures implemented to solve problems

Sorted collection of recyclable waste

Sorted collection of recyclable waste was started during the late 1970s in Numazu City and Hiroshima City, followed by municipalities throughout Japan during the late 1980s. In terms of improving the quality of collected recyclable waste as well as reducing sorting costs, sorting waste at the source of waste generation is the most efficient way to promote waste recycling. For this reason, sorted collection of recyclable waste has made substantial progress since the 1990s based on a variety of recycling acts.

Initiatives for promoting sorted waste collection

Cooperation of residents

Local governments prepared flyers and handbooks that explained how to sort and put out waste in plain language using illustrations and distributed them to residents in order to promote their understanding of sorted waste collection.

Furthermore, local government staff held briefings for residents to explain not only how to sort waste, but also why sorted collection was necessary and how recycling acts were implemented. Local government staff gave demonstrations using plastic containers and packaging to meet the needs of individual residents.

Local governments prepared pamphlets for non-Japanese residents as well.

Source: Official website of Yokohama City

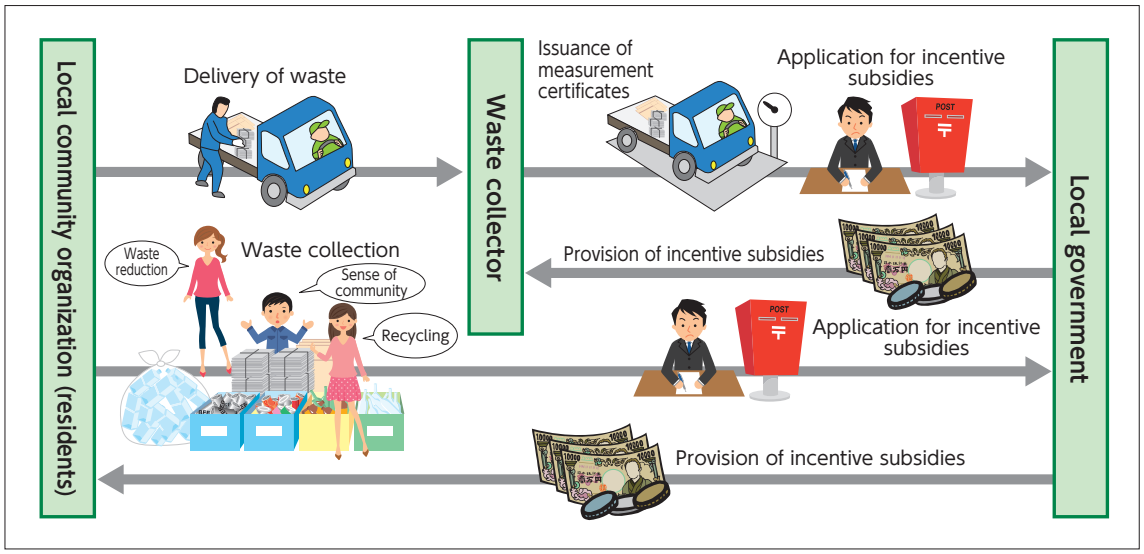
Group collection

Group collection of waste is a system in which independent resident groups in local communities, including neighborhood associations, district organizations, and volunteer groups, collect recyclable waste discharged from homes, such as empty bottles, empty cans, used paper, and cardboard, in a specific place at a specific time, and deliver the collected waste to resource recycling operators in order to recycle waste as resources.

Group collection reduces waste collection costs not only for local governments, but also for waste collectors by enabling them to efficiently collect specific amounts of waste. Group collection provides advantages to residents as well, such as enabling them to sort recyclable waste at home on specific days and creating new opportunities for communication with other residents. To increase the amount of recyclable waste collected and to reduce waste, many local governments have created incentive systems, including providing subsidies to local community organizations that practice group collection.

Group collection by a neighborhood association

Photo courtesy of Kawasaki City



Source: Compiled from a figure on the website of Yokohama City

Measures implemented to solve problems

Enhancement of regulations on industrial waste

In view of problems such as the shortage of final disposal sites for industrial waste and illegal waste dumping, the Waste Management Act was revised several times from 1997 onwards for the purpose of promoting the proper management, reduction, and recycling of waste as well as solving built-in problems regarding industrial waste management, including the lack of the sense of responsibility for covering management costs.

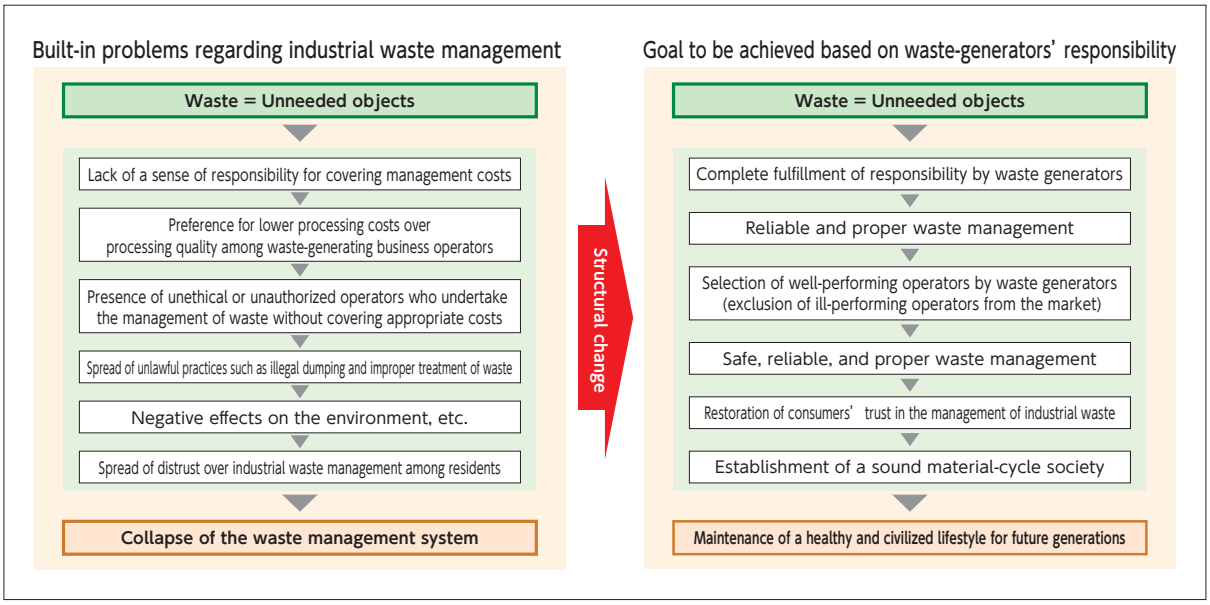
More specifically, the Japanese government implemented reform of the industrial waste management structure, focusing on effectively ensuring the fulfillment of responsibility by waste-generating business operators, preventing improper waste management, and providing appropriate waste management facilities.

Major targets of the reform of the industrial waste management structure based on the revised Waste Management Act

❶Ensuring the fulfillment of responsibility by waste-generating business operators	❷Preventing improper waste management	❸Providing appropriate waste management facilities
●Enhancing the manifest system ●Expanding the scope of restitution orders	●Tightening requirements for the authorization of waste management operators and facilities ●Increasing penalties (fines)	●Enhancing procedures for the construction of waste management facilities and making the procedures more transparent ●Providing support for the development of high-performance facilities

*Manifest system

The manifest system was created to prevent illegal waste dumping and other improper management operations by gathering accurate data on waste management processes and to ensure proper waste management based on waste generators' responsibility. This system obligates business operators generating industrial waste (including intermediate treatment operators) to issue manifests (industrial waste management sheets) when outsourcing the management of industrial waste, so as to confirm that the waste has been properly managed until its final disposal according to the outsourcing agreement.



Measures implemented to solve problems

Dioxin emission control

Survey research and technological development through industry-academia-government collaboration

Since dioxin emissions were first reported in 1983, the Japanese government has assessed the behavior of dioxins in the environment and their health impact as well as conducted survey research on their biological effects. The government has also developed a variety of technologies, including technologies for proper waste incineration, for the purification of contaminated soil, for detoxifying and dissolving dioxins, and for simple measurement and analysis.

State-of-the-art equipment for the prevention of pollution, including dioxin emission control, was introduced in the Chitose Waste Processing Factory completed in March 1996.

Photo courtesy of the clean Association of TOKYO23

Exhaust gas emission control and the development of waste incineration facilities

Since 1997, based on the Guidelines for the Prevention of Dioxin Emissions from Waste Management drafted by the Advisory Commission on the Reduction of Dioxin Emissions from Waste Management, the Air Pollution Control Act, and the revised Waste Management Act, the Japanese government has developed a variety of emission control measures, such as controlling dioxin emissions from incinerator stacks and improving waste incineration facilities. At a conference of dioxin control-related cabinet members held on March 30, 1999, the government drafted Basic Guidelines for the Promotion of Dioxin Control Measures in order to promote measures to drastically reduce dioxin emissions through a unified effort of all government organizations.

In 1999, with a view to preventing environmental pollution by dioxins and removing them from the environment, the Japanese government enacted the Act on Special Measures against Dioxins. This act defines basic standards for measures regarding dioxins and stipulates rules for measures regarding contaminated soil.

As a result of the development of emission control technologies and waste incineration facilities as well as of the tightening of control regulations, dioxin emissions from waste incineration facilities were reduced in 2011 by approximately 99% compared to the level of 1997.

Current strategies for waste management and 3R

National government measures to establish a sound material-cycle society

To further promote the development of a sound material-cycle society, the Japanese government not only enacts laws, but also undertakes the following activities with the aim of promoting public understanding and enhancing collaboration with other entities.

3R Promotion Month

The Japanese government has specified October as 3R (Reduce, Reuse, and Recycling) Promotion Month to enhance the understanding and cooperation of consumers and business operators regarding 3R initiatives. During the 3R Promotion Month each year, a variety of programs and events are organized by government agencies, local governments, and other interested parties to promote the establishment of a sound material-cycle society.

3R Promotion National Convention (since 2006)

The 3R Promotion National Convention is held annually by the Ministry of the Environment in collaboration with the 3R Promotion Forum and local governments to provide an opportunity for consumers, business operators, and government staff to gather together to compare notes regarding the establishment of a sound material-cycle society and for individual participants to review their lifestyles. The Waste Reduction Promotion National Conference, predecessor of the 3R Promotion National Convention, had been held annually since 1992.

＊The 3R Promotion Forum was established in 2006; its members include companies, research institutes, business organizations, NPOs, and NGOs. The forum is engaged in a variety of 3R awareness-raising programs.

Source: Website of the 3R Promotion Forum

Minister of the Environment's Awards for Contributions to the Establishment of a Sound Material-Cycle Society (since 2006)

The Minister of the Environment's Awards for Contributions to the Establishment of a Sound Material-Cycle Society were started in 2006 for the purpose of honoring individuals, companies, organizations, and communities that have achieved outstanding results through their pioneering or innovative initiatives for the establishment of a sound material-cycle society. The award ceremony is held every year at the 3R Promotion National Convention.

Source: Website of the 3R Promotion Forum

Environmentally Friendly Shopping Campaign (since 2000)

During the 3R Promotion Month, the Ministry of the Environment, the 3R Promotion Forum, and the Ministry of Economy, Trade and Industry work together to conduct the Environmentally Friendly Shopping Campaign in collaboration with prefectures, municipalities, logistics business associations, and consumer organizations. Various activities are undertaken in this campaign to demonstrate to consumers, distributors, and retailers the need for environmentally friendly consumer behavior, such as using personal bags for shopping, cooperating in simplifying packaging, and purchasing environmentally friendly products and products sold by measure.

Source: MOE Website

3R Promotion Meister system

To raise consumers' awareness about the need to reduce the disposal of container and packaging waste, including plastic shopping bags received from stores, the Containers and Packaging Recycling Act defines the responsibility of the Minister of the Environment to appoint 3R Promotion Meisters (container and packaging waste disposal reduction promoters). The appointed Meisters provide the public with information on the disposal of container and packaging waste, promote the importance of initiatives to reduce such waste, and offer guidance and advice to consumers.

The R mark and the 3R mark

In 1995, to promote the use of recycled paper and raise public awareness, the Waste Reduction Promotion National Council, predecessor of the 3R Promotion Forum, created the R mark as a logo to show the percentage of recycled pulp contained in paper at a glance. Using recycled paper raises the percentage of used paper contained in paper materials, thereby promoting the effective use of valuable resources.

The 3R mark was designed by the 3R Promotion Council with the aim of making 3R activities better known by creating an easy-to-understand image of the three Rs and promoting the active participation and cooperation of as many people as possible. The 3R mark can be freely used by companies, NPOs and local government organizations in their 3R programs as well as PR activities and campaigns.

＊The 3R Promotion Council was established to provide opportunities for government organizations, consumers, businesses, and other interested parties to closely collaborate and communicate with each other to develop extensive nationwide recycling initiatives for the purpose of establishing a sound material-cycle society. The council develops extensive nationwide initiatives to promote 3R.

3R mark of MOE

R mark

3R mark

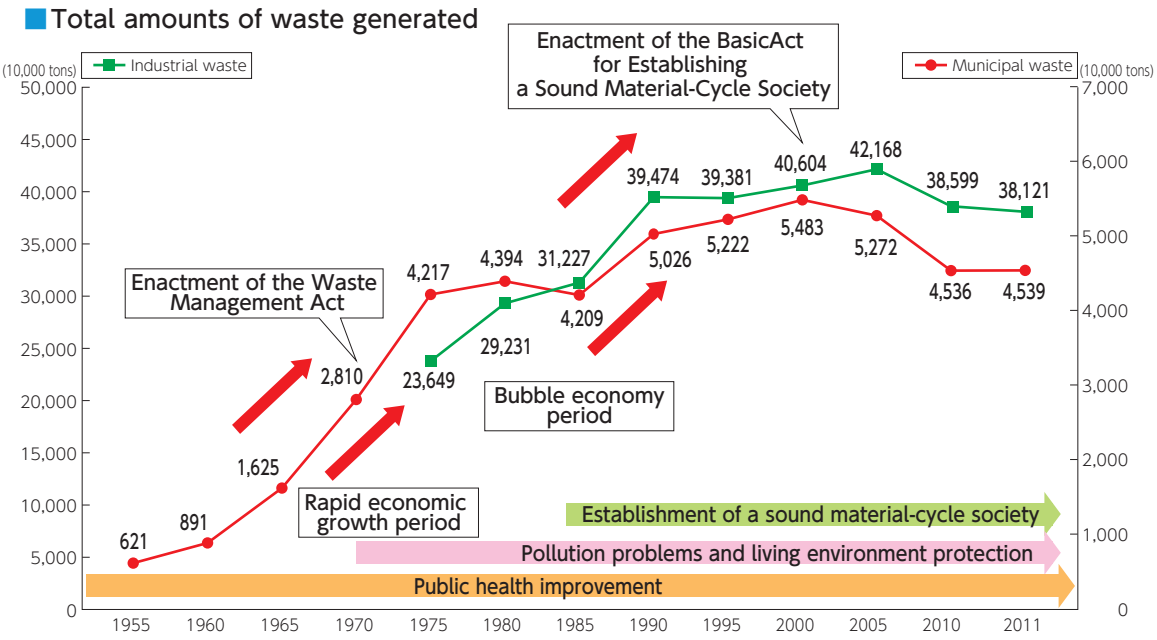
Development of "Eco-towns"

The Japanese government certifies advanced environmentally harmonious areas as "Eco-towns." There are 26 Eco-towns throughout Japan. These Eco-towns serve as centers for material circulation in their respective regions. The government is implementing model projects to help these Eco-towns perform their roles.

Results that have been achieved by measures taken

Amounts of waste generated

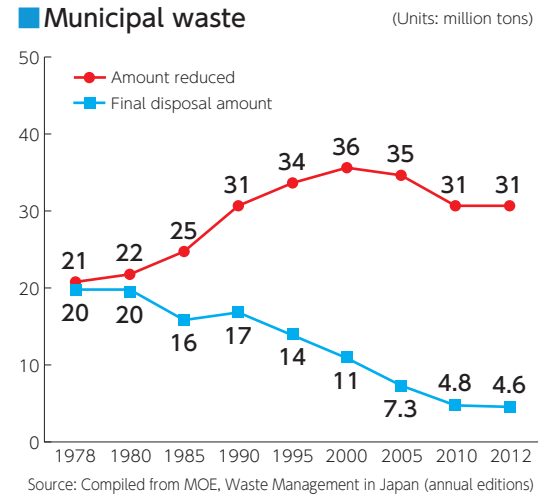
The amount of municipal and industrial waste generated in Japan continued to increase over time until around 2000. Waste generation increased especially sharply during the rapid economic growth period (1960s to 1970s) and the bubble economy period (late 1980s to early 1990s). Since 2000, due partly to the effects of changes in the industrial structure and the Japanese economy, waste generation has tended to decrease as a result of progress in sorted collection, recycling and in the development of a sound material-cycle society.



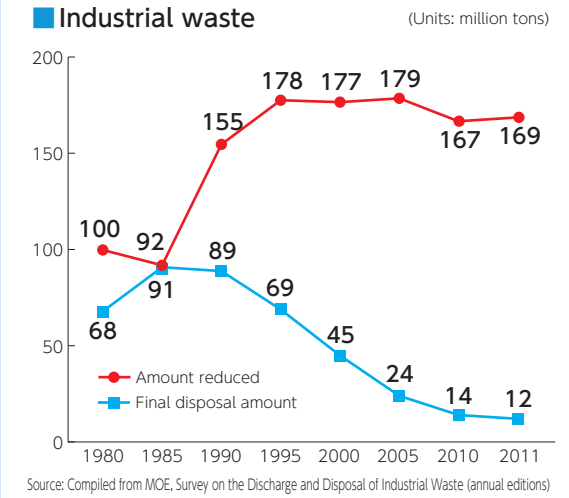
Source: Compiled from MOE, Waste Management in Japan: Survey on the Discharge and Disposal of Industrial Waste (annual editions)

Amounts of final waste disposal and waste reduction

The Japanese government has strived to reduce the ever-growing amount of waste through incinerating and recycling waste. Since 2000, the government has also strived to reduce waste disposal by defining numerical targets for the final disposal amount in the Basic Recycling Plan as well as by implementing systematic and effective measures to incinerate and recycle waste. As a result of such efforts, the final waste disposal amount has greatly decreased, as shown in the graphs below.



Source: Compiled from MOE, Waste Management in Japan (annual editions)

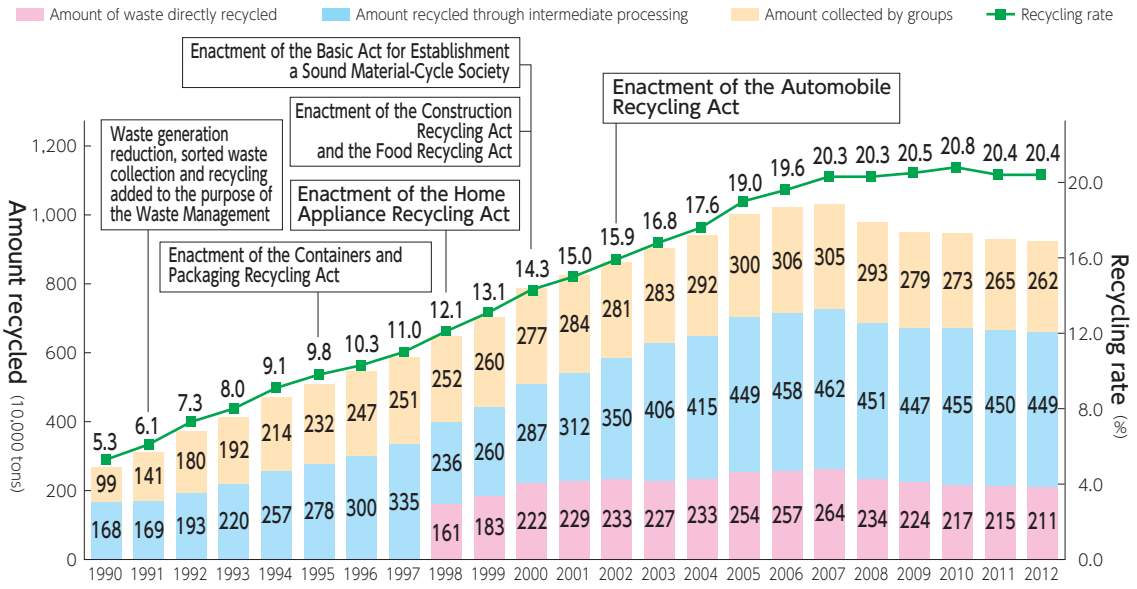


Source: Compiled from MOE, Survey on the Discharge and Disposal of Industrial Waste (annual editions)

Amount of Municipal waste recycled and the recycling rate

In addition to the Basic Recycling Act, the Japanese government has enacted a variety of specific recycling acts since the 1990s in order to effectively promote the recycling of municipal waste.

Changes in the amount of waste recycled and the recycling rate

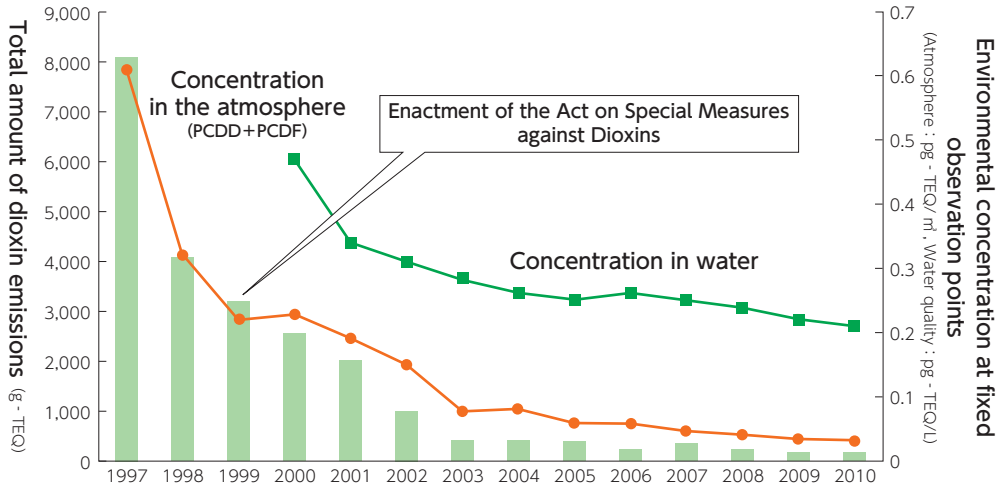


Source: Compiled from MOE, Waste Management in Japan (annual editions)

Amount of Dioxin emissions

The Japanese government has implemented regulations, developed incineration facilities, and conducted industry-government-academy joint research and technology development in order to ensure the proper management of dioxins and other hazardous substances that are generated from waste incineration. As a result, the generation of such hazardous substances has been successfully reduced to minimize damage to the health of the Japanese people by pollution.

Changes in the total amount of dioxin emissions and dioxin concentrations in the atmosphere and water



Source: MOE pamphlet, Dioxins 2012

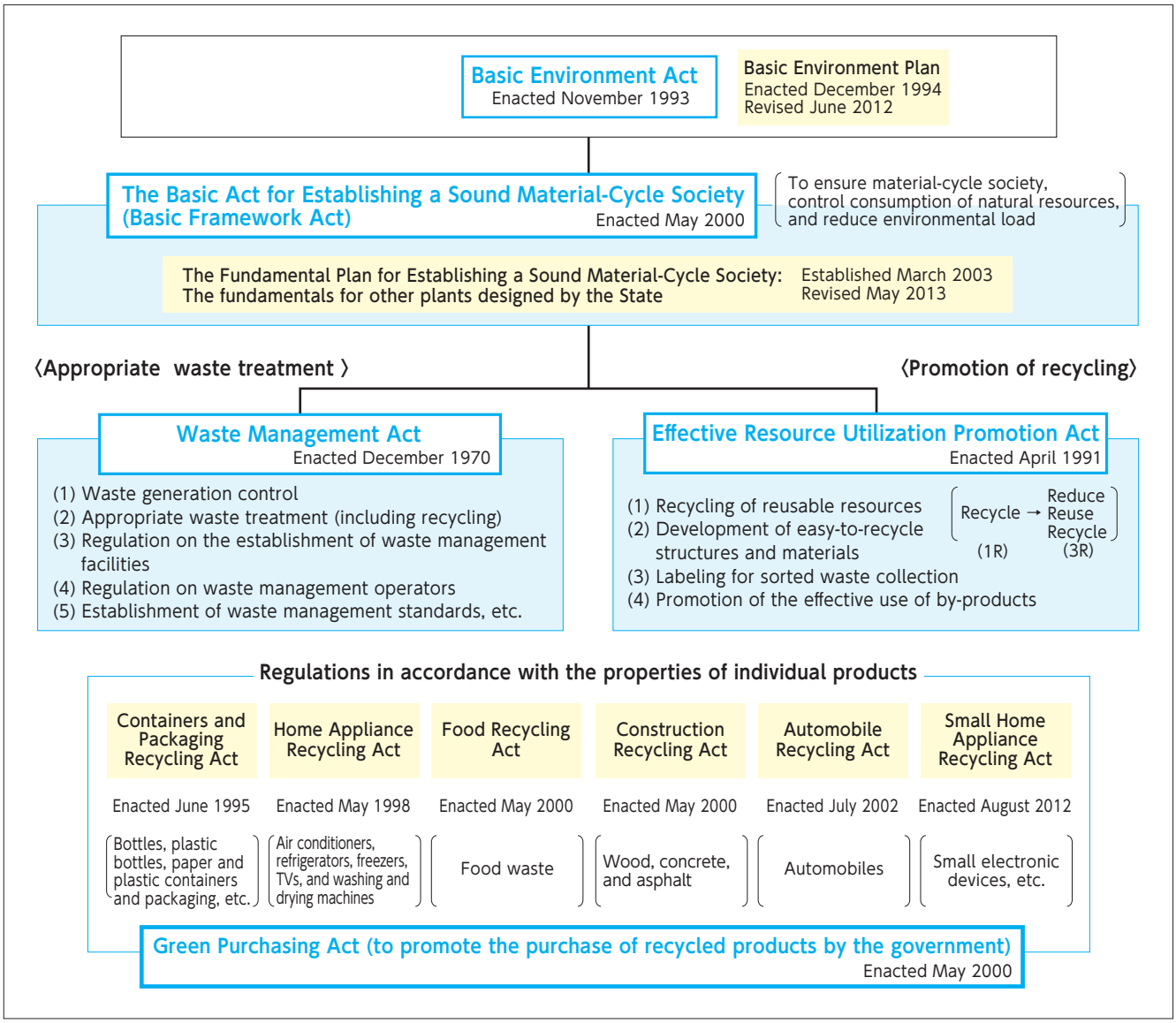
2 Legal Systems Regarding Waste Management and 3R

Legal systems for establishing a sound material-cycle society

Under the Basic Environment Act, which forms the backbone of environmental policies in Japan, Japan's legal system for establishing a sound material-cycle society is composed of the Basic Act for Establishig a Sound Material-Cycle Society (Basic Recycling Act), which provides the fundamental principles and guidelines for the development of a sound material-cycle society, and specific laws that determine rules required to implement the fundamental principles. Based on the Basic Recycling Act, the Japanese government has also formulated a Fundamental Plan for Establishing a Sound Material-Cycle Society (Fundamental Recycling Plan) in order to promote comprehensive and planned promotion of strategies for the establishment of a sound material-cycle society.

The following laws have been developed with a view to establishing a sound material-cycle society: the Waste Management and Public Cleansing Act (Waste Management Act), which aims to protect living environments and improve public health through waste generation control and appropriate waste treatment; the Act on the Promotion of Effective Utilization of Resources (Effective Resource Utilization Promotion Act), which aims to ensure effective use of resources, to reduce waste generation, and to preserve the environment; six Recycling Acts that have been enacted in accordance with the properties of individual products; and the Act on the Promotion of Procurement of Eco-friendly Goods and Services by the State and Other Entities (Green Purchasing Act), which aims to create a society capable of sustainable development under the initiative of government organizations by promoting the purchase of environmentally friendly products and services.

Legal system for Establishing a "Sound Material-Cycle Society"



The Basic Act for Establishing a Sound Material-Cycle Society

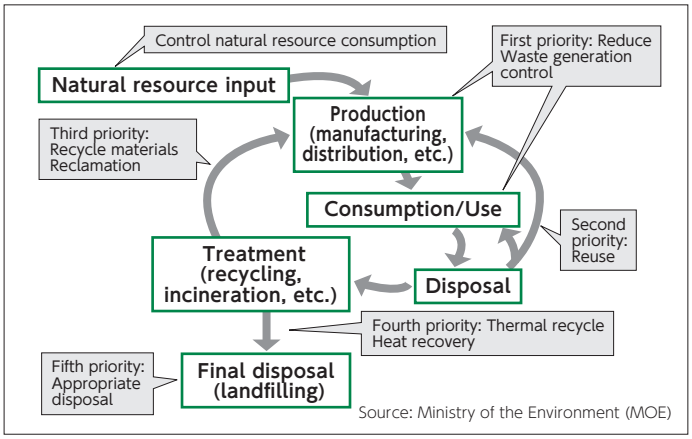
In 2000, the Basic Act for Establishig a Sound Material-Cycle Society (Basic Framework Act) was enacted to achieve the following purposes: to move away from the current economic system based on mass production, mass consumption and mass disposal, which is facing serious problems, such as an enormous increase in waste resulting from rapid economic development as well as the resulting shortage of final disposal sites; and to promote the establishment of a sound material-cycle society designed to ensure the implementation of 3R (Reduce, Reuse, and Recycle) and the appropriate management of waste.

The Basic Recycling Act defines the vision of a sound material-cycle society that reduces natural resource consumption and minimizes environmental impact. At the same time, the law specifies the order of priority in the management of recyclable resources as well as the roles of different entities (national and local governments, business operators, and consumers).

The Basic Recycling Act also legally established, for the first time, the basic principle that recyclable resources should be processed in the following order of priority: (1) generation control, (2) reuse, (3) recycling, (4) thermal recovery, and (5) appropriate disposal.

In defining the roles of different entities, this law distinguishes between the principle of waste generator responsibility, which places the responsibility for the management and recycling of waste on consumers and business operators that dispose of waste, and the principle of extended producer responsibility (EPR), which places the responsibility for the manufacture, design and post-use management of products on their manufacturers.

Vision of a sound material-cycle society



Source: Ministry of the Environment (MOE)

The Basic Recycling Act defines all waste, both valuable and non-valuable, simply as "waste." With a view to realizing a sound material-cycle society that reduces natural resource consumption and minimizes environmental impact, the law assumes that it is necessary to reduce the amount of products that are disposed of as waste; that generated waste must be considered "recyclable material" to be used effectively to promote appropriate circulation of materials (reuse, recycling, and thermal recovery); and that waste that cannot be recycled must be properly disposed of.

The Fundamental Plan for Establishing a Sound Material-Cycle Society

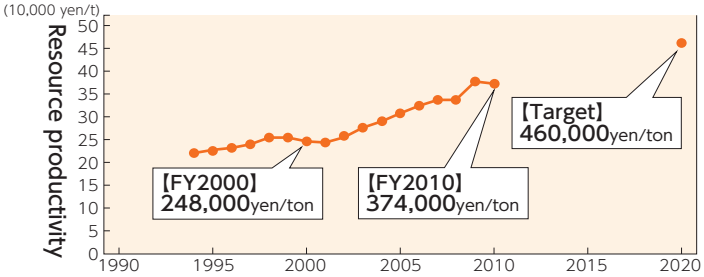
The Fundamental Plan for Establishing a Sound Material-Cycle Society(Fundamental Recycling Plan) is developed by the national government in order to promote the comprehensive and planned promotion of strategies for the development of a sound material-cycle society based on the Basic Recycling Act.

The First Fundamental Recycling Plan was formulated in 2003 to define the image of a sound material-cycle society, including lifestyles in which consumers use good products with great care, as well as environmentally friendly manufacturing and services. The plan was revised in 2008 and the Second Fundamental Recycling Plan aimed to promote integration with initiatives for a low-carbon, environmentally friendly society as well as to create regional circulation networks in order to develop initiatives that meet local resource needs. The plan was revised again in 2013. In addition to conventional strategies focused on the quantity of waste, the Third Fundamental Recycling Plan directed attention to the quality of the use of resources, adopting the following new strategy goals: (1) enhancing initiatives for reducing and reusing waste, which tend to lag behind initiatives for recycling; (2) promoting the recovery of useful metals; (3) enhancing initiatives for security and safety; and (4) promoting international cooperation for 3R initiatives.

To quantify the level of development of initiatives for the establishment of a sound material-cycle society, the Fundamental Recycling Plan creates material flow diagrams and sets goals regarding resource productivity, the recycling rate, and the final disposal amount - three elements that represent different aspects of the material flow (entrance, circulation, and exit). These indicators reveal steady progress to this day. In particular, the FY2015 goals for the recycling rate and the final disposal amount, set in the Second Fundamental Recycling Plan, have already been achieved prior to the target year.

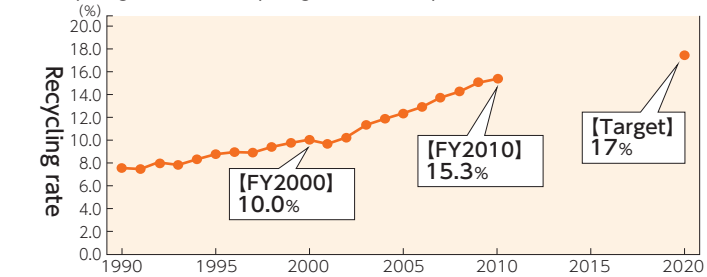
Inlet: Resource productivity

GPD / input of natural resources, etc.

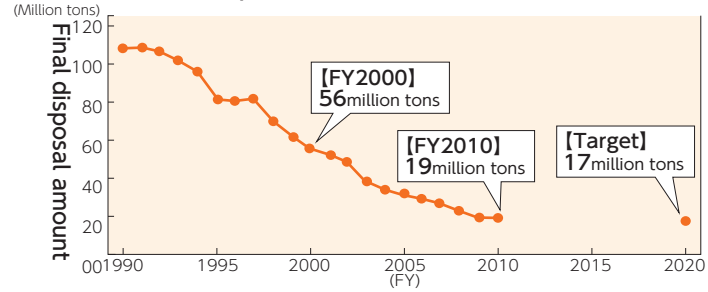


Cycle: Recycling rate

Recycling amount /(recycling amount + input of natural resources,etc.)



Outlet: Final disposal amount



Source: MOE, Overview of the Third Fundamental Plan for Establishing a Sound Material-Cycle Society

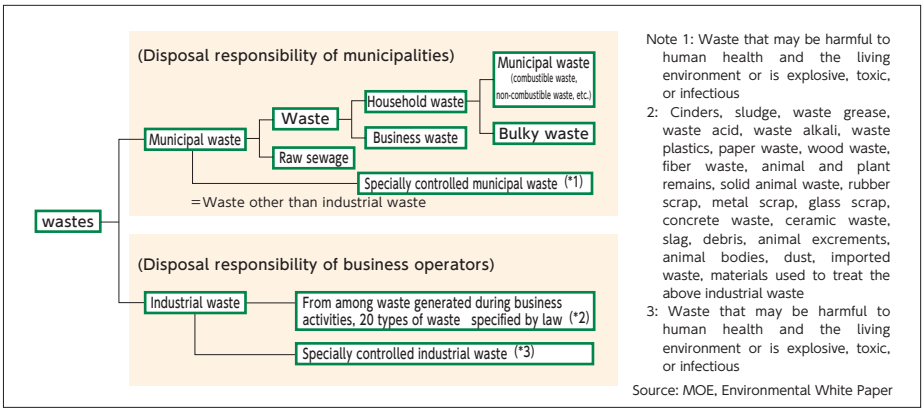
Categories of waste and the flow of appropriate waste treatment

Categories of waste

Since the rapid economic growth period in Japan, an increase in the amount of waste generated from corporate manufacturing activities, particularly in the amount of hard-to-manage waste, has made it difficult to manage waste in compliance with the Public Cleansing Act (1954-1970), which placed the responsibility for waste management on municipalities. Against this background, based on the Polluter-Pays Principle (PPP), the Waste Management and Public Cleansing Act (Waste Management Act) was enacted in 1970 in order to legally specify 20 types of waste generated from corporate activities as "industrial waste" and to place the responsibility for the management of industrial waste on business operators that generate such waste. The new act also created a system for municipalities to have responsibility for managing household waste as "municipal waste" as ever.

With a view to promoting proper management of hazardous substances, the Waste Management Act also specifies waste with properties that may cause damage to human health or the living environment, such as explosiveness, toxicity and infectivity, as waste subject to special control, and controls the specified waste accordingly.

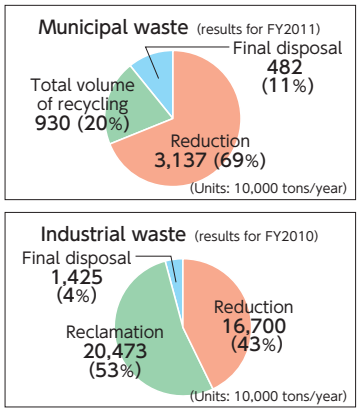
■Categories of waste



Note 1: Waste that may be harmful to human health and the living environment or is explosive, toxic, or infectious
2: Cinders, sludge, waste grease, waste acid, waste alkali, waste plastics, paper waste, wood waste, fiber waste, animal and plant remains, solid animal waste, rubber scrap, metal scrap, glass scrap, concrete waste, ceramic waste, slag, debris, animal excrements, animal bodies, dust, imported waste, materials used to treat the above industrial waste
3: Waste that may be harmful to human health and the living environment or is explosive, toxic, or infectious

Source: MOE, Environmental White Paper

■Treatment of waste

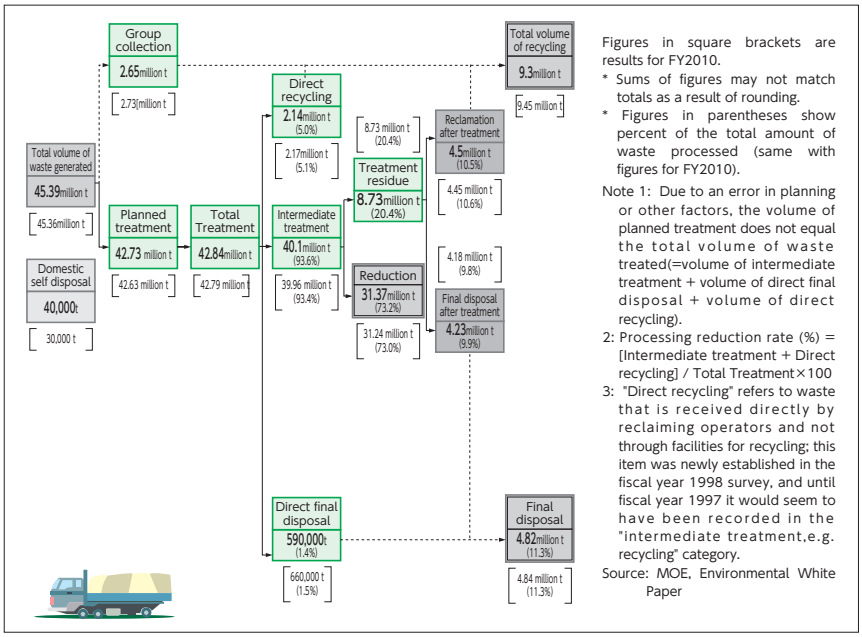


Source: MOE, Waste Management in Japan (FY2011); MOE, FY2012 Survey Report on the Disposal and Processing of Industrial Waste (Results for FY2010)

Flow of appropriate waste treatment

When recycling and disposing of waste (recyclable resources) for the purpose of establishing a sound material-cycle society, there is a need to take all available measures to minimize environmental impact within technologically and economically feasible limits. To that end, it is necessary first to reduce waste disposal to a minimum by reusing reusable waste and by recycling recyclable waste that cannot be reused. Secondly, it is also necessary to recover heat from non-reusable, non-recyclable waste that is thermally recoverable as well as to appropriately dispose of non-recyclable waste. In Japan, waste is managed under these basic principles by using appropriate technologies and systems in each stage of processing, as shown in the figure below.

■Municipal waste treatment flow (FY2011)

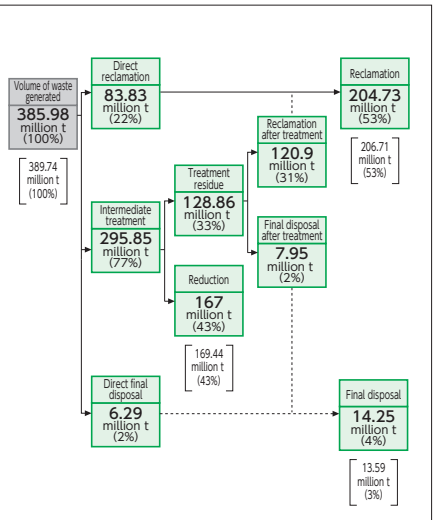


Figures in square brackets are results for FY2010.
* Sums of figures may not match totals as a result of rounding.
* Figures in parentheses show percent of the total amount of waste processed (same with figures for FY2010).

Note 1: Due to an error in planning or other factors, the volume of planned treatment does not equal the total volume of waste treated(=volume of intermediate treatment + volume of direct final disposal + volume of direct recycling).
2: Processing reduction rate (%) = [Intermediate treatment + Direct recycling] / Total Treatment×100
3: "Direct recycling" refers to waste that is received directly by reclaiming operators and not through facilities for recycling; this item was newly established in the fiscal year 1998 survey, and until fiscal year 1997 it would seem to have been recorded in the "intermediate treatment,e.g. recycling" category.

Source: MOE, Environmental White Paper

■Industrial waste treatment flow (2010)

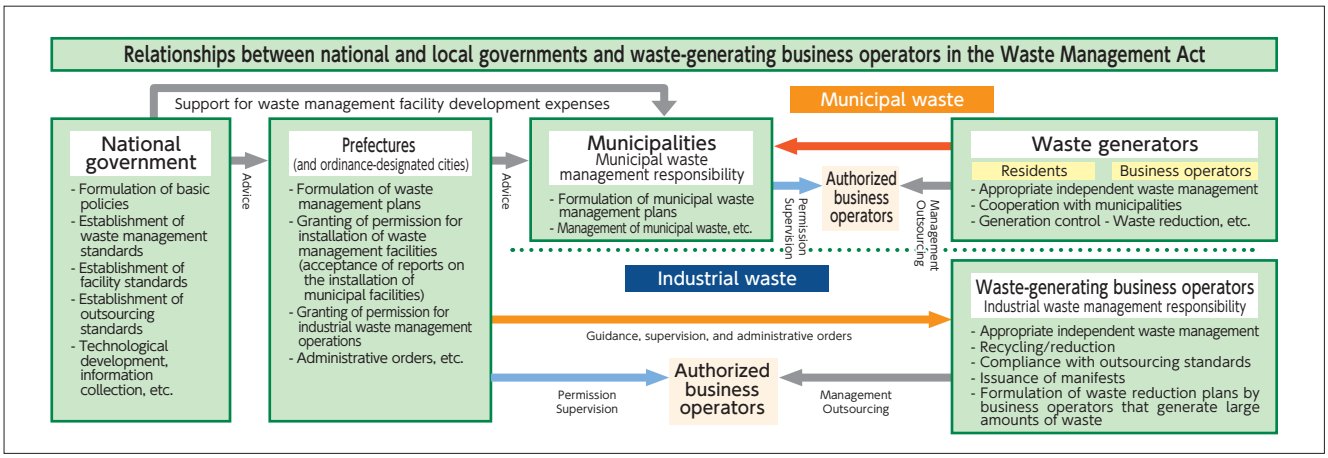


Figures in square brackets show results for FY2009.
* Sums of individual figures may not match totals as a result of rounding.

Source: MOE, FY2012 Survey Report on the Disposal and Processing of Industrial Waste (Results for FY2010)

Roles and responsibilities of different entities

In order to establish a sound material-cycle society, it is essential that various entities, including national and local governments (prefectures and municipalities), business operators, and consumers, recognize their respective roles specified in the Basic Recycling Act in promoting 3R. It is equally important that the entities each perform their own responsibilities for waste management and functionally collaborate with each other to create and maintain systems for proper waste management. To that end, the Waste Management Act clearly defines the responsibilities of national and local governments, business operators generating waste and other waste generators (consumers) for waste management.



National government	To help other entities properly perform their responsibilities, the national government formulates and implements fundamental and comprehensive strategies, including gathering and analyzing information on waste, enacting laws and regulations, promoting technological development, and providing technological and financial support for municipalities and prefectures.
Prefectures	Prefectures provide necessary technological support for municipalities (bearing responsibility for municipal waste management) to help them adequately perform their responsibilities. At the same time, prefectures gather information on how industrial waste is managed in areas under their jurisdiction, formulate waste management plans and provide guidance and supervision to ensure the appropriate management of industrial waste. In addition, prefectures also authorize and supervise industrial waste processing operators' business operations.
Municipalities	Municipalities are responsible for managing municipal waste within areas under their jurisdiction, and formulate and implement waste management plans. Municipalities also promote the independent activities of residents in order to reduce the amount of municipal waste in their areas, as well as implement measures required for the proper management of municipal waste.
Waste-generating business operators	Business operators are responsible for properly managing waste (industrial waste) generated from their corporate activities; they work to reduce waste through recycling and implement measures, such as outsourcing waste management operations, to ensure proper waste management. Business operators must also develop products and containers that can be easily managed when they are processed as waste, and provide information about how to manage them.
Waste generators (consumers)	Consumers that generate municipal waste are responsible for promoting waste recycling by using recycled products and for reducing waste disposal or sorting waste to be disposed of, thereby cooperating with national and local governments in their efforts to reduce and properly manage waste.

Example of financial support by the national government

Grants-in-aid for the establishment of a sound material-cycle society

The development of waste management facilities initially requires a large sum of funds. To cover such expenses, the national government provides grants-in-aid in order to promote the development of wide-area, comprehensive waste management facilities and to establish a sound material-cycle society while respecting regional differences and the autonomy of municipalities (the subsidy rate is usually 1/3; 1/2 for pioneering projects).

[Facilities eligible for grants-in-aid]

- Material recycling promotion facilities (Recycling facilities and stockyards (temporary storage yards) for non-combustible waste and plastics)
- Energy recovery promotion facilities (waste power generation facilities, thermal recovery facilities, biogasification facilities, etc.)
- Organic waste recycling promotion facilities (human waste and garbage recycling facilities)
- Septic tanks
- Final waste disposal sites
- Projects for the improvement of key equipment in existing waste management facilities
- Projects for supporting the formulation of plans to extend the lives of equipment in waste management facilities

Grants-in-aid budgets for the establishment of a sound material-cycle society

(Units: million yen)

Budget	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013
Budget allocated by MOE	23,000	43,000	46,000	52,634	54,275	46,813	53,748	53,947	35,675

Source: MOE's website on Grants-in-aids for the Establishment of a Sound Material-Cycle Society

Waste management expenses

Municipalities are responsible for properly managing waste in areas under their respective jurisdictions and implement measures to construct, improve and maintain waste management facilities as well as to properly manage waste. The following figures show expenses related to waste management based on the example of a Japanese city (Kawasaki City, Kanagawa Prefecture) with a population of approximately 1 million.

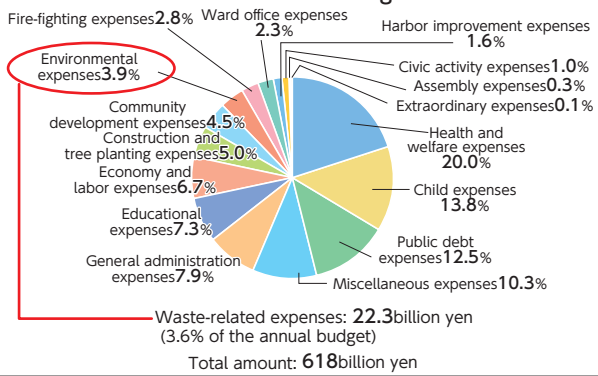
Figure 1 shows the percentage of waste-related expenses relative to the city's budget (general account). Waste-related expenses amount to 22.3 billion yen, accounting for 3.6% of the total budget of 618 billion yen. Out of waste-related expenses, those required for the construction and improvement of facilities are 7.3 billion yen, while those required for waste management and facility maintenance are 14.4 billion yen.

Figure 2 shows the breakdown of expenses for waste management and facility management. As this figure shows, personnel expenses account for 63.8% (9.2 billion yen) of the total, while total waste management expenses (management expenses plus outsourcing expenses) account for 33.4% (4.8 billion yen). The further breakdown of total waste management expenses (management expenses plus outsourcing expenses) shows that expenses for waste collection and transportation and expenses for intermediate processing account for approximately 2.2 billion yen, respectively while expenses for final disposal 0.4 billion yen.

Figure 3 shows waste management expenses by type of waste. Management expenses for ordinary waste account for the largest percentage (69.1%, 9.9 billion yen) of the total, followed by empty bottles (6.9%, 0.99 billion yen) and empty cans (5.9%, 0.85 billion yen). The number of waste management facilities operated by the city and the results of waste management are shown in Table 1. As shown in this table, incinerated waste accounts for the largest amount (376,513 tons/year).

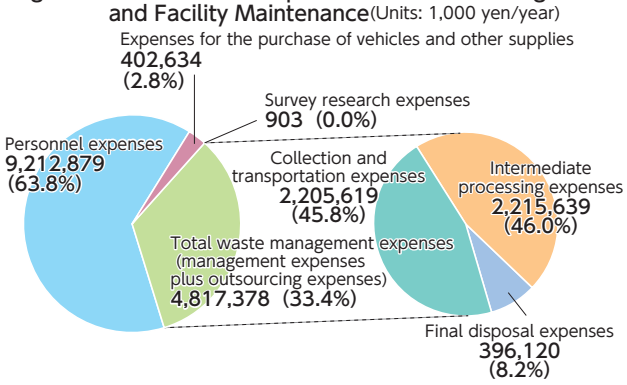
Data on municipalities' waste management expenses and facilities(example of a city with a population of approximately 1 million (Kawasaki City)) (FY2011)

Figure 1: Percentages of Waste-related Expenses Relative to the Annual Budget



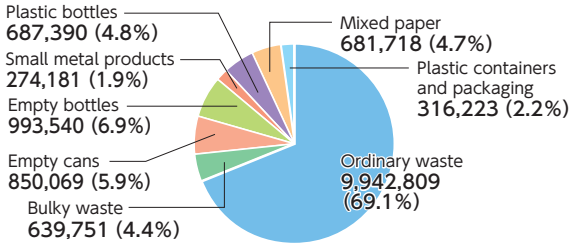
Source: Compiled from Overview of Kawasaki City's Finance, June 2011

Figure 2: Breakdown of Expenses for Waste Management and Facility Maintenance (Units: 1,000 yen/year)



Source: Compiled from FY2011 Overview of Kanagawa Prefecture Municipal Waste Management

Figure 3: Waste Management Expenses by Type of Waste (Units: 1,000 yen/year)



Source: Compiled from Kawasaki City, FY2013 Overview of the Environment Bureau's Projects-Waste Management-

Table 1: Number and Performance of Municipal waste Management Facilities

	Incineration facilities	Bulky waste management facilities	Recycling facilities	Final disposal sites
Number of facilities	5	2	4	1
Management performance (t/year)	376,513	11,962	31,490	50,356

Source: Compiled from FY2011 Overview of Kanagawa Prefecture Municipal Waste Management

Column

Example of a waste management facility: Osaka Bay Phoenix Center

In Japan's metropolitan regions, such as the Tokyo and Kinki areas where land was densely used, it was very difficult to meet the pressing need for stable waste management that arose as a result of an enormous increase in the amount of waste since around the rapid economic development period. The Osaka Bay area was one such area faced with difficulty in securing land for waste landfills. At the same time, in order to develop and enhance port and urban functions in ports in the area, it was necessary to create new land by reclamation.

As a result, with a view to developing an ocean landfill to ensure proper waste management in districts that require wide-area waste management, the Wide-area Coastal Environment Development Center Act was enacted in 1981 and the Phoenix Project was launched to create an enormous landfill island in Osaka Bay through cooperation between local and national governments. The Osaka Bay Regional Offshore Environmental Improvement Center (Osaka Bay Phoenix Center) was established in 1982 with funds provided by 6 prefectures and 4 port-managing corporations. At present, the center is used for the final disposal of 60% (425,000 m³) of the municipal waste generated from the civil activities of approximately 20 million residents of 168 municipalities in 6 prefectures in the Kinki area, as well as 50% (543,000 m³) of industrial waste generated from the industrial activities of 900,000 establishments for the shipment of products worth 50 trillion yen.

Photo courtesy of:
Osaka Bay Regional Offshore Environmental Improvement Center

Specific recycling laws

Containers and Packaging Recycling Act (enacted in 1995)

Targets	Steel cans, aluminum cans, glass bottles Cardboard, paper cartons, paper containers and packaging Plastic bottles, plastic containers and packaging

Container and packaging waste comprised a large percentage of waste that continued to rapidly increase in amount, accounting for 60% of household waste in terms of volume and approximately 30% in terms of weight. Although it was technologically possible to recycle container and packaging waste, such waste was hardly ever recycled. Against this background, to reduce the generation of container and packaging waste and to minimize the total amount of waste by promoting recycling, it was necessary to develop a new system that included consumers and manufacturers. In light of these circumstances, the Act on the Promotion of Sorted Collection and Recycling of Containers and Packaging (Containers and Packaging Recycling Act) was enacted in 1995.

The Containers and Packaging Recycling Act specified the respective roles of consumers, municipalities, and business operators (container manufacturers and business operators that sell products using containers and packaging). The act placed the responsibility for sorted waste disposal on consumers, the responsibility for sorted waste collection on municipalities, and the responsibility for recycling on business operators, in order for these three entities to work together to promote the recycling of containers and packaging. The most important characteristic of the Containers and Packaging Recycling Act was that it adopted the concept of extended producer responsibility (EPR) for the first time in Japan to impose physical and financial responsibility for waste recycling on business operators.

Responsibilities of different entities

(1) Consumers' responsibility: Sorted disposal

Consumers carefully sort and dispose of waste in compliance with the standards for the sorted collection of container and packaging waste established by municipalities. They also reduce waste generation by using their own shopping bags instead of plastic bags received from the store, or by choosing plain-wrap products.

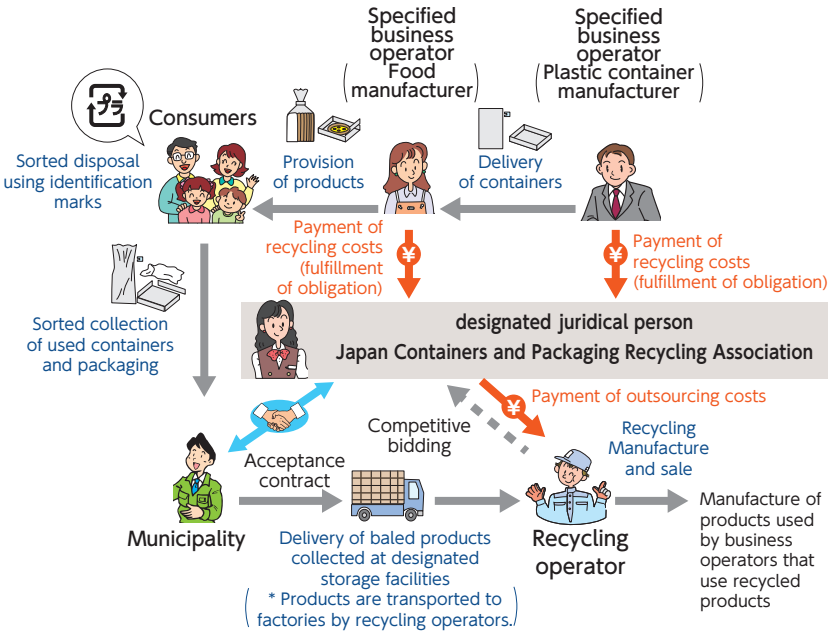
(2) Municipalities' responsibility: Sorted collection

Municipalities sort and collect container and packaging waste disposed of by households and deliver it to recycling operators. Based on five-year plans for the sorted collection of container and packaging waste, municipalities also promote the sorted collection of such waste in areas under their jurisdiction, as well as collaborate with business operators and residents to reduce the disposal of container and packaging waste in these areas.

(3) Business operators' responsibility: Recycling

Business operators are obligated to recycle containers and packaging that were manufactured or imported, or that were used in their business operations. Actually, business operators outsource recycling operations to corporations designated by the Containers and Packaging Recycling Act and cover the recycling costs in order to fulfill their obligation. In addition to recycling waste, business operators must also reduce the generation of container and packaging waste by reducing the thickness and weight of containers and packaging, by charging fees for plastic shopping bags received from the store, and by using returnable containers.

■Flows of recycling costs and containers and packaging (example: plastic containers and packaging)

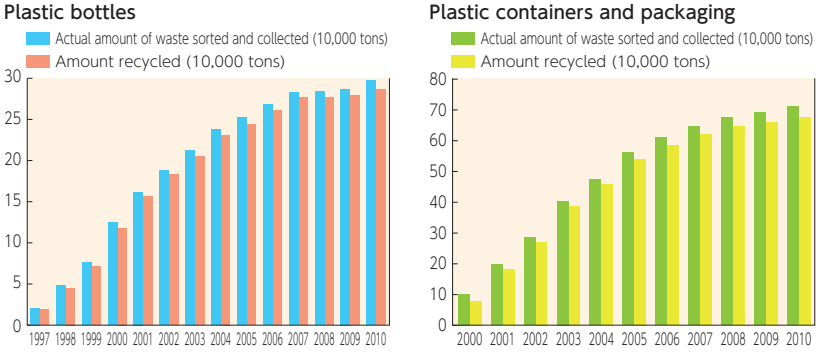


Source: Compiled from a figure on the website of the Japan Containers and Packaging Recycling Association

Results achieved by the initiatives

Container and packaging waste sorted, collected, and recycled has increased in amount (see the figure on the right). The final disposal amount of municipal waste has continued to decrease from year to year, while the residual time for municipal waste landfills has greatly increased from 8.5 years at the time of the enactment of the act (1995) to 19.4 years (2011).

■Actual amounts of waste sorted and collected and amounts recycled



Source: MOE, FY2010 Results of Sorted Collection and Recycling of Waste by Municipalities Based on the Containers and Packaging Recycling Act

Home Appliance Recycling Act (enacted in 1998)

Targets	Home air conditioners TVs (cathode-ray tube, LCD, and plasma TVs) Refrigerators and freezers Washing machines and dryers

Since the period of rapid economic growth, home appliances, such as TVs, air conditioners, refrigerators, and washing machines, have been widely used in Japan as essential household items. Such home appliances were disposed of as bulky waste; however, proper disposal involved difficulties due to their size and weight. Although they contained large amounts of useful resources, including iron, aluminum, and glass, most home appliances were landfilled. There was also public concern over the depletion of the ozone layer by CFCs as well as environmental pollution by heavy metals and other hazardous substances contained in waste home appliances. Against this background, the Act on the Recycling of Specified Kinds of Home Appliances (Home Appliance Recycling Act) was enacted in 1998 in order to establish a new recycling system aimed at imposing new obligations on home appliance manufacturers and retailers.

The Home Appliance Recycling Act obligates home appliance retailers to accept four types of waste home appliances (air conditioners, TVs, refrigerators and freezers, and washers and dryers) from consumers (waste generators) and to deliver them to manufacturers; manufacturers to recycle waste products; and consumers (waste generators) to pay collection and transportation fees as well as recycling charges when disposing of their home appliances.

Responsibilities of different entities

(1) Consumers' responsibility: Delivering waste home appliances to retailers and covering recycling costs

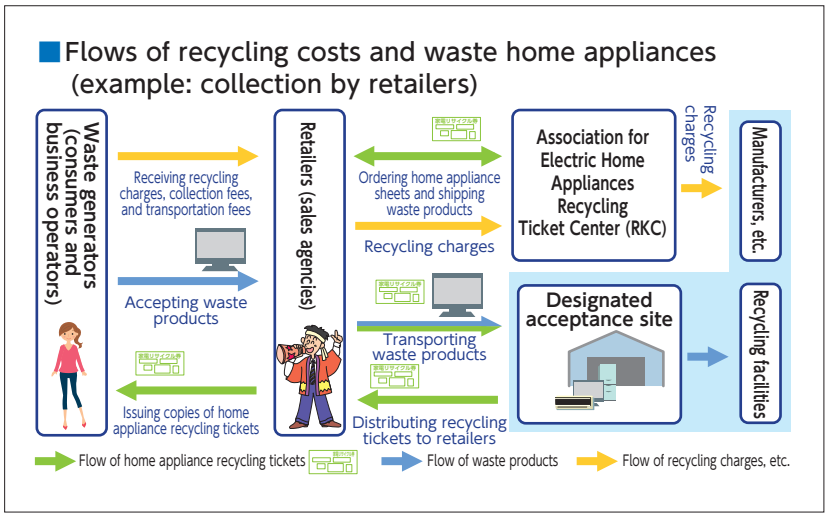
Consumers (waste generators) who use home appliances cover costs for the collection, transportation and recycling of waste products.

(2) Home appliance retailers' responsibility: Accepting waste home appliances and delivering them to manufacturers

Retailers accept end-of-life home appliances from consumers (waste generators) and deliver them to home appliance manufacturers.

(3) Home appliance manufacturers' responsibility: Recycling waste home appliances

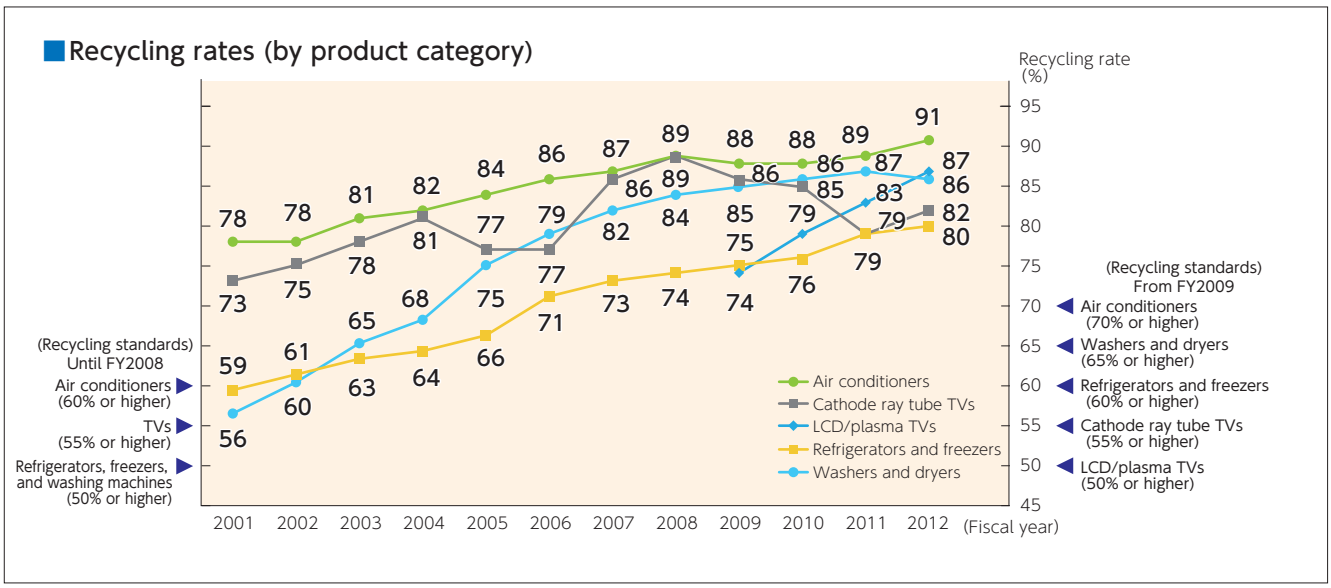
Manufacturers recycle waste home appliances received from retailers. When recycling waste products, manufacturers also recover and destroy CFCs used as coolants or heat insulators in air conditioners and refrigerators.



Source: Compiled from a diagram on the website of the Association for Electric Home Appliances

Results achieved by the initiatives

Recycling rates for home appliances are as follows: 91% for air conditioners; 82% for cathode ray tube TVs; 87% for LCD and plasma TVs; 80% for refrigerators and freezers; 86% for washers and dryers. These rates all exceed the recycling standards specified in the Home Appliance Recycling Act.



Source: Website of the Association for Electric Home Appliances

Food Recycling Act (enacted in 2000)

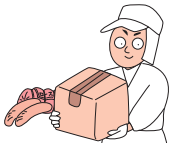
Targets	Food waste, etc. Inedible residue generated in the manufacture and processing of food products, unsold or leftover food generated in the process of food distribution and consumption, etc.

In Japan, food is discarded in massive amounts in manufacturing and distribution processes due to excessive demand for freshness, among other factors. At the same time, large amounts of food are left over in the consumption process. Enormous amounts of food waste generated in these processes are discarded without being recycled into fertilizers or stock feed. Meanwhile, in the late 1990s, Japan was faced with serious problems regarding waste management, including the capacity of landfills reaching their limits. In light of these circumstances, the Act on the Promotion of the Recycling of Recyclable Food Resources (Food Recycling Act) was enacted in 2000 with a view to ensuring the effective use of food resources and reducing the disposal of food waste.

The Food Recycling Act defines basic rules regarding the control and reduction of food waste generation by different entities as well as the recycling and thermal recovery of useful food waste (recyclable food resources). The Act also mandates that measures be taken to promote the recycling of recyclable food resources by food-related business operators in every area including manufacturing, wholesale, retail, and the restaurant industry.

The Food Recycling Act created a system for registering business operators that manufacture fertilizers and stock feed by using recyclable food resources as raw material, as well as a system for authorizing plans to implement recycling programs by food-related business operators, recycling operators, and farmers, to use fertilizers and stock feed obtained from such recycling programs, and to use primary industry products manufactured by using recycled fertilizers and stock feed (recycling loop). Users of these systems are eligible for preferential measures specified in related regulations in order to efficiently recycle food waste.

Responsibilities of different entities



Food manufacturers and processors

Food wholesalers and retailers

Restaurants and food caterers

Food-related business operators

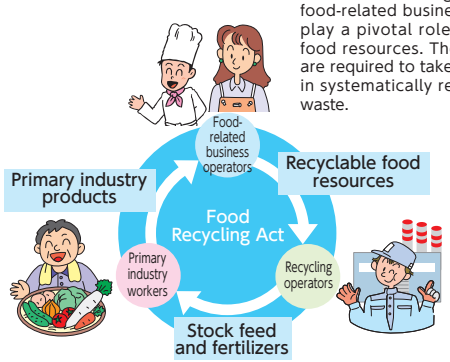
- Reducing food waste generation
- Recycling food waste that can be used as recyclable food resources
- Recovering heat when processing non-recyclable food waste
- Taking measures to reduce food waste

Consumers

- Reducing food waste generation by improving the way food is purchased or cooked
- Promoting recycling through the use of recycled products

System for recycling food waste

Food waste disposed of by food-related business operators is recycled into fertilizers and stock feed by recycling operators, which are then used by primary industry workers to produce products, which are in turn used by food-related business operators. Food resources circulate through these processes.



As food waste generators, food-related business operators play a pivotal role in recycling food resources. Therefore, they are required to take the initiative in systematically recycling food waste.

Primary industry workers are required to use recycled fertilizers and stock feed as much as possible to produce their products and provide such products to food-related business operators to ensure resource circulation between food production and consumption.

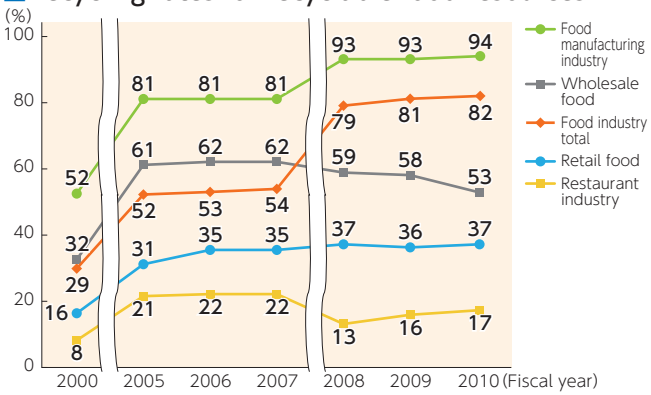
Recycling operators recycle recyclable food resources and play the role of connecting food-related business operators and users of fertilizers and stock feed. Recycling operators are required to provide information to other parties involved as well as to develop programs that are friendly to the environment in which we live.

Source: Compiled from a diagram on the Japan Food Industry Association's website

Results achieved by the initiatives

The recycling rate for recyclable food resources has continued to increase since 2000, when the Food Recycling Act was enacted, reaching 82% in 2010. Although the recycling rate in the food manufacturing industry is generally high, the recycling rate for recyclable food resources becomes lower in the order of wholesale food, retail food, and the restaurant industry. One of the reasons for this is that waste sorting becomes more difficult in the lower reaches of the food distribution chain.

Recycling rates for recyclable food resources



Source: Ministry of Agriculture, Forestry and Fisheries Statistics Department, "Results of Periodic Reports from Food-related Operators That Annually Generate 100 Tons or More of Food Waste" and "Survey Reports on the Recycling of Recyclable Food Resources"

Note: Figures for years until FY2007 are estimated from the Statistics Department's past Survey Reports on the Recycling of Recyclable Food Resources. Figures for years FY2008 and beyond are estimated based on periodic reports (food-related business operators that annually generate 100 tons or more of food waste are obligated by the Food Recycling Act to submit reports) as well as on statistical surveys conducted to obtain data unavailable in periodic reports.

Construction Recycling Act (enacted in 2000)

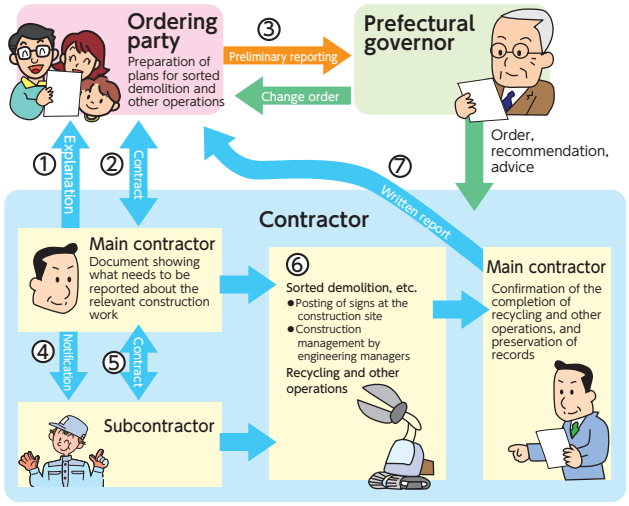
Targets	Specified construction materials (1) Concrete (2) Construction materials composed of concrete and iron (3) Wood (4) Asphalt and concrete

Construction-generated waste, such as concrete blocks, asphalt-concrete blocks, and construction-generated wood, accounts for approximately 20% of all industrial waste (FY1995) and approximately 70% of waste illegally disposed of (FY1999). In addition, as more and more buildings constructed during the 1960s needed renovation in the 1990s, the Japanese construction industry was faced with serious problems, such as the shortage of landfills and improper waste disposal due to a further increase in construction waste. In light of these circumstances, with a view to ensuring the effective use of resources, the Act on the Recycling of Construction Materials (Construction Recycling Act) was enacted in 2000 to promote the recycling and reuse of construction waste.

The Construction Recycling Act obligates contractors that demolish buildings made of specified construction materials (concrete blocks, asphalt-concrete, wood, etc.) or construct new buildings (subject to the Construction Recycling Act) exceeding a standard size by using specified construction materials to sort demolition debris and recycle construction waste.

Flow of sorted demolition and recycling

(1) Explanation: The main contractor provides the ordering party with a written document to explain plans for sorted demolition and other operations.
(2) Contract: It is necessary to specify the method used for sorted demolition in the contract concluded between the ordering party and the main contractor.
(3) Preliminary reporting: The ordering party prepares plans for sorted demolition and other operations to submit a report to the relevant prefecture in advance.
(4) Notification: When outsourcing work to a subcontractor, the main contractor notifies the subcontractor of what needs to be reported to the prefecture.
(5) Contract: It is necessary to specify the method used for sorted demolition in the contract concluded between the main contractor and the subcontractor.
(6) Sorted demolition, recycling, and other operations
(7) Reporting: When having completed recycling and other operations, the main contractor provides the ordering party with a written document of completion and also prepares and preserves a record concerning how recycling was performed.

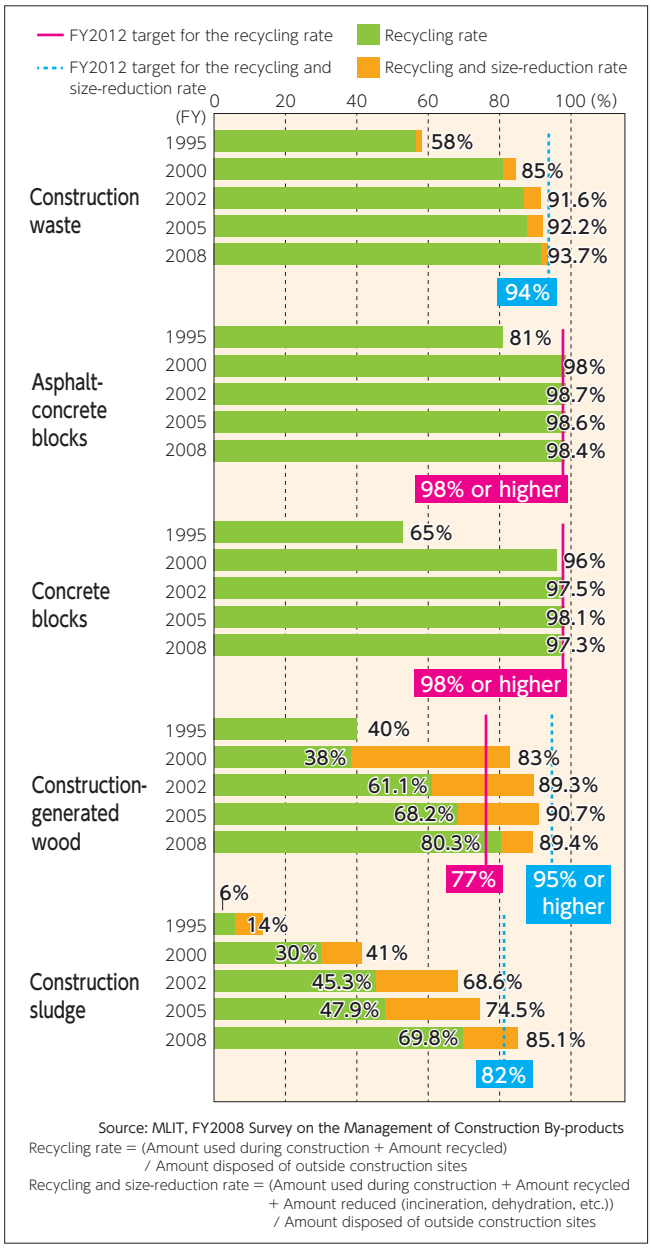


Source: Compiled from a diagram in MOE's leaflet on the Construction Recycling Act

Results achieved by the initiatives

As shown in the figure below, the recycling rate and the recycling and size-reduction rate for specified construction materials have continued to increase steadily over the years.

Recycling rates and recycling and size-reduction rates for different categories of construction waste



Source: MLIT, FY2008 Survey on the Management of Construction By-products
Recycling rate = (Amount used during construction + Amount recycled) / Amount disposed of outside construction sites
Recycling and size-reduction rate = (Amount used during construction + Amount recycled + Amount reduced (incineration, dehydration, etc.)) / Amount disposed of outside construction sites

Automobile Recycling Act
(enacted in 2002)

Automobiles are made of iron and other useful metals. Therefore, approximately 80% of the total weight of automobiles was recycled in the late 1990s, with the remaining 20% being mostly landfilled as shredder residues (plastic and other waste left after dismantling and crushing). However, due partly to rises in disposal costs resulting from the shortage of landfill space, there were concerns over illegal dumping and improper disposal of end-of-life automobiles. It was also necessary to properly recover CFCs contained in car air conditioners and develop measures to appropriately dispose of air bags and other parts that are difficult to handle when dismantling a vehicle. To cope with these problems, the Act on the Recycling, etc. of End-of-life Vehicles (Automobile Recycling Act) was enacted in 2002.

The Automobile Recycling Act defines the responsibility of automobile makers to accept the three most difficult-to-handle automotive items that are often illegally discarded (shredder residues, CFCs, and air bags) and to recycle them (destroy CFCs) in order to actively promote the recycling and proper disposal of end-of-life automobiles. Automobile owners pay recycling fees to cover the costs required for the disposal of end-of-life automobiles.

Flows of recycling expenses and end-of-life automobiles

Automobile owner

(1) The automobile owner pays the recycling fee when purchasing an automobile (deposits the fee into the account of a fund management corporation) and delivers the automobile to the business operator (car dealer, etc.) when putting it out of service.

Business operator (car dealer)

(2) The car dealer accepts the end-of-life automobile from its owner and provides a certificate of acceptance to the owner.

CFC recovery operator

(3) The CFC recovery operator recovers CFCs from the end-of-life automobile and delivers the recovered CFCs to the automobile maker or importer and the end-of-life automobile to the vehicle dismantler.

Vehicle dismantler

(4) The vehicle dismantler recovers air bags and other parts from the end-of-life automobile and delivers the recovered parts to the automobile maker or importer; then removes used parts from the automobile and delivers the dismantled automobile to the vehicle crusher.

Vehicle crusher

(5) The vehicle crusher crushes the dismantled automobile with a shredding machine, sorts waste into metals and shredder residues and delivers shredder residues to the automobile maker or importer.

Automobile maker/importer/ Designated recycling institution

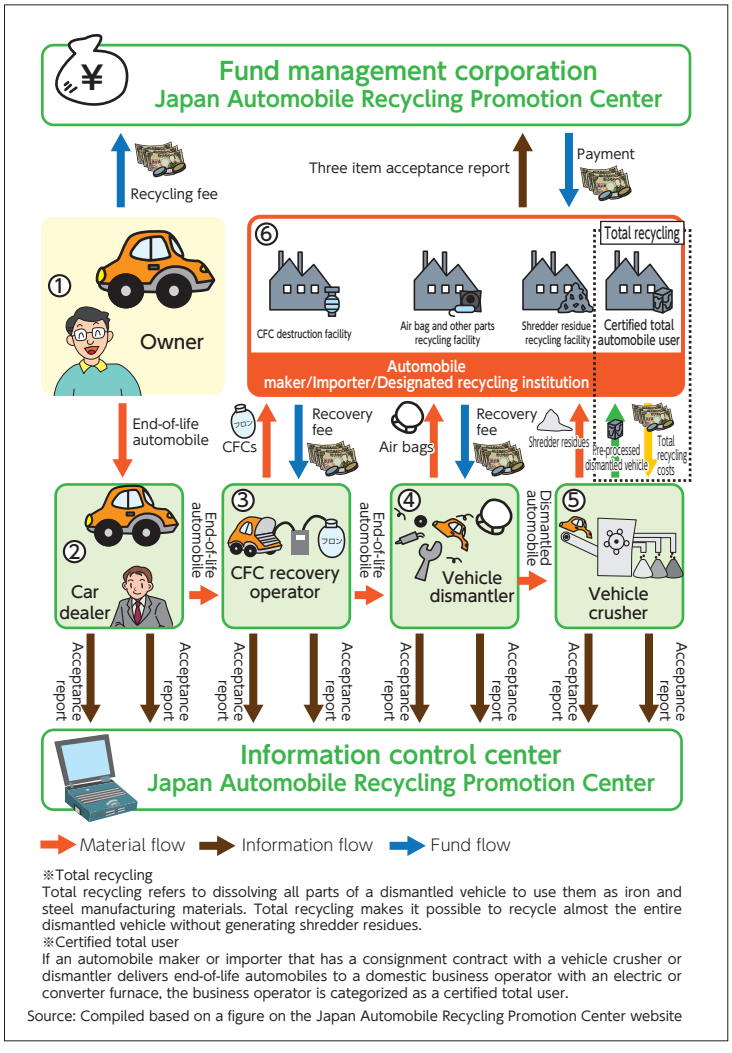
(6) The automobile maker or importer properly disposes of the three automotive items received (CFCs, air bags, and shredder residues). The automobile maker or importer can also outsource the total recycling of the automobile.

Fund management corporation

The fund management corporation properly manages the recycle fee deposited by the automobile owner until the automobile is put out of service.

Information control center

To properly manage the recycling process, the information control center gathers information on how end-of-life automobiles are recycled by different operators.



※Total recycling
Total recycling refers to dissolving all parts of a dismantled vehicle to use them as iron and steel manufacturing materials. Total recycling makes it possible to recycle almost the entire dismantled vehicle without generating shredder residues.
※Certified total user
If an automobile maker or importer that has a consignment contract with a vehicle crusher or dismantler delivers end-of-life automobiles to a domestic business operator with an electric or converter furnace, the business operator is categorized as a certified total user.

Source: Compiled based on a figure on the Japan Automobile Recycling Promotion Center website

Results achieved by the initiatives

The rates of recycling of Automobile Shredder Residues (ASR) and air bags by automobile makers and other operators have both exceeded the numerical targets and remain at high levels.

Rates of Recycling of Automobile Shredder Residues (ASR) and Other Automobile Parts by Automobile Makers and Other Operators

	Shredder residues	Air bags
Target	30 (FY2005-) 50 (FY2010-) 70 (FY2015-)	85
2004	49～69.1	91.6～100
2005	48.0～70.0	93.0～94.7
2006	63.7～75.0	93.5～95.1
2007	64.2～78.0	92.0～94.7
2008	72.4～80.5	94.1～94.9
2009	77.5～82.1	93.2～100
2010	79.9～87	93～100
2011	92～94	92～100

Source: METI and MOE, Implementation of the Automobile Recycling Act (2012)

Small Home Appliance Recycling Act (enacted in 2012)

Targets	Designated by government ordinance from among electronic devices and other electrical appliances used by general consumers in their daily lives, such as PCs, mobile phones, digital cameras, clocks and hair dryers, that can be efficiently collected and transported and particularly need to be recycled

Small home appliances, such as mobile phones, digital cameras, and audio devices, contain large amounts of useful metals, including iron, aluminum, copper, and precious metals. Nevertheless, except for iron and aluminum, most such metals were landfilled without being recycled, or otherwise improperly disposed of in Japan and elsewhere by unauthorized waste collectors. Also, some small home appliances that contain lead and other hazardous metals require particularly careful handling. In light of such circumstances, the Act on the Promotion of the Recycling of End-of-life Small Electronic Devices and Other Electrical Appliances (Small Home Appliance Recycling Act) was enacted in 2012 in order to make effective use of useful metals contained in small home appliances and to properly dispose of them.

The Small Home Appliance Recycling Act supports an incentive-oriented system that enables interested parties (consumers, business operators, municipalities, retailers, certified operators, etc.) to develop their own waste collection and recycling methods in cooperation with each other and to recycle waste in accordance with their own circumstances. End-of-life small home appliances contain valuable resources. Therefore, this act aims to develop a system that allows interested parties to make profits from recycling through their own efforts to efficiently collect end-of-life products from across their region.

Responsibilities of different entities

General consumers
- Sorted disposal
- Delivering end-of-life products to municipalities or retailers commissioned by certified operators

Waste-generating business operators
- Sorted disposal
- Outsourcing disposal operations to certified operators or other entities that are capable of properly recycling end-of-life products

Municipalities
- Sorted collection
- Delivering end-of-life products to certified operators

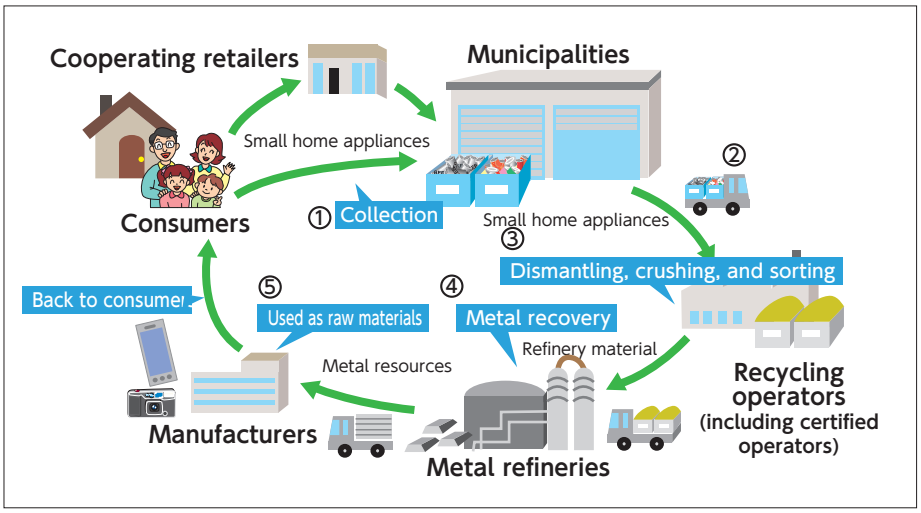
Retailers
- Cooperating in efficiently collecting end-of-life products from consumers by measures such as installing collection boxes in municipalities

Certified operators
- Accepting end-of-life small home appliances
- Recycling

Manufacturers
- Developing new designs, parts, and materials to reduce recycling costs
- Using materials obtained from recycling

Recycling system

(1) General consumers disposing of end-of-life small home appliances sort their waste products and dispose of them in compliance with the collection procedure specified by the municipalities they live in.
* End-of-life small electrical appliances for industrial use disposed of as waste are delivered to certified business operators as industrial waste.
(2) Municipalities collect the end-of-life products disposed of to deliver them to appropriate recycling operators, including certified operators.
(3) Recycling operators dismantle and crush the end-of-life products, sort the waste into different types of metals and plastics, and deliver them to metal refineries or other business operators.
(4) Metal refineries recycle the end-of-life products that have been dismantled, crushed and sorted into metals and plastic materials.
(5) Recycled metals and other materials are used as raw materials for products.
In this way, the small home appliances collected from consumers are recycled and returned to consumers as products.



Source: Compiled from a figure in the pamphlet MOE and METI, Small Home Appliance Recycling Act Put into Effect

Collection procedures

Collection procedures are chosen in accordance with the characteristics of individual municipalities.

Box collection

Collection boxes for small home appliances are installed at public facilities, supermarkets, and home appliance stores in order to collect end-of-life products.

Pick-up collection

End-of-life small home appliances are collected along with bulky waste and non-combustible waste to be sorted at waste management facilities.

Station collection

A new category for small home appliances is created for sorted waste collection.

Effective Resource Utilization Promotion Act

Japan is poor in natural resources and the world currently faces an ongoing depletion of resources. These circumstances make it imperative to move away from a social system designed for mass production, mass consumption, and mass disposal. To that end, the Act on the Promotion of Effective Utilization of Resources (Effective Resource Utilization Promotion Act) was enacted in 1991 with a view to ensuring the effective use of resources. The Effective Resource Utilization Promotion Act mandates that 10 industries and 69 products requiring 3R initiatives be designated by government ordinance and that specific programs to be independently implemented regarding designated items be developed by ministerial ordinance. The act also specifies rules about measures to promote 3R in product manufacture and design, identification labeling for sorted waste collection as well as the development of systems for independent waste collection and recycling by business operators.

Industries, products and by-products designated by government ordinance

- **Industries specified for resource conservation**
  Targeted industries : Five industries, including paper manufacturing and steel manufacturing industries
  Objective : Reduction in the generation of by-products and promotion of recycling
- **Industries specified for reuse**
  Targeted industries : Five industries, including paper manufacturing and glass container manufacturing industries
  Objective : Recycling of waste as raw material and reuse of parts
- **Specified by-products**
  Targeted by-products : Coal ash in the electric industry and soil, concrete blocks, wood, etc. in the construction industry
  Objective : Reuse of waste as raw material by relevant business operators
- **Products specified for resource conservation**
  Targeted products : 19 products, including automobiles, home appliances, and PCs
  Objective : Streamlining of the use of raw materials by manufacturers, promotion of long-term use, etc.
- **Products specified for reuse**
  Targeted products : 50 products, including automobiles, home appliances, and PCs
  Objective : Promotion of easy-to-recycle product designs by manufacturers
- **Products specified for labeling**
  Targeted products : Seven products, including steel cans, aluminum cans, plastic bottles, and small reusable batteries
  Objective : Identification labeling for sorted collection
- **Products specified for recycling**
  Targeted products : PCs and small reusable batteries
  Objective : Collection and recycling by business operators

Green Purchasing Act

In order to create a sound material-cycle society, it is important to promote not only initiatives regarding the supply of recycled products, but also initiatives regarding demand. There is a need for purchasers of products and services to carefully evaluate their needs when purchasing products and to place priority on purchasing products that minimize environmental impact (green purchasing).

Adding an environmental perspective to purchasers' standards for choosing products will likely have effects on product development by manufacturers as well as on the type of products provided by product distributors. However, in order to develop markets for environmentally friendly products, it is essential to create situations that allow such products to compete with conventional products. To that end, there is a need to generate initial demand. National and local government expenditures account for more than 20% of the GDP and have significant effects on the market. In view of these circumstances, the Act on the Promotion of Procurement of Eco-friendly Goods and Services by the State and Other Entities (Green Purchasing Act) was enacted in May 2000.

The Green Purchasing Act defines practices required in order to switch demand to environmentally friendly products, including promotion of the purchase of such products by national and local governments and provision of relevant information, with a view to creating a society capable of sustainable development that minimizes environmental impact. National and local governments take the initiative in green purchasing and play a leading role in developing green markets in order to further promote the establishment of a sound material-cycle society.

Roles of different entities in promoting the Green Purchasing Act

National government, independent administrative agencies, etc.

The national government formulates basic policies on the promotion of green purchasing for independent administrative agencies and other public organizations.

▼

Ministries, government agencies, independent administrative agencies, and other public organizations formulate and announce annual policies for the purchasing of environmentally friendly products.

▼

Organizations purchase products based on their policies.

▼

Organizations summarize results and report them to the Minister of the Environment.

Local government organizations

Local government organizations make efforts to formulate and implement policies regarding green purchasing.

Business operators and consumers

Business operators and consumers purchase environmentally friendly products as much as possible.

3 Development for the Future

Thanks to the advancement of 3R initiatives, the development of a legal foundation, including specific recycling laws, as well as an increase in the environmental awareness of consumers, the final waste disposal amount has been greatly reduced and initiatives for the development of a sound material-cycle society have made steady progress. Nevertheless, with resource restrictions becoming ever stricter around the globe, it is all the more necessary to reduce the consumption of natural resources. Also, initiatives for the two Rs that are given higher priority than recycling in the Basic Recycling Act ("Reduce" and "Reuse") are still lagging behind. There are other lingering problems as well, such as the system for recovering useful resources from waste products not being fully developed.
In addition, the experience of the nuclear accident at Tokyo Electric Power Company's Fukushima Daiichi Nuclear Power Station after the Great East Japan Earthquake highlighted the need to protect the environment and to ensure public safety and security when using recyclable resources.

Against this background, policies regarding the establishment of a sound material-cycle society have advanced from the stage focused on the quantitative aspects of resource circulation, where recycling is promoted by placing priority on reducing waste, to a new stage focused more on qualitative aspects. What is required in this stage is to raise resource efficiency by using waste more effectively as valuable resources and sources of energy and thereby reduce the consumption of natural resources that may be depleted in the near future while at the same time protecting the environment and ensuring safety and security.

As was the case with Japan during its rapid economic growth period, developing countries in Asia and elsewhere are now faced with serious problems resulting from a rapid increase in waste generation, creating an urgent need for global initiatives. We need to share our rich experience and knowledge about waste problems and recycling with these countries and take an active part in establishing sound material-cycle societies on a global scale.

In view of these circumstances, the Third Fundamental Plan for Establishing a Sound Material-Cycle Society (approved at a Cabinet meeting on May 31, 2013) provides guidelines for future initiatives, along with numerical targets for FY2020 (20 years after the establishment of the Basic Recycling Act), so that all government institutions can work together toward establishing a sound material-cycle society.

Intensive utilization of recyclable resources and securing of resources

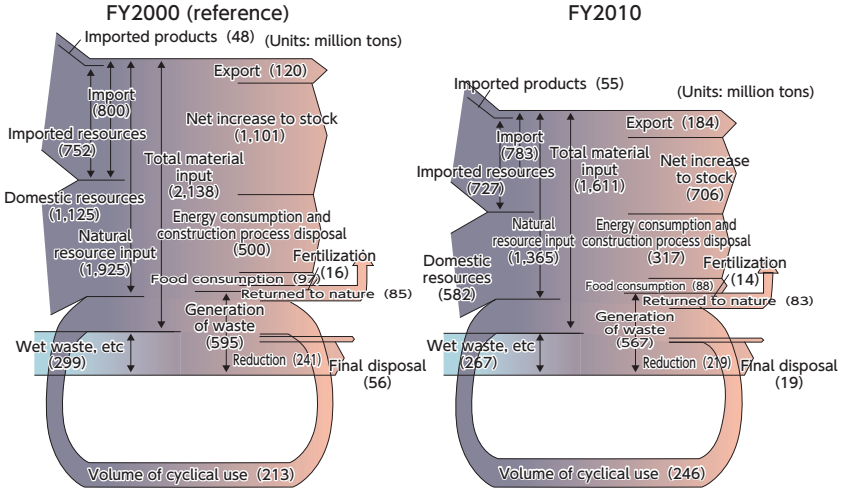
Thanks to the advancement of 3R initiatives, Japan's material flow indicators have greatly improved in recent years. In particular, the volume of cyclical use increased by 33 million tons from FY2000 to FY2010 (see the figure below); the FY2015 goal for the recycling rate (volume of cyclical use / (volume of cyclical use + natural resource input)) specified in the Second Fundamental Recycling Plan has also been achieved prior to the target year. As these figures show, there has been steady progress in the use of recyclable resources in Japan.

At the same time, however, recycling often results in a decrease in product quality compared to original products and the reduction of recycling costs has not made much progress in many cases.

In terms of resource input at the entrance of the economic system, Japan is dependent on imports from overseas for the supply of metal resources, which are hardly ever mined domestically. Metal prices have tended to rise in recent years. In addition, based on a comparison between the amount of resources that have been mined worldwide (above-ground resources) and the amount of resources buried underground that are confirmed to be minable in the future (underground resources), it is estimated that the amount of above-ground resources already exceeds the amount of underground resources for gold and silver. For these reasons, there is an increased need to use above-ground resources more efficiently.

Under these circumstances, it is important to promote the decoupling of economic growth and environmental impact by supporting green innovation (innovation in environmental and energy technologies) and by improving the environment while at the same time encouraging the growth of competitive recycling industries that are resistant to fluctuations in economic conditions (environmental industries that not only contribute to waste management, but also to the development of a sound material-cycle society that actively recycles and uses waste).

Material flow in Japan



Note: Wet wastes, etc.: Water taken in socioeconomic activities and water content included in wastes (e.g. sludge, animal wastes, raw sewage, waste acid, or waste alkali); and input of earth and sand as a result of economic activities (e.g., sludge generated by the mining, construction and waterworks industries and slag from the mining industry)
Source: MOE, Environmental White Paper

The first step toward the establishment of a sound material-cycle society is to understand the material flow in the economy - i.e., how much resources are mined, consumed and discarded. An accurate understanding of the material flow enables us to reduce waste generation and recycle materials as well as to promote the efficient utilization of all materials input into society.

The overview of the material flow (FY2010) in Japan shows that there is a total material input of 1.61 billion tons, of which 710 million tons are stored in the form of buildings and other social infrastructure. The overview also shows that 180 million tons of materials are exported as products, 320 million tons are disposed of in energy consumption and industrial processes, and 570 million tons of waste are generated. Out of the generated waste, 250 million tons are recycled for use, which accounts for 43.4% of the amount of waste generated.

Major initiatives for the future

Creation of a socio-economic system designed to further promote 2R initiatives

In order to enhance the development of a sound material-cycle society, it is necessary to further promote initiatives for the two Rs that are given higher priority than recycling. To that end, in addition to changing consumer lifestyles, which are represented in the lower reaches of the material flow, we need to create a system that, for example, allows business operators to be recognized by society for their active participation in promoting 2R initiatives to reduce the size and weight of containers and packaging or to develop long-life products.

By regarding product reuse as one of the major fields of the recycling industry, we will promote initiatives to create environments that allow consumers to use recycled products with a sense of security, including providing guarantees for the performance of recycled products, in order to promote the widespread use of recycled products as well as the development of healthy business markets for such products. We will also develop tools for visualizing the effects of 3R practices and provide information - for example, release software that shows 3R practices, including recycling, that can be implemented by individual consumers, retailers and other business operators, and enables them to easily calculate the effects of such practices.

Source: Miyako Ecology Center's website

Source: Miyako Ecology Center's website

Use of recyclable and biomass resources as energy sources

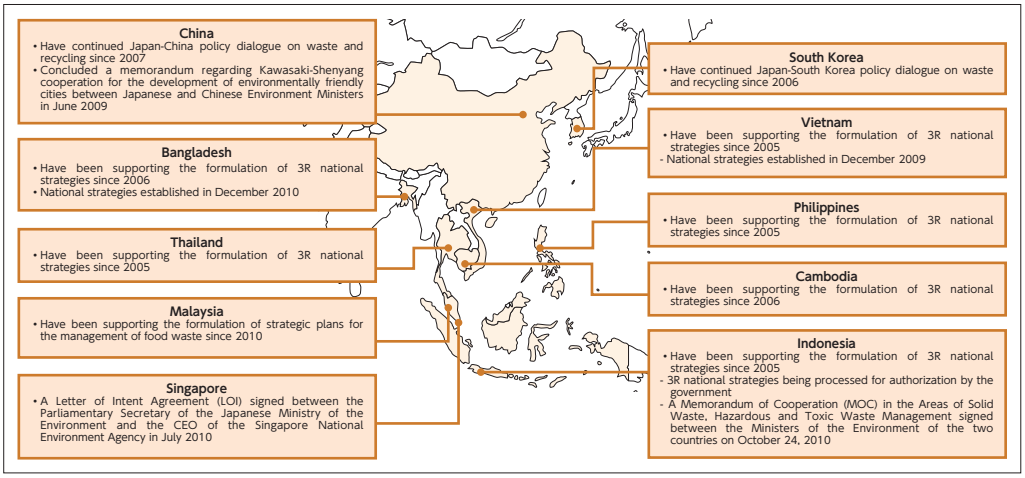
As a result of power shortages as well as criticism against the conventional energy and environmental strategies that depend heavily on nuclear power generation, there have been growing expectations for new forms of energy supply since the Great East Japan Earthquake. These new forms of supply use energy generated by thermal recovery from recyclable and biomass resources (which provide distributed power sources and stable power supplies) and also utilize such resources for fuel. At present, however, power generation efficiency and the residual heat utilization rate still remain low in waste management facilities. There is a need to further increase the use of waste as a source of energy. It is also necessary to promote initiatives for the development of technologies for biomass resources and for the stable supply of such resources and to overcome technological difficulties with the aim of creating an integrated system that covers all processes from raw material production through to the collection, transportation, manufacture, and utilization of biomass resources.

To that end, we will enhance the development of high-efficiency waste power generation facilities by local governments or private business operators and improve the thermal recovery efficiency of waste power generation. At the same time, we will promote the effective use of low and medium temperature heat generated from incineration facilities and industrial processes, including using such heat for local heating and cooling. We will also expand the production of biogas and promote biogasification, thereby improving the efficiency of recovering methane from kitchen garbage.

Promotion of international initiatives

A variety of initiatives are being developed to establish sound material-cycle societies in Asia, including adopting the Hanoi 3R Declaration at the fourth conference of the Regional 3R forum in Asia held in March 2013. As part of our efforts to contribute to reducing global environmental impact, we will continue to promote international cooperation between multiple countries through the Regional 3R forum in Asia and the Pacific (its name changed from the fifth conference in 2014) and other events; to collaborate with international organizations such as the UNEP International Resource Panel for sustainable resource management; to encourage international cooperation between two countries; to enhance the overseas development of recycling industries; and to increase appropriate import and export of recyclable resources. We will also set up a platform for supporting overseas development in order to enhance information sharing and collaboration between interested parties with the aim of promoting public-private joint initiatives, as well as advertising Japan's 3R and waste management technologies overseas and providing support for participation in overseas exhibitions.

The import and export of waste are restricted by the Waste Management Act and the Japanese Basel Act. Based on the Framework for the Environmentally Sound Management of Hazardous Wastes and Other Wastes, which was adopted at the Eleventh Conference of the Parties to the Basel Convention held in May 2013, we will continue to perform a leading role and provide support to establish environmentally sound management of waste.



Source: MOE pamphlet, More Effective Use of Resources in the Future

Ministry of the Environment
Minister's Secretariat, Waste Management and Recycling Department
Policy Planning Division, Office of Sound Material-Cycle Society

Information

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Information site for international development of Japanese recycling industry
http://www.env.go.jp/recycle/circul/venous_industry/index.html

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URL http://www.jesc.or.jp/