Chapter 1

The world in transition, and Japan's efforts to establish a Sound Material-Cycle Society

The 20th century saw the world move toward economic growth and the emergence of a mass-production and mass-consumption society in developed countries. However, developments in the 20th century also caused the collapse of the primitive sound material-cycle (SMC) society and produced major environmental problems, including pollution and dioxin problems. Japan, which achieved rapid economic growth in the latter half of the century, also faced pollution and other serious environmental problems and sought ways to solve them. In recent years, Japan has dedicated itself to the solution of the waste management problems which followed the previous environmental problems and has been creating a new SMC Society. The nation's new challenge is to take an integrated approach to the establishment of a low-carbon society in order to counter the major problem of global warming, to create a society in harmony with nature that helps conserve ecosystems and will allow people to enjoy the blessings of nature for many years to come, and to establish a SMC Society.

On the other hand, the 21st century, which has been called the century of the environment, is seeing rapid economic growth in developing countries, especially in Asia, and the associated generation of huge amounts of wastes. As waste management problems become more serious, there is a growing need to address problems such as global warming and the security of resources, which are expected to be in short supply as demand increases.

With these developments in mind, we reevaluates the primitive SMC Society that Japan created in the Edo era and examines the process that has been underway since about 2000 to establish a new SMC Society in Japan. The experience gained by Japan has involved the creation of many technologies, frameworks and systems which should have the potential to make a major contribution not only to Japan's future ability to establish a SMC Society but also to its integrated efforts to create a low-carbon society and a society in harmony with nature, in keeping with the mottainai spirit (not being wasteful with goods), and will assist the formulation of future policy measures by other countries, including developing countries.

Section 1 The international situation related to waste management

The amount of global waste generation is increasing as the economy and population continue to grow, all around the world, especially in Asia (Figure4-1-1).

A forecast on municipal solid waste generation in the member states of the Organization for Economic Cooperation and Development (OECD) *(OECD Environmental Outlook to 2030)* estimates that the total waste generation in the OECD member states in 2005 was about 1.7 times the amount in 1980, and that the 2025 amount will be about 2.2 times the 1980 figure (Figure4-1-2).

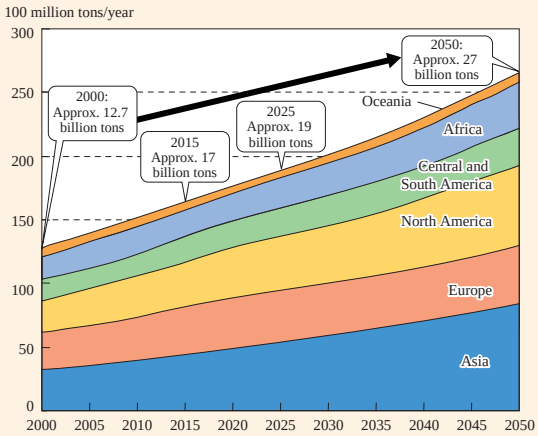
A wider variety of wastes is also emerging, including medical wastes and so-called e-wastes, or electrical and electronic wastes such as TVs, personal computers and refrigerators after which become unusable. Some of these wastes contain hazardous substances or cause infection and must be treated with special care.

In January 2008, a serious incident related to waste management occurred in Naples, Italy. The city's final disposal site reached full capacity and the wastes that had no other "outlet" were left on street corners (Figure4-1-3).

(1) International recycling of waste

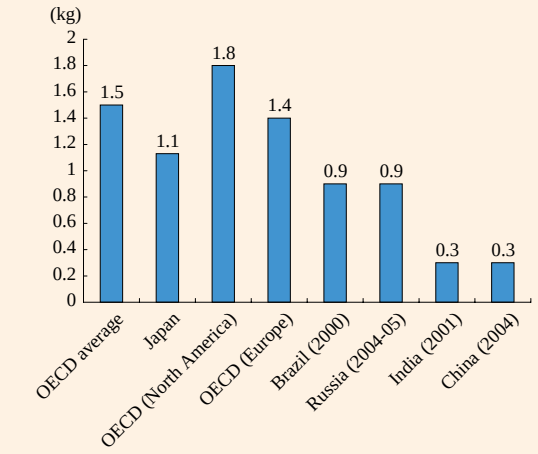
Meanwhile, the prices of natural resources are soaring due to increasing demand for natural resources, especially in China. Demand is also growing for certain circulative resources (CRs) distributed for commercial gain, such as metal scrap, used paper and waste plastic, as the economies of China and other East Asian countries develop. As a result, imports of such CRs into these countries have surged recently. For example, steel scrap exports from Japan almost tripled from approximately 2.81 million tons in 2000 to approximately 7.63 million tons in 2006 (Figure4-1-4).

Figure 4-1-1 Future Prospects of World Waste Generation [2000-2050]



Source : A paper written by Prof. Tanaka of Okayama University

Figure 4-1-2 Per capita daily municipal solid waste generation in OECD countries (2005)

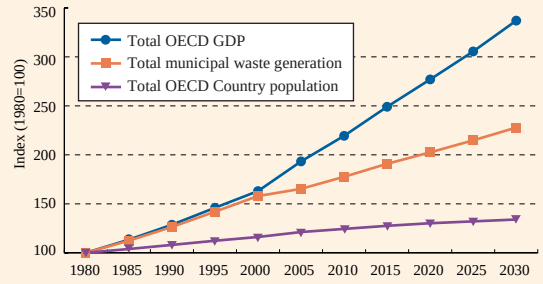


Source: Created by the Ministry of the Environment, based on OECD data

Such increases in the international movement of CRs, especially those from developed countries to developing ones, can be attributed to the following factors: (i) recycling laws enacted in developed countries have helped increase the amount of CRs recovered, establishing new supply sources for CRs; (ii) as many companies in developed countries have moved their production to developing countries in Asia and other regions, developing countries are finding that the amounts of CRs collected domestically are too great for them to use by themselves; (iii) as a result of economic growth in importing countries, demand for resources has increased so much that the amounts of CRs generated within the country are no longer large enough to meet demand[1].

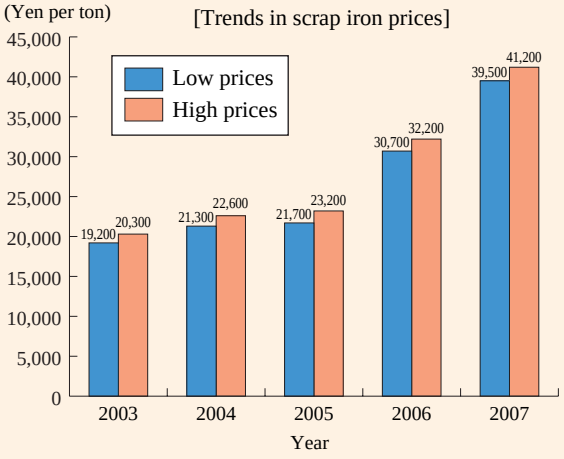
Such transboundary movements of CRs can, as long as they are environmentally sound, enable resources to be reused and recycled more efficiently and inexpensively. They can also foster the development and growth of the recycling industry and can therefore contribute to not only

Figure 4-1-3 OECD Country municipal waste generation (1980-2030)

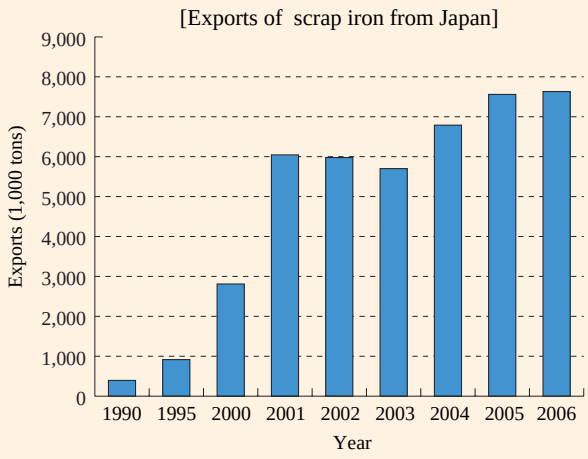


Source: Prepared by the Ministry of the Environment, based on OECD data

Figure 4-1-4 CR prices and exports



Note: The scrap iron (scrap steel) prices are H2 scrap cash prices (including delivery) for every December.
Source: Japan Iron and Steel Recycling Institute



Source: Ministry of the Environment

1 *International Trade of Recyclable Resources in Asia,* Edited by Michikazu Kojima, Institute of Developing Economies

employment creation but also the establishment of a sustainable society in developing countries.

On the other hand, there are several important challenges associated with the transboundary movement of CRs. One of these challenges is that an outflow of resources from a country (in the form of exports of CRs, based on market principles) can lead to a slowdown or a hollowing out of the domestic recycling industry. Some point out that this may hinder Japan's ability to steadily maintain and strengthen its waste management and recycling structures that have been built up over the years. In addition, it is known that some CR importing countries have yet to fully establish a mechanism for responsible waste management and are therefore posing a risk of environmental pollution. Another consideration is that imports of secondhand products and recycled products can be regarded as transboundary movements of potential wastes because these products can turn into wastes after a short time of use, offsetting their availability at low prices in the importing countries and the fact that this allows effective use to be made of resources. Initiatives to establish an international SMC Society should take account of disadvantages such as these (Figure4-1-5).

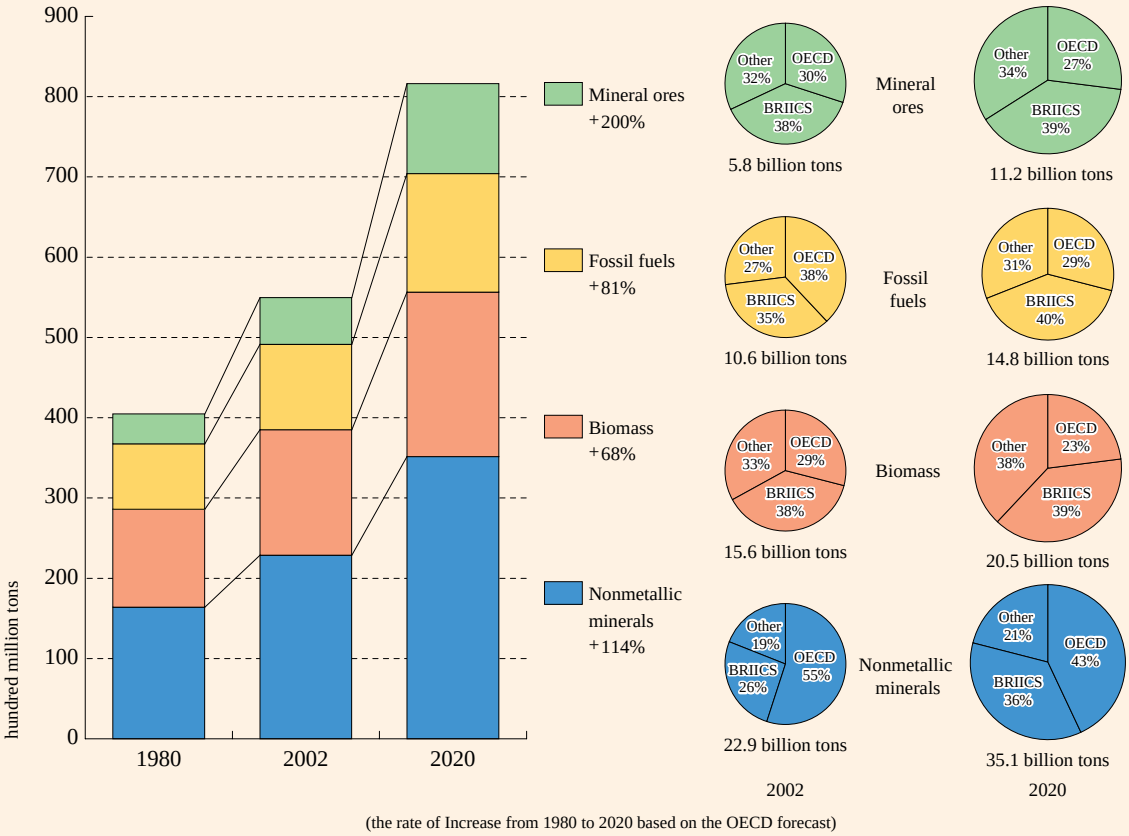
(2) Efforts by the international community and Japan

Japan faced serious waste management problems in the 1990s, such as a shortage of final disposal sites and large-scale illegal dumping cases, all of which raised concerns about environmental pollution. However, radical policy reforms implemented in the early stages of these problems allowed Japan to become a world leader in the establishment of a SMC Society by the early 21st century.

Based on such experience, at the G8 Sea Island Summit in 2004, Japan proposed the "3R Initiative," aimed at internationally promoting the establishment of a SMC Society through 3R activities. The 3Rs refer to restraining generation (Reduce), reuse (Re-use) and regeneration (Recycle), and represent the concept of balancing environmental conservation and economic growth through the effective use of resources. The G8 leaders endorsed this proposal and adopted it as the G8's new initiative, which led to the announcement of the "Science and Technology for Sustainable Development: '3R' Action Plan and Progress on Implementation."

Following on from this, the Ministerial Conference on the 3R Initiative was held in Tokyo in April 2005 to officially launch the 3R Initiative. On this occasion, Japan

Figure 4-1-5 Global resource extraction, by region and type of resource (1980, 2002, 2020)* BRIICS (Brazil, Russia, India, Indonesia, China, and South Africa)



(the rate of Increase from 1980 to 2020 based on the OECD forecast)

Source: Prepared by the Ministry of the Environment, based on OECD data

announced “Japan’s Action Plan for a Worldwide Sound Material-Cycle Society through the 3R Initiative” (also known as “Japan’s Action Plan to Promote Global Zero-Waste Societies”). Japan put forward another proposal at the G8 Summit in Saint Petersburg, Russia, in 2006, and the G8 countries all agreed that they would set appropriate targets, taking account of resource productivity, furthering efforts to optimize the resource cycle. In addition to its involvement at summit meetings, Japan has also been leading international discussions on 3R promotion and fostering political dialogue and information sharing through the Senior Officials Meetings on the 3R Initiative, held in March 2006 and October 2007.

Japan’s leadership in other international discussions, not just those of the G8, can be observed in its involvement with the OECD’s ongoing project on material flows and resource productivity and in the fact that a Japanese delegate serves as the chair of the Working Group on Environmental Information under the OECD Environment Policy Committee. From the viewpoint of promoting the 3R Initiative, Japan also supports the International Panel for Sustainable Resource Management, which was organized by the United Nations Environment Programme (UNEP) in 2007 for the purpose of scientifically evaluating the environmental effects of the use of natural resources.

In April 2008, the OECD-UNEP Conference on Resource Efficiency was held in Paris, bringing together relevant ministers, senior government officials in charge, experts, businesses, NGOs and the like from around the world. The participants affirmed the importance of sharing best practices on national initiatives and continuing efforts to improve resource efficiency. The meeting of OECD Environmental Ministers that took place following the above conference also reaffirmed the perception that 3R activities and resource productivity improvement are of major importance with regard to restricting natural resource consumption and reducing environmental burdens (Figure4-1-6).

To provide guidelines for Japan’s contribution to building a future framework for the world, the Cabinet endorsed “Becoming a Leading Environmental Nation Strategy in the 21st Century ~ Japan’s Strategy for a Sustainable Society” in June 2007, setting out the direction of the environmental policies that Japan should implement in cooperation with other countries. This document cites “the construction of a sound material-cycle society through 3R activities” as one of the eight priority strategies to be rolled out within the next year or two. Specifically, this centers on two goals: efforts to construct a SMC Society in Asia and the promotion of the 3R Initiative, proposed by Japan, within the G8. In order to achieve the first goal, the national strategy stipulates that Japan should carry out the following actions: disseminate Japan’s 3R systems, technologies and experience to the international community and establish an international information center on the 3Rs along with common rules on the 3Rs; integrate Japan’s accomplishments on sustainable resource circulation with the formulation of the East Asia Sound Material-Cycle Society Vision, which spells out the basic concept and targets for establishing an East Asia SMC Society, and thereby seek to create a sound and smoothly functioning resource cycle across East Asia.

With respect to the Asian region, Japan has been supporting Asian countries’ activities since the launch of the 3R Initiative, in line with Japan’s Action Plan to Promote Global Zero-Waste Societies. This support includes assisting counties in developing a 3R plan or strategy and providing information on 3R systems, technologies and expe-

Figure 4-1-6 Examples of material flow information and their relation to policy targets

Official material flow indicators (approved or proposed)

Qualitative targets → Quantitative targets → Time-framed quantitative targets

Broad consideration of sustainability → Focus on resource efficiency/productivity

Belgium	Denmark	Finland	Sweden	U.K.	Austria	Netherlands	Portugal	Germany	Italy	Poland	Japan
- Decoupling of resource consumption and economic growth	- More efficient use of resources	- Resource efficiency and life cycle	- Efficient cycles for non-hazardous substances and resources	- Improvement of resource efficiency	- Resource productivity (Factor 4)	- Dematerialization (Factor 4)	- Resource use in industry (Factor 1.5)	- Material productivity (Factor 2 in 2004-2020)	- Total material requirement (TMR) - 25% reduction by 2010 - 75% reduction by 2030 - 90% reduction by 2050	- Strength of materials, water and waste in manufacturing (50% reduction in 1990-2020)	Targets for 2000-2015: - 60% increase in resource productivity (GDP/DMI) - 40-50% increase in the cyclical use rate - 60% reduction in final disposal amount

Source: Prepared by the Ministry of the Environment, based on OECD data

Abstracts of Chair's Summary G8 Environment Ministers Meeting

Kobe, Japan
May 24-26, 2008

The 3Rs

Progress of the 3R Initiative

31. The contributions of the 3R Initiative in advancing 3Rs activities in each G8 member country and other countries since its proposal at the G8 Sea Island Summit in 2004 were recognized. It was also recognized that the 3R Initiative has provided a platform for sharing information and exchanging views and experiences on 3Rs-related policies among the G8 and other countries. It was noted that the 3R Initiative has demonstrated the G8 countries' determination to contribute to the establishment of a sustainable society.

Prioritized implementation of 3Rs policies and increases in resource productivity

32. It was observed that the promotion of the 3Rs and increases in resource productivity are important for achieving sustainable development in both the G8 and other countries. Towards that end it was also observed that comprehensive policies comprising both regulatory and market-based tools, and addressing the full life-cycles of products are needed. Furthermore, the need for policies to further stimulate technological development and innovation and to create markets for resource-efficient products was acknowledged. However, it was also recognized that governments alone cannot produce the necessary changes and that the contribution of all actors and sectors of society is crucial.

33. In addition to environmentally sound waste treatment and recycling, high priority was placed on waste reduction. Several efforts to reduce the use of disposable plastic bags and other single-use consumer products were described. Japan observed that China, Japan, and the Republic of Korea will jointly call for other countries to follow suit. It was noted that substantial reductions of waste generation and resource utilization require fundamental changes in awareness and lifestyle.

34. It was noted that both G8 and non-G8 countries recognize that strong linkages and the co-benefits exist between the promotion of environmentally sound waste management and the 3Rs, and the reduction of greenhouse gas emissions. In addition, the views from non-G8 countries emphasizing the importance of developing and disseminating technologies for the promotion of the 3Rs in accordance with national circumstances were also noted.

35. The progress and achievements of the work by the OECD on material flow analysis and resource productivity and the contributions on sustainable resource management by UNEP were welcomed.

Establishment of an international sound material-cycle society

36. The occurrence of severe health and environmental problems related with improper recycling of end-of-life products, such as e-waste, as well as with improper ship dismantling, in developing countries were considered. However, the potential resource value of such materials was also recognised. The hope was expressed that further collaboration between the 3R Initiative and the Basel Convention[2] will both promote capacity building for environmentally sound waste management in developing countries and facilitate sound international resource circulation.

Confirmation of the significance of collaboration for capacity development in developing countries

37. The importance of technical and financial support toward capacity development for the 3Rs in developing countries, building on existing frameworks, was observed. It was also observed that there is a need for improved coordination of international assistance related with the 3Rs and better synchronization of development agencies' activities in this field were called for. Furthermore, it was noted that effective capacity development requires a multi-stakeholder approach, involving the private sector, local governments and NGOs.

Agreement on Kobe 3R Action Plan

38. G8 Ministers agreed on the Kobe 3R Action Plan and to report the progress in 2011. Finally, Japan observed that it has launched its "New Action Plan towards a Global Zero Waste Society," which it hopes will stimulate further international co-operation in the spirit of the Kobe 3R Action Plan.

2 The United States is not a party to the Basel Convention.

rience. Such activities have laid the groundwork for the establishment of an East Asia SMC Society.

In addition, the Asia 3R Conference was held in Tokyo in October 2006. This was the first conference that brought together policymakers from Asian countries to discuss waste management and 3R promotion. The participants agreed on the importance of promoting the 3Rs. The conference convened for the second time in March 2008 in order to share updates on the recent progress of each country's 3R policies and exchange opinions on effective measures for promotion, directed towards future expansion. The results of the conference have provided valuable input to etc, G8 Environment Ministers Meetings, held in Kobe in May 2008.

Japan has made up Kobe 3R Action Plan as a chair at G8 Environment Ministers Meetings. This is very significant because it is going to promote each country set some targets such as Resource Productivity matched to particular each circumstance.

Section 2 Japan's efforts directed towards establishing a SMC Society

(1) The outline of the Fundamental Plan for Establishing of a SMC Society

The Fundamental Plan for Establishing a SMC Society approved by the Cabinet in March 2003 (hereinafter referred to as "the First Fundamental Plan") was modified, and the revision (hereinafter referred to as "the Second Fundamental Plan") was approved by the Cabinet in March 2008.

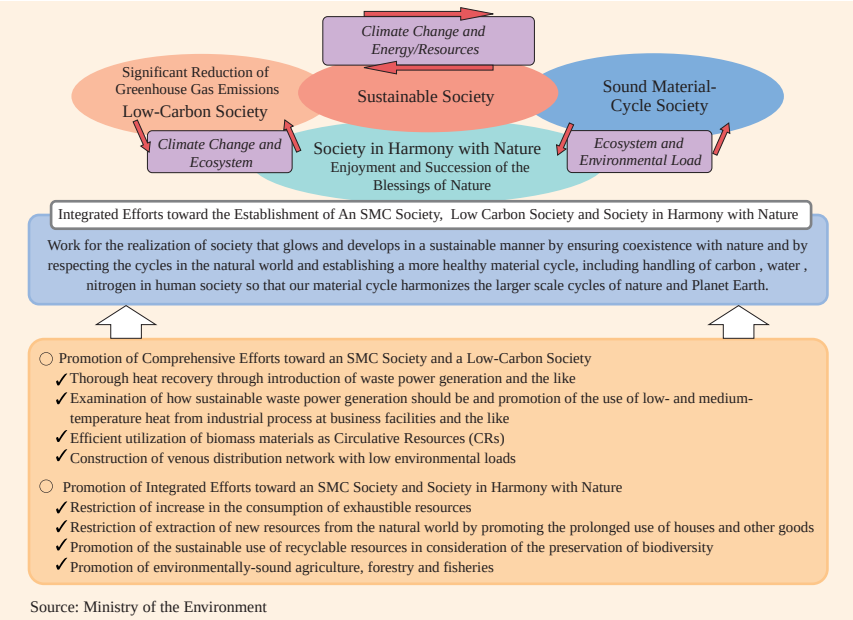
A major event related to Japan's environmental policy since the formulation of the First Fundamental Plan was the establishment of the Third Basic Environment Plan (approved by the Cabinet on April 7, 2006) and the 21st Century Environment Nation Strategy (approved by the Cabinet on June 1, 2007). The previous three reviews of the First Fundamental Plan's progress had highlighted the need for a more accurate assessment of material flows; a greater effort to raise public awareness; the promotion of SMC-based community development; and stronger measures to incorporate international perspectives in order to address the situation in which international movements of materials are increasing and waste generation and demand for resources are expanding, worldwide.

This was also the time when Japan was expected to take the initiative in rolling out 3R activities across the international community, with the G8 Hokkaido Toyako Summit scheduled for the following year.

In light of these developments, the Central Environment Council released, on August 24, 2007, a document titled "Detailed Guidelines for the Formulation of a New Fundamental Plan for Establishing a SMC Society." This document spelled out priority considerations to be addressed when developing specific measures needed for the formation of a SMC Society.

The guidelines suggested four issues on which further discussion should take place and specific measures should be set forth: (i) integrated efforts toward a SMC Society, a low-carbon society and a society in harmony with nature, to assist the creation of a sustainable society; (ii) formulation of the quantitative vision for a SMC Society, including the redefinition of target levels and introduction of new supplementary indicators, as needed; (iii) establishment of SMC blocks, in which resource cycles of optimal size are formed in accordance with the region's characteristics and the properties of the CRs available, and the waging of a national campaign to promote the 3Rs involving increased efforts to reduce and reuse waste; (iv) dis-

Figure 4-1-7 Deployment of Integrated Efforts toward A Sustainable Society



Source: Ministry of the Environment

Figure 4-1-8 Overview of the 2nd Fundamental Plan for Establishing a Sound Material Cycle Society (decided by the Cabinet on March,2008)

Current situation and Issues

- All three indicators; "resource productivity", "cyclinical use rate" and "final disposal amount" improves towards year 2010 targets set by the 1st fundamental plan and are expected to achieve the targets. However, reduction of household waste progresses rather slowly. Need to respond to global environmental issues such as worldwide resource limitation as well as global warming
- Thus, it is necessary to further develop sound material cycle societies both domestically and internationally by implementing the 3Rs thourughly

Mid-to-long term image of SMS

- Realize "Sustainable Society" by integrating with activities to realize "low carbon society" and "nature harmonious society"
  Realize "Stock-based Society" by stocking and utilizing goods to achieve wealthy society
- Regionally-characteristic SMS (Spheres of sound material cycle) , Lifestyle along the concept of Mottainai, Collaboration and partnership between stakeholders, and dissemination of the 3Rs into economic activities including manufacturing

Activities of stakeholders

◯ Partnership and Collaboration
Mutual collaboration of every stakeholders to establish sound material cycle society

◯ Citizens
- Campaign of life style change such as "my chopsticks" and "my bag"

◯ Businesses
- Prevention of illegal dumping and implementation of the 3Rs
- Advanced waste management, inter-industrial collaboration

◯ NGO/NPO and Universities and others
- Interface of collaboration and partnership
- Accumulation of knowledge and reliable information

◯ Local governments
- Partnership with stakeholders and implementation of nation-wide activities

◯ National government
- Partnership among stakeholders and implementation of nation-wide activities

① Integrated efforts with low carbon and nature-harmonious society (waste power generation and biomass utilization),
② Establishment of "spheres of sound material cycle",
③ National campaign on the 3Rs,
④ Promotion of sound material cycle business through various measures such as green purchasing,
⑤ Development of 3R mechanisms focusing on reduction,
⑥ Advanced 3R technology and system,
⑦ Information gathering and development of human resources,
⑧ Establishment of international sound material cycle society based on action plan to promote global zero waste societies, East Asia vision of sound material cycle society, or improving resource productivity

Source : Ministry of the Environment

Figure 4-1-9 Enhancement of material flow indicators and effort indices

Enhanced Indicators in the New Fundamental Plan (Material flow indicators)

Directions

1. Establish new numerical targets with FY 2015 as the target year.
2. Measure the progress of the integrated development of the efforts toward a low-carbon society and a sound material-cycle society.
3. Assess imports and exports of CRs as well as the environmental loads generated overseas through the extraction and use of resources by incorporating international viewpoints into the indicator system.

1 Indicators for which Quantitative Targets are Set
(1) "Inlet": Resource Productivity (= GDP/Natural resources and the like input)
(2) "Cycle": Cyclical Use Rate (= Amount of cyclical use / Total material Input)
(3) "Outlet": Final Disposal Amount (= Final disposal amount of waste)

2 Supplementary indicators for which quantitative targets have been set
(1) Resource productivity excluding earth and rock resources input
(2) Coordination with efforts toward low-carbon society
[1] CO_2 emission reduction in the area of waste
[2] Greenhouse gas emissions from waste and greenhouse gas emissions from fossil fuel, which can be replaced by recycling of waste into raw fuel, waste power generation and the like (measurement)

3 Indicators to monitor changes
(1) Resource productivity of fossil resources
(2) Biomass resources input rate
(3) TMR (Total Material Requirement) as a hidden flow (Measurement example: About 21 times the import of metallic resources)
(4) Indicators based on international resource cycles
(5) Resource productivity by industry area

4 Issues to be examined
Development of inventory concerning the computation of environmental loads and conversion factor that can be share internationally should be clearly defined as agenda to be examined in the future.

Enhanced Indices in the New Fundamental Plan (Effort Indices)

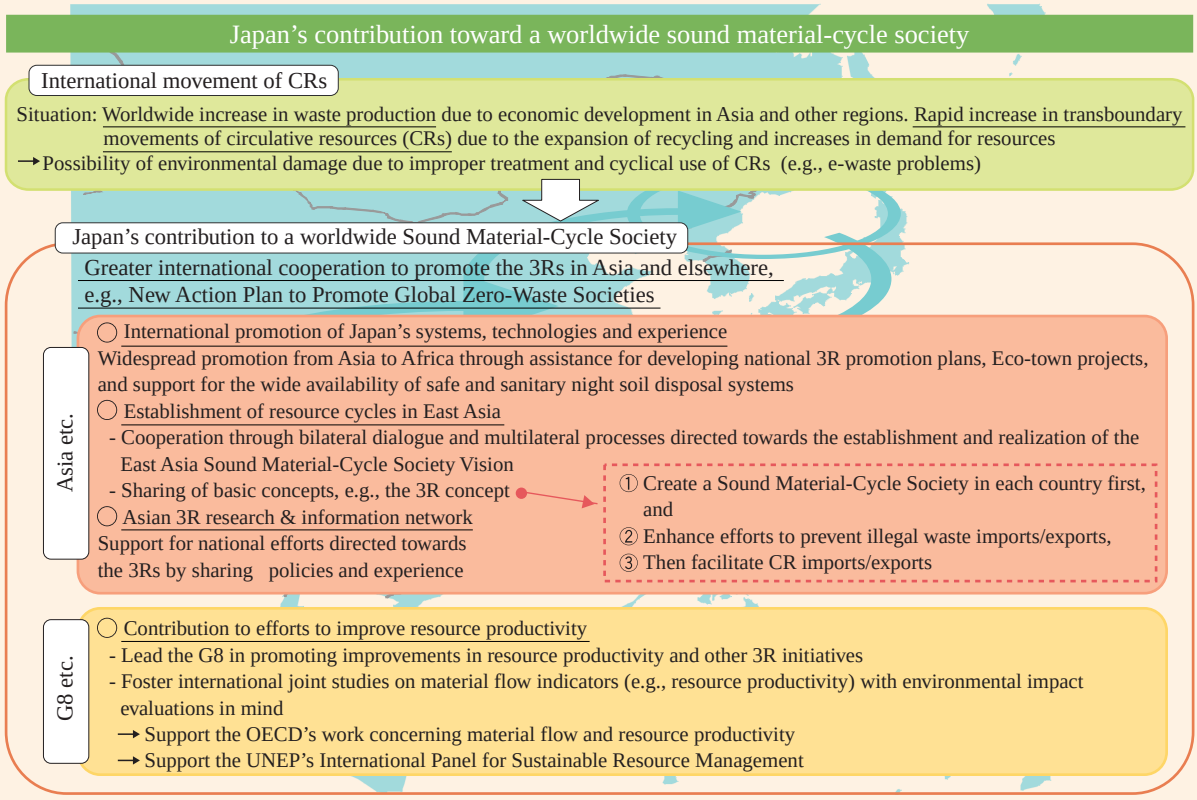
1. Enhance and strengthen effort indices by dividing them into Indices for which targets are set and Indices to monitor changes.
2. Define Indices to promote reduce and reuse, e.g., reduce in general waste and the rate of refill products shipped.
3. Strengthen Indices to measure efforts by local governments, which play a key role in establishing an SMC society, e.g., municipalities most active in promoting the 3Rs and the number of environmental workshops and mutual exchange sessions held.

1 Indices to set a target
(1) Reducing the Quantity of Waste
a. Reducing the quantity of municipal solid waste
b. Reducing the amount of industrial waste
(2) Changes in awareness of and attitude toward an SMC society
(3) Promoting SMC Society Businesses
a. Promoting green purchasing
b. Promoting environmental business management
c. Expanding SMC society business market
(4) Steady implementation of individual recycling laws and the like

2 Indices to monitor changes
(1) Size of the market for rental and lease businesses and the shipping rate for refill products
(2) Rate of refusal of free plastic shopping bags (rate of "bring my own shopping bags") and the volume of sales of disposable products (e.g. imported chopsticks)
(3) Size of the market for secondhand goods and the rate of use of returnable bottles
(4) Number of stadiums introducing "reusable cups" and the like
(5) Number of fundamental plans for sound material cycles and the like at local levels
(6) Percentage of local governments that are implementing paid garbage collection and top municipalities in terms of waste reduction efforts
(7) Number of resource recovery facilities (recycle plazas and the like)
(8) Rate of recycling of municipal solid waste, total amount of waste collected, top municipalities in terms of recycling efforts, percentage of local governments that are implementing sorted collection, and amount of sorted collection by municipalities by item, and the like
(9) Number of environmental learning and exchange meetings held by local governments and the like, and number of applications to the "Assistance Program for local communities Establishing an SMC Society"

Source: Ministry of the Environment

Figure 4-1-10 Outline of the establishment of a worldwide Sound Material-Cycle Society



Source : Ministry of the Environment

semination of Japan's systems, technologies and experience related to 3R promotion to the international community and the implementation of measures to ensure correct resource circulation in East Asia, from an international viewpoint.

The Second Fundamental Plan, which was formulated in line with the above guidelines, sets out the basic direction of the national efforts. Since the natural material cycle, and the material cycles in socioeconomic systems that are part of it, are inseparable, the government will need to take both into account in order to ensure an environmentally sound water cycle and foster the appropriate cycling of nitrogen and other materials in nature. The plan's details are described below (Figures4-1-7, 4-1-8, 4-1-9, 4-1-10).

Pursuant to this Second Fundamental Plan, the government will comprehensively implement various other related measures.

(2) Indicators and numerical targets for establishing a SMC Society

To quantitatively evaluate progress in the development of a SMC Society, the Second Fundamental Plan defines material flow indicators and effort indices.

Effort indices are used to measure the progress of measures and initiatives being implemented by different entities to assist the establishment of a SMC Society.

A Material flow indicators

Intensive discussions were held in order to define material flow indicators during the 10 meetings of the Material Flow Study Group (chaired by Dr. Itaru Yasui, former vice-rector of the United Nations University), from June 2006 to January 2008. In addition, the government and the OECD jointly hosted an international seminar on material flows and resource productivity, at which the general chair was Dr. Yuichi Moriguchi from the Research Center for SMC and Waste Management, the National Institute for Environmental Studies. The aim of this seminar was to bring together experts in indicators and statistics from OECD member states, China, India and Russia. The indicators were improved and enhanced by means of these processes, based on cutting-edge knowledge from Japan and abroad.

When establishing a SMC Society, it is essential to know what kinds of waste are generated where, and in what quantity. The accurate acquisition of this information allows the causes of waste generation to be identified and facilitates both restraining generation and the cyclical use of waste.

Such information is not only applicable to the waste generation process but is also useful for promoting the efficient

use of the total material input to a society. Japan should, therefore, first clarify its nationwide material flows. This will then be of great help in future policymaking.

The government has created a diagrammatic illustration of material flows (Material Flow Chart) by calculating the material flows that encompass all movements of materials in an economic society and then collecting data that show how much resources were input into the Japanese economic society, how much were reserved in society, consumed as energy, or turned into waste, and how much of the generated waste was recycled or disposed of in final disposal sites (Figure4-1-11).

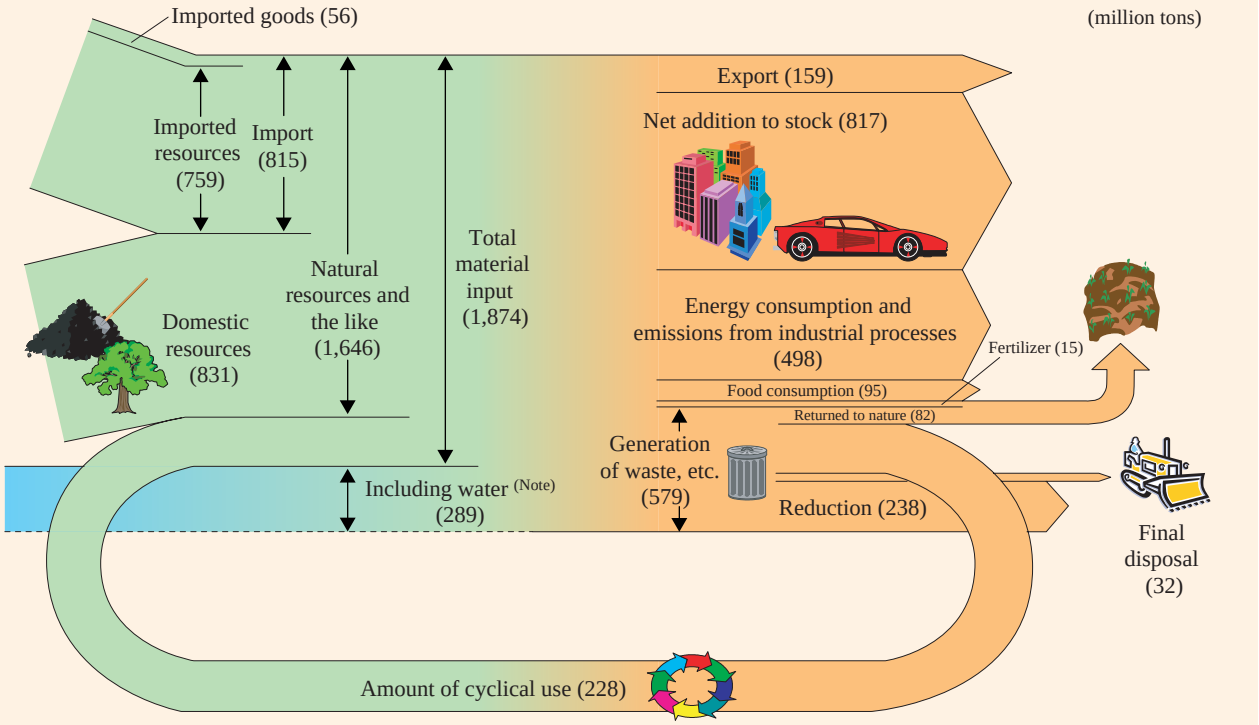
The Second Fundamental Plan sets targets for three indicators -- resource productivity, the cyclical use rate, and the final disposal amount -- referring to the "inlet," "cycle," and "outlet" aspects of Japan's nationwide material flow, respectively. These targets are to be pursued through the joint efforts of the government and other concerned parties. The target year for the Second Fundamental Plan is FY 2015, envisaging a society even farther ahead, in FY 2025.

The target for the inlet has been set by resource productivity: approximately ¥420,000 per ton in FY 2015. This indicator is designed to comprehensively measure how effectively industries and people are using products. Since natural resources are exhaustible, generate environmental burdens associated with extraction, and eventually turn into wastes, this indicator should be increased so that adequate gross domestic product (GDP) can efficiently be achieved from smaller inputs of resources. The target figure is double the rate in FY 1990 (approximately ¥210,000 per ton) and roughly 60% higher than the rate in FY 2000 (approximately ¥260,000 per ton) (Figure4-1-12).

The target for the cycle has been set by the cyclical use rate: approximately 14-15% in FY 2015. In principle, this indicator should be increased so that appropriate cyclical use can be expanded in order to reduce the amount of final disposal. The target figure is about 80% higher than the rate in FY 1990 (approximately 8%) and about 40-50% higher than the rate in FY 2000 (approximately 10%). Note that the total input in an economic society is the sum of the natural resources input and the amount of cyclical use (Figure4-1-13).

The target for the outlet has been set by the final disposal amount: approximately 23 million tons in FY 2015. The final disposal amount is an indicator that is directly linked to the urgent problem of a shortage of final disposal sites. Being expressed as the sum of the final disposal amount of municipal solid waste and industrial waste, this indicator should be reduced. The target figure is about 80% lower than the amount in FY 1990 (approximately 110 million tons) and about 60% lower than the amount in

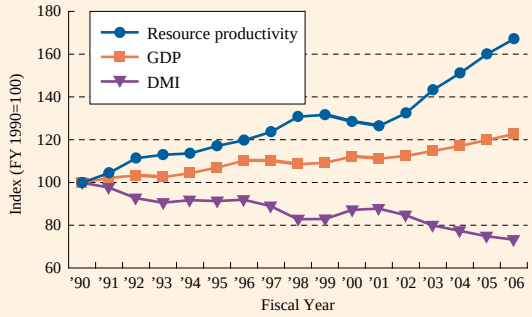
Figure 4-1-11 Material flow in Japan (FY 2005)



(Note) Including water: Input of water included in waste and the like (sludge, animal manure, human waste, waste acid, waste alkali) and sediment and the like associated with economic activities (sludge from mining, building and water works and tailing from mining)

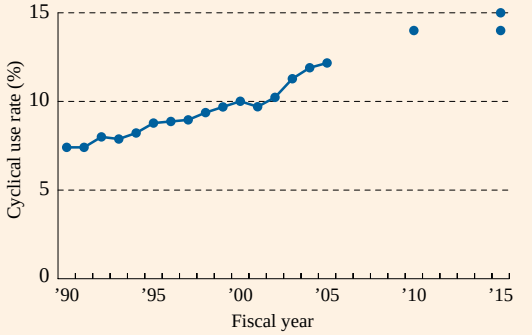
Source : Ministry of the Environment

Figure 4-1-12 Trends of Resource Productivity



Source : Ministry of the Environment

Figure 4-1-13 Trends in the cyclical use rate



Source: Ministry of the Environment

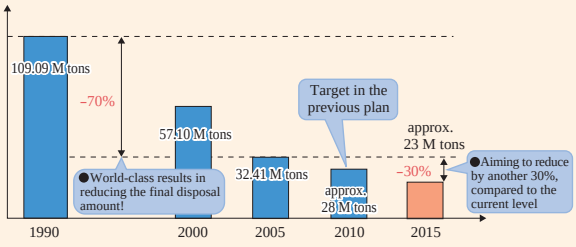
FY 2000 (approximately 56 million tons) (Figure4-1-14).

In addition to these three indicators, above, two supplementary indicators were also set as targets: (i) resource productivity excluding the input of earth and rock resources and (ii) coordination with efforts directed towards a low-carbon society.

As a result of a progress review of the First Fundamental Plan, it was pointed out that, as far as resource productivity is concerned, the input of non-metallic mineral resources (earth and rock resources) has a large impact on the total natural resources input. This point was addressed by setting an additional target that supplements current resource productivity, namely, (i) resource productivity excluding the input of earth and rock resources. The target figure is about ¥770,000 per ton in FY 2015, which corresponds to 30% improvement compared to approximately ¥590,000 per ton in FY 2000.

In order for the indicator to measure (ii) coordination with efforts directed towards a low-carbon society, a target for emission reduction measures in the waste sector was set in line with the revised Kyoto Protocol Target Achievement Plan: a reduction of 7.8 million tons of CO2 by FY 2010. In the future, it would be desirable that a target be set for net greenhouse gas emissions from the waste sector (calculated by subtracting greenhouse gas emissions derived from fossil fuels for which waste power

Figure 4-1-14 Trends in the final disposal amount of waste, since 1990



Source: Ministry of the Environment

generation and wastes recycled as fuels or raw materials is to be substituted). However, since there is no internationally recognized and agreed common method of calculation available, including that for sector-specific distribution, Japan will just collate this data for the time being.

The Second Fundamental Plan also introduced the following indicators to monitor changes for use as reference indicators for future policy implementation.

One of these indicators is the resource productivity of fossil resources. This is a noteworthy indicator from the viewpoint of anti-global warming measures, considering that fossil resources are exhaustible and therefore need to be used efficiently.

Total material requirement (TMR), or the hidden flow, was included as an additional indicator to help increase awareness of global environmental problems. TMR includes hidden flows such as materials that are extracted in conjunction with target resources during resource extraction and are then removed as waste. TMR is considered as a quantitative measure of the sustainability of resource use and the global environmental burdens derived from resource use. Reducing new resource extraction from nature and promoting cyclical use of metallic resources will help reduce the domestic and overseas environmental burdens caused by resource use in Japan. This indicator can also be used to evaluate progress in the recycling of rare resources (difficult to measure simply by weight). An example of TMR measurement can be seen with regard to imported metallic resources, which are closely related to 3R measures. Estimates show that the TMR associated with Japan's imports of metallic resources is approximately 2.1 billion tons, which is 21 times the amount of actual pure metal imported (about 0.1 billion tons).

When measuring TMR, accurate information needs to be gathered on the grade of ore collected from each mine for the extraction of metallic resources. However, since Japan imports most of the metallic resources in demand, it is not very easy for Japan to gather accurate information on ore grades and so on from overseas mines. Therefore,

those who make use of this indicator must be aware that a significant proportion of all the source data are just estimates. Another point that should be taken into consideration is that the value of TMR is not a direct representation of the impact on environmental destruction. There are initiatives underway to minimize environmental burdens by planting trees in order to restore the modified environment after resource extraction.

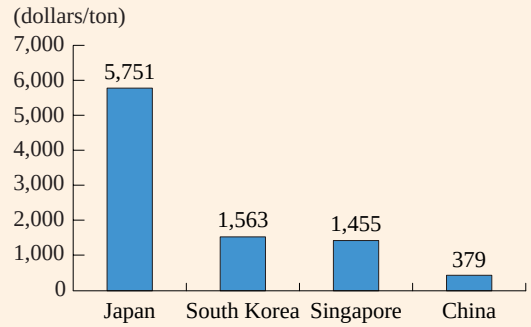
Securing a stable supply of metallic resources from overseas is vital for Japan. However, overseas mines are experiencing degradation in ore grades and the deepening of ore deposits, and these trends can have an impact on TMR values. To address such changes, Japan should continue collecting and accumulating data at the global level.

For resource productivity purposes, the government has decided to keep track of not only nationwide indicators but also industry-specific resource productivity. This focuses on resource-intensive goods and services in order to obtain estimates for each industry sector, and allows a more accurate analysis of the factors affecting change. In the future, it is hoped that industry-specific resource productivity will be measured in many countries so that international comparisons can be made of the effectiveness of resource use.

The Second Fundamental Plan also identified various issues that need to be examined further.

One of these issues is the development of material flow indicators that allow international comparisons to be made so that Japanese data can be compared with those of other developed countries and other Asian countries. This requires the establishment of common calculation methods and the construction of relevant databases. With this in mind, Japan will make a proactive contribution to the international accumulation of knowledge. In particular, Japan will assist Asian countries in collecting and organizing statistics on resource productivity, the cyclical use rate, and the final disposal amount (Figure4-1-15).

Figure 4-1-15 Resource productivity in Asian countries (2004)



*1 Natural resource input does not include nonmetallic minerals.
*2 GDP data are real GDP figures based on purchasing power parity in 2000 , cited from the "World Development Indicator" of the World Bank
Source: Created by the Ministry of the Environment, mainly based on UN statistics

On the other hand, there is also a concept called environmental efficiency, which measures the relative efficiency between environmental burdens and the added value of goods and services by using the corporate or product value instead of GDP, and by using environmental burdens instead of resource consumption, such as natural resources input. Using this concept, the government will be able to collect and analyze the information needed for the quantitative assessment and evaluation of environmental burdens associated with resource extraction and the use of resources and products, and will create inventories relevant to the calculation of these environmental burdens. In particular, the government will seriously consider promoting joint research projects between Japanese research institutes and between Japanese and foreign research institutes or international organizations.

In the case of conversion factors that involve statistical imperfections or a lack of international consensus, the government will continue to contribute to discussions in the OECD and the UNEP directed towards the definition of internationally shared conversion factors and will make good use of the results.

[An example of resource extraction with a high impact on the environment]
Source: Masatsugu Taniguchi, United Nations University

[An example of resource extraction followed by afforestation]

B Effort indices

When establishing a SMC Society, it is essential that not only the government but also all the entities concerned play their respective parts. Unlike the material flow indicators, which are designed to measure the entire country's progress in creating a SMC Society, the effort indices deal with measures taken by the entities concerned in order to establish a SMC Society. These indices are used to set targets for the activities of these parties and to help expedite their activities. By making it possible to carry out quantitative assessment and evaluation, these indices also help achieve a SMC Society.

The effort indices need to be flexibly modified and expanded in accordance with the results of annual reviews and analyses, in order to ensure that activities carried out by individual entities contribute to steady progress, overall. Given the possibility that new and more ambitious indices may be developed at the local and regional level, these effort indices are also expected to serve as a reference point when setting regional targets.

(An excerpt from "Effort indices" in Chapter 2, Section 2 of the Second Fundamental Plan)
1 Indicators for target setting
(1) Reduction of waste
a. Reduction of municipal solid waste
(a) The target for both the public and enterprises is a reduction of approximately 10% from the FY 2000 level in the effort index of per capita daily waste generation (calculated from the amount of municipal solid waste as the sum of the wastes collected through scheduled collection and group collection and the wastes carried in).

The target set by the First Fundamental Plan concerning both per capita daily residential waste generation and per capita daily commercial waste generation was a reduction of approximately 20% from the FY 2000 levels. This was a target that could be achieved by reducing waste generation and fostering cooperation on sorting and resource collection.

In addition to the indices used to evaluate cooperation on sorting and other efforts directed towards resource recovery, which followed on from the previous plan, the Second Fundamental Plan also defined targets directly concerning the reduction of waste generation. These indices are related to the "Reduce" component of the 3Rs, and the restriction of waste generation. It is hoped that efforts to "Reduce" (the most important factor in establishing a SMC Society) will be enhanced, as a result.

(An excerpt from "Effort indices" in Chapter 2, Section 2 of the Second Fundamental Plan)
2 Indicators used to monitor changes
(2) Rate of refusal of free plastic shopping bags (rate of shoppers bringing their own shopping bags); volume of sales of disposable products (imported disposable wooden chopsticks)
As indices of the public's efforts to reduce waste, the government will monitor the rate of refusal of free plastic shopping bags (rate of shoppers bringing their own shopping bags) and the volume of sales of disposable products (imported disposable wooden chopsticks).

As indices of the public's efforts to reduce waste, the government will measure the rate of refusal of free plastic shopping bags (rate of shoppers bringing their own shopping bags) and the volume of sales of disposable products (imported disposable wooden chopsticks).

It is essential that the government assesses and examines certain factors in detail for each type of product used by people in their everyday lives. This includes reductions in usage, the amount reused, and environmental burdens throughout the life cycle of a product (life cycle assessment (LCA)), from resource extraction through to disposal.

(An excerpt from "Effort indices" in Chapter 3, Section 2 of the Second Fundamental Plan)
2 Indicators to monitor changes
(6) Percentage of local governments charging for garbage collection; municipalities most active in promoting waste reduction
As indices of local governments' efforts to reduce waste, the government will monitor the percentage of local governments charging for garbage collection and identify those municipalities which are most active in promoting waste reduction.

As indices of local governments' efforts to reduce waste, the government will measure the percentage of local governments charging for garbage collection and identify those municipalities which are most active in promoting waste reduction.

Since local governments play a key role in establishing a SMC Society, the government will use a broad range of indices to monitor changes and keep track of their activities. This will include those municipalities which are most active in promoting recycling, and the number of recycling centers and other resource recovery facilities.