Asia-Pacific
Economic Cooperation

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Guidebook for the Development of Sustainable Cities Focusing on Resource Circulation and Waste Management

A Methodology for Measuring and Realizing the Sustainability of Cities in the APEC Region

SOM Friends of the Chair (FoTC) on Urbanization

April 2018

APEC Project: SOM 01 2016S

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APEC#218-OT-03.1

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Lists of Definition of Terms

This Guidebook (Resource Circulation and Waste Management) defines terms as follows:

Definition of terms

Terms in the Guidebook	Definition
Municipal waste	"Municipal solid waste," which is solid waste that municipalities take responsibility for disposal. The composition of municipal solid waste varies from economy to economy, from municipality to municipality, and the term therefore follows a definition specified by an economy or municipality of a Guidebook (Resource Circulation and Waste Management) user.
Hazardous substances and hazardous waste	There are substances that are dangerous or harmful to human health and the environment, including substances such as Mercury, Lead, and others that individual domestic regulations define, as well as those detailed in the Basel Convention and other international conventions. These terms therefore follow definitions specified by an economy or municipality of a Guidebook (Resource Circulation and Waste Management) user.

1. Background , Purpose and Use of the Guidebook

1.1 Background and purpose

The ongoing rapid economic growth in Asia-Pacific region can increase greenhouse gas emissions, worsen waste treatment problems, cause pollution, and tighten the supply-demand situation of energy, resources, water, and food. These factors are posing serious issues shaking the basis of economic growth and social infrastructure of the Asia-Pacific region. Environmental burden is increasing in line with the economic growth and urbanization. It is important for each city to take initiatives to solve its own problems as the situation varies from city to city. Such initiatives are expected to contribute to achieving the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development which includes aims to enhance sustainability of cities and communities. In SDGs, while sustainable cities are expected to meet providing universal access to safe, inclusive and accessible, green and public spaces; and supporting positive economic, social and environmental links between urban, peri-urban and rural areas, they are deemed to secure clean water and sanitation; secure access to sustainable energies; develop resilient infrastructure; build sustainable cities; sustainable consumption and production.

In 2014, the 22nd APEC Economic Leaders' Meeting in Beijing endorsed the APEC Accord on Innovative Development, Economic Reform and Growth which identifies Urbanization as one of the five pillars for promoting experience sharing, policy dialogue, capacity building and practical cooperation as well as APEC Cooperation Initiative for Jointly Establishing an Asia-Pacific Urbanization Partnership. In Ningbo Initiative that was adopted at the APEC High-Level Urbanization Forum in Ningbo in 2016, member economies are encouraged to share best practices, experience and lessons on sustainable development, and carry out demonstration projects among APEC cities. In addition, Friends of the Chair on Urbanization plays an important role in implementing the APEC Cooperation Initiative for Jointly Establishing an Asia-Pacific Urbanization Partnership and the Ningbo Initiative. Aligned with the Leaders' instruction and aforementioned initiatives of APEC, Japan proposed a new proposal titled "Developing the Methodology for Measuring and Realizing the Sustainability of Cities in the APEC region" in 2016. This Guidebook is a deliverable through considerations and discussions based on the proposal.

It is the purpose of this Guidebook to promote applying appropriate solutions for addressing environmental problems to the city, thereby contributing developing sustainable cities.

Japan has overcome the increased environmental loads revealed by the rapid urbanization by the united effort of communities, businesses, and governments, and gained the experience and know-how to establish the resource circulation society where resources are utilized efficiently, through the lengthy effort. This Guidebook is the outcome of the intensive discussion by APEC economies through deliberation and opinion exchanges by a Japanese expert group (consisted of business, academics, and governments), APEC expert groups such as the PPSTI (APEC Policy Partnership on Science, Technology and Innovation) and the EWG (Energy Working Group), and also through cooperation from the project co-sponsors of Viet Nam, Singapore, and Australia, regarding the methodologies to share the Japan's experience and know-how to solve the increased environmental loads revealed by the rapid urbanization in the APEC region. This Guidebook also has been based on the discussion with APEC economies in the workshop at the margin of APEC's Second Senior Officials' Meeting (SOM2) held in May 2017.

At the same time, cities experiencing rapid growth share the same economic challenges: increasing environmental burdens; insufficient development of systems and institutions to enforce

the environmental policy; data shortages for understanding the current situation; insufficient development, maintenance, and management of infrastructures; a shortage of financial sources to implement these initiatives; a shortage of investment by private businesses in the environmental sector, and a lack of environmental awareness among residents.

The Guidebook helps evaluate the current-status of a city, and tells you advantages and problems of a city. It also provides you with policy packages, and technologies and systems as solutions for addressing problems of your city. The Guidebook provides not only the contents of the solutions, but also points to consider in solution selection and decision, and you can therefore refer to them when you consider solution. After introducing solutions, you can measure effects of such solutions based on items to be verified.

1.2 Assumed user, composition, and use

This Guidebook is for use by central and local governments in Asia-Pacific regions that desire to solve environmental problems revealed by the rapid urbanization. Moreover, this Guidebook can be used not only by local governments in urban areas, but also by those in other areas such as rural areas, mountainous areas, and islands.

The Guidebook is composed and can be used as shown in the figure below. Chapter 1, an introductory section, describes the background, purpose, and composition of this Guidebook. Chapter 2, serving as a role for "developing a medical record and providing diagnosis", explains how to evaluate the current-status, which is indispensable to reviewing solutions. Chapter 3, as a role for "providing a prescription", provides information necessary to determine a specific solution based on the discussion in the preceding chapters.

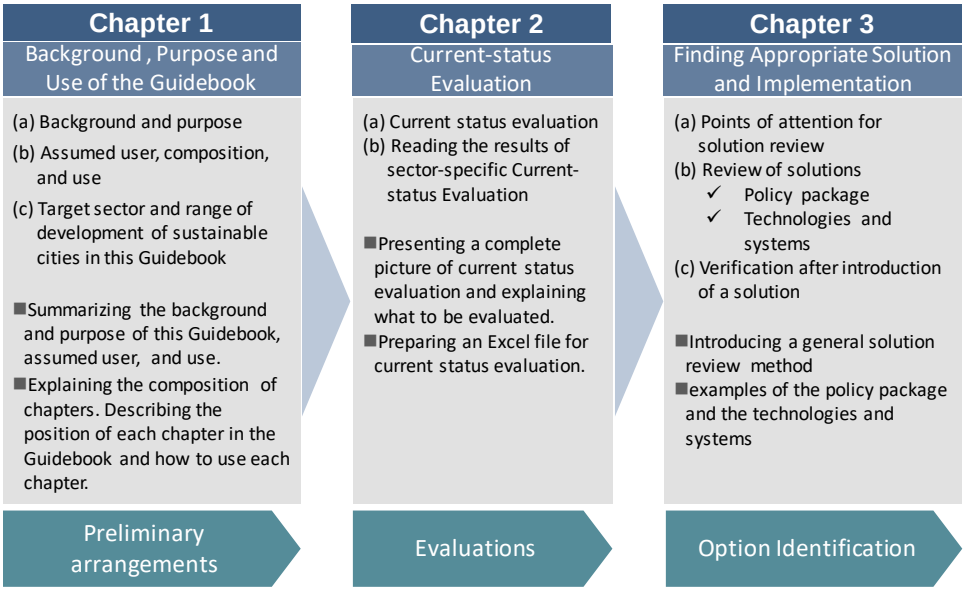


Figure 1-1 Composition and use of this Guidebook

In promoting policies effectively, you should adopt the so-called PDCA cycle, such as planning policies based on a Current-status Evaluation, verifying after carrying out the policies, and improve the contents of the policies based on the verified results, and then continuously develop them. Referring to each chapter of the Guidebook, you should Plan (Current-status Evaluation, solution selection and decision), Do (solution introduction), Check (verification after the introduction, reevaluation of current status as needed), and Act (selection and decision of new solutions), with the aim of developing into a sustainable city.

1.3 Target sector and range of development of sustainable cities in this Guidebook

This Guidebook is aimed to help solve, among the various problems revealed by the rapid urbanization, the problems specific to the resource circulation and waste management sector.

The "development of sustainable cities″is defined in SDGs as the essential factor to ensure the

citizen's quality of life, and this Guidebook is able to be connected with actions to achieve the SDGs.

In order to realize the "development of sustainable cities", this Guidebook sets forth a concept that it is essential to achieve and maintain the appropriate status of seven key sectors indicated in Figure 1-2 related to cities. This idea comes from ISO37151 which specifies five elements for improving urban environmental infrastructure: communications, energy, water, solid waste, and transport. This Guidebook adds two more elements—air and soil—because both are indispensable in improving and maintaining living environment. These seven sectors are covered in the SDGs as well.

Keeping the seven key sectors in appropriate conditions will bring about the "development of sustainable cities," thereby being expected to contribute to addressing the climate change problems as well as further deterioration of the environment, and marine litter problems, as global problems. Global resource consumption has experienced an unprecedented increase due to the rapid economic growth in emerging economies. Production, consumption, and disposal of resources are closely related to emissions of greenhouse gases. Improving resource efficiency through the promotion of resource circulation is expected to not only achieve a recycling based society, but also reduce the emission of greenhouse gases, and furthermore contribute to addressing climate change problems. Since exploration and extraction of fossil fuel, metals and other mineral resources cause deterioration of natural environment, such as deforestation of natural forest and deterioration of soil environment, promoting resource circulation is expected to prevent deterioration of natural environment and contribute to biodiversity as well. In addition, promoting the prevention of waste generation and resource circulation in cities will finally contribute to reduce marine litter in a global scale.

<Seven key sectors for realizing sustainable cities in this Guidebook>

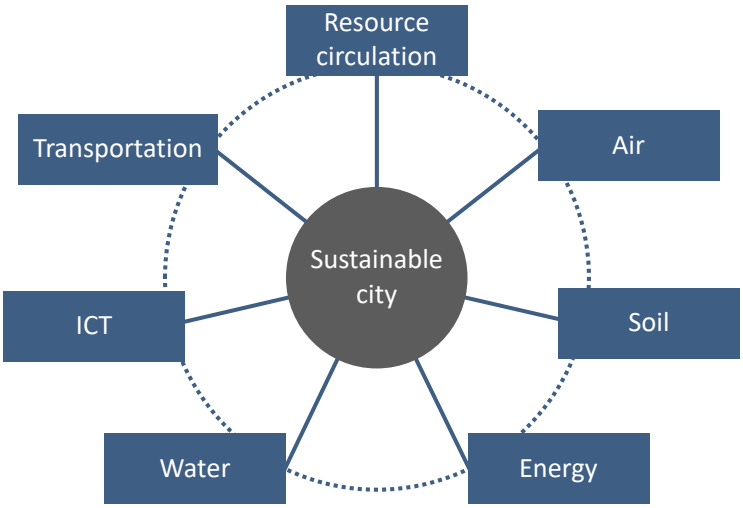


Figure 1-2 Seven key sectors for achieving the development of sustainable cities in this Guidebook

This Guidebook focuses on the "resource circulation and waste management sector" of the seven sectors. The Guidebook is aimed to help address revealed environmental problems in the sector due to the rapid urbanization and develop into sustainable cities by playing a role for developing a medical record and providing a prescription for the health of a city.

Once you start the development of sustainable cities in the resource circulation and waste management sector, it may affect other sectors. It may be positive effect due to synergetic effect, or may be negative effect due to a trade-off relationship. Therefore, the reference document of this Guidebook will consider the relationship between the resource circulation and waste management and the specifically close related evaluation items form other sectors, water, air, soil, and energy sectors.

2. Current-status Evaluation

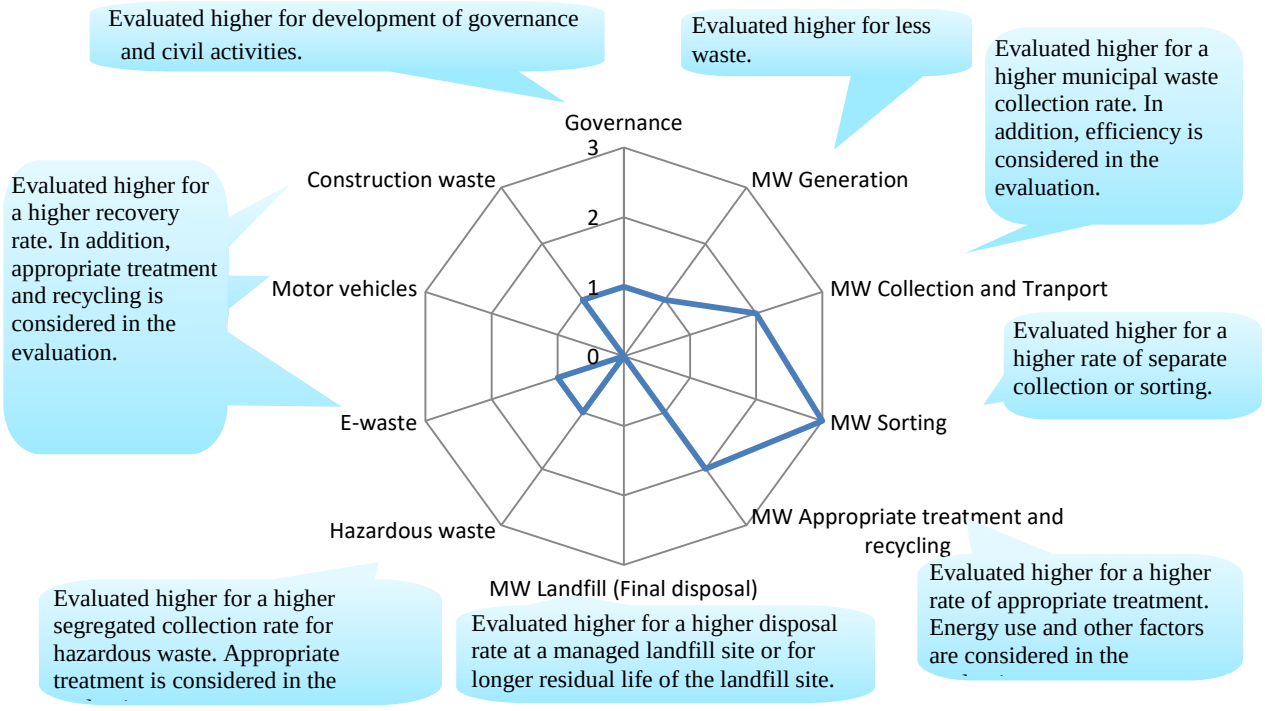
In Current-status Evaluation, users of the Guidebook evaluate the resource circulation and waste management sector on the basis of information and data on the target city.

Please note that the Current-status Evaluation of the Guidebook should not be used to compare with other cities. This is because cities have different definitions of waste that they evaluate, as well as some evaluation items need subjective judgement of individual cities and a strict quantitative evaluation is impossible for those. However, the Current-status Evaluation is useful for identifying an overall trend of the development status of a city and can be used for comparing trends of individual cities.

2.1 Current-status Evaluation method

Upon considering solutions for the resource circulation and waste management sector, it is essential to understand the strength and weakness of your city. From the evaluation result, by visualizing the strength and weakness of your city, it is able to clarify the major axes which the solutions should be considered.

The reference document of this Guidebook provides the evaluation sheets which can be used for evaluating status of actions in each sector as one example of methodologies for current-status evaluation. By evaluating and entering current-status of the city on these evaluation sheets, a radar chart as follows will be produced. These evaluation sheets provide evaluation axes for the resource circulation and waste management sector of Governance, treatment of municipal waste, and treatment of hazardous wastes, and additionally provide evaluations of treatment statuses of E-wastes, motor vehicles, and construction wastes by the score of 4 grades (score 3, 2, 1 and 0).



* MW: Municipal Waste

Figure 2-1 Image of the Current-status Evaluation results for the resource circulation and waste management sector

2.2 Reading the results of sector-specific Current-status Evaluation

At the end of Current-status Evaluation, the current-status of each sector-is shown on a chart. The chart enables you to know on each axis what measure should be taken.

On the chart, select the primary axis to review solutions.

An axis which is evaluated relatively low indicates there is room for improvement. In this regard, it is desirable that the axis will be set as a primary axis.

However, a lower evaluated axis does not necessarily need to be selected as the primary axis. As the primary axis, you may select an axis that bears more importance to your city or an axis in which you are more interested in order to review solutions.

The Guidebook's Current-status Evaluation mainly evaluate whether there exists an activity to address the problems or not. In this sense, even if an axis is evaluated as highest score, you should remember that it does not necessarily mean environmental problems of a city are completely solved. On the other hand, evaluation of addressing environmental problems are shown in the below mentioned section, "Verification of solution after introduction", which introduces what to be considered in evaluation. When you continue to address environmental problems, it would be better to advance activities and consider solutions to improve the quality of items already evaluated higher in the Current-status Evaluation chart, referring to the Chapter 3 Solution Review.

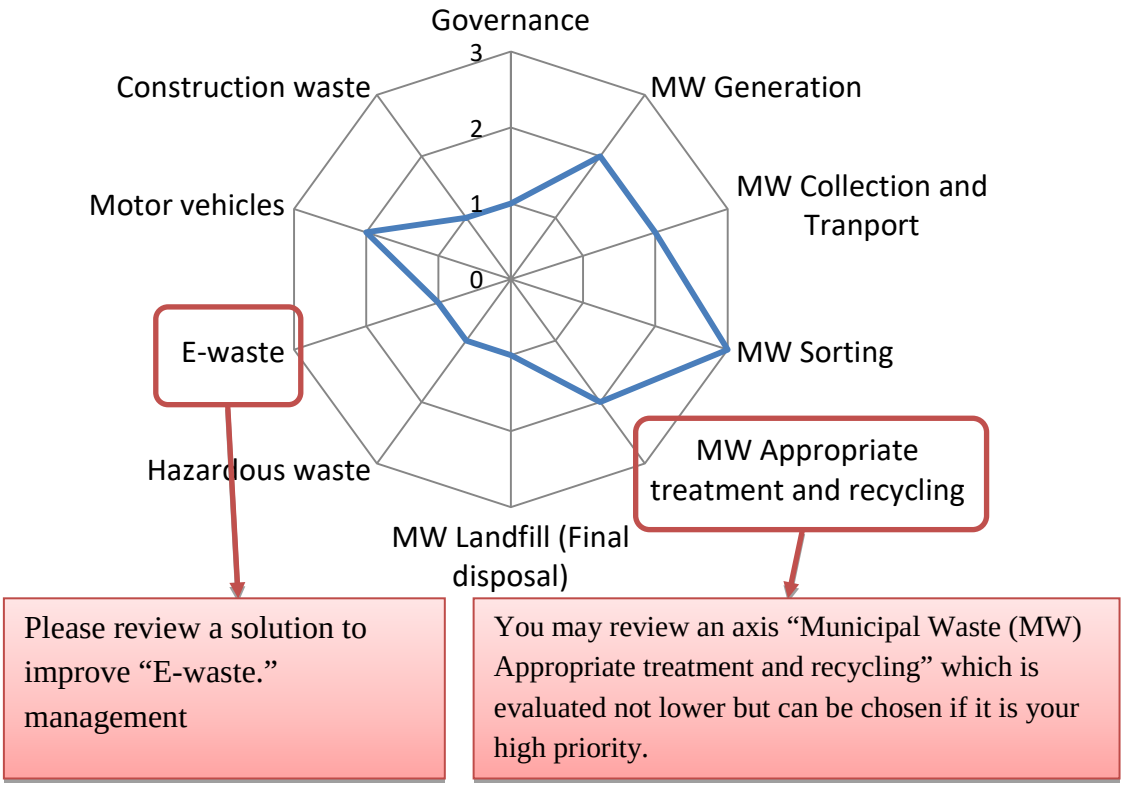


Figure 2-2 Chart of the Current-status Evaluation results for the resource circulation and waste management sector

3. Finding Appropriate Solution and Implementation

Solution should be identified and introduced, based on the results of the Current-status Evaluation.

3.1 Solution selection

3.1.1 How to consider solution selection

When you select solutions in the resource circulation and waste management sector, you should consider the priorities (hierarchy) of waste treatment, such as preventing waste, reuse, recycling, energy recovery, and landfill as a last resort.

If you cannot conduct the Current-status Evaluation due to the lack of data, thus not being able to select solutions, you should conduct data collection first. You should examine necessary data and monitoring methods, then collect and organize data on a time-series basis.

How to understand the Current-status Evaluation results for the resource circulation and waste management sector and how to consider solution selection on each axis is shown in the table 1 at the end of the Guidebook as an example. Please refer to the table at the time of solution selection.

3.1.2 Points to consider in solution selection

When you select a solution, it is preferable for you to consider the below points.

(1) Preparation for adapting a solution

To introduce a solution, how should we prepare for it under the current situation?

If a city is to introduce a complicated policy that can affect a large number of stakeholders, then the review can take a long time in order to obtain their consent. It will take a long period before the policy demonstrates its results. To make the policy acceptable to citizen, it is advisable to set up a trial period and trial area to introduce the policy step by step.

If a city is to introduce facilities that require advanced technology for operation and repair, the city will need a lot of time to train operators. This can keep new facilities idle for a long time, if operators were not trained in advance.

(2) Preconditions for the introduction of a solution

Before introducing a solution, it may be necessary to have a social scheme and system. For instance, if you are considering introducing recycling technology for a product, you will need to establish a system for separate collection of the product and delivery to a recycling operator. A recycling system would fail to function properly if you do not have the necessary sorting or recycling technology.

In addition, even when you can recycle waste by the introduction of a system or a technology, you also need to create a market for recycled products after the recycling process in order to promote utilization of recycled products and achieve a recycling based society.

Before introducing a specific solution, you must have in place an appropriate system, policy, and technology.

(3) Development of a quality and effective solution

For sustainable development of cities and for satisfaction and benefits to citizens, it is important to ensure the quality of solutions. While concepts of quality and effective solutions could be different depending on cities, in this guidebook, introducing quality and effective solutions which prioritize to be economical (e.g. reduction in life-cycle cost), safety, resistance to natural disasters, environmental and social considerations, and contribution to the local society and economy (technology transfer and human resource development) is encouraged. These solutions may have high initial cost but are less costly in the long term because they are long-lasting, easy to use, and environmentally friendly, and prepared against disasters.

In particular, to introduce a technology, you need to consider not only initial cost but running cost as well. Running cost of inexpensive devices and facilities may be greater than expensive one, because the former may be inefficient or liable to malfunction, as well as less durability. As a result, whole life cycle cost of inexpensive one which combines initial cost and running cost may be higher than when quality and effective solutions are introduced. In selecting a technology to be introduced, it is necessary to estimate the service life of the technology and compare it with the expected life-cycle cost. When examining lifecycle cost, it is necessary to take into account of final costs necessary for removal and disposal of introduced equipment, facilities, and end-of-life products.

When you introduce a quality and effective solution, it can be expected to contribute to not only the resource circulation and waste management sector but also addressing global environmental problems, such as climate change and deterioration of natural environment. For instance, when you introduce a technology for promoting resource circulation, the introduction of such technology may require additional energy. However, in some cases, if you recycle waste energy which has never been used, some processes such as resource extraction and production can be omitted, thereby reducing energy consumption of the whole lifecycle and leading to greenhouse gas emission reduction and contribution to solving climate change problems. Since exploration and extraction of fossil fuel, metals, and other mineral resources cause deterioration of natural environment, such as deforestation of natural forest and deterioration of soil environment, promoting resource circulation is expected to prevent deterioration of natural environment and contribute to biodiversity as well.

(4) Integrity of the whole

Once introduced in the resource circulation and waste management sector, a solution can affect other sectors, policies, or technologies. These factors may have a trade-off relation with one another. For instance, waste incineration can result in air pollution to damage the health of residents, unless the incineration facilities are furnished with an appropriate exhaust gas treatment system. In contradiction to the trade-off effects, the secondary effects may emerge beyond the expected effects from the solutions. For example, introducing solutions may lead to the promotion of wastes prevention and recycling, as well as the reduction of litter entering the sea, contributing to the prevention of marine litter generation.

It is necessary to measure the effect on other sectors of any solution adopted and determine whether the solution will ensure the sustainability of the city as a whole, its surrounding areas and the earth on the whole.

(5) Cooperation with other cities and the central government

The city can introduce a policy on its own or may need to cooperate with other cities or the central government.

By coordinating with neighboring cities in waste collection and transport, a city may be able to collect waste efficiently in a larger area. If a city has large waste treatment facilities, then the city may be able to accept wastes from surrounding cities to build an efficient waste treatment system. On the other hand, if a city introduces a policy on its own, it may negatively affect neighboring cities.

When a city introduces an advanced policy, you should consider it in collaboration with an economy or other neighboring cities, or check whether the policy is consistent with a direction of central or neighboring city's policy.

(6) Setting goals of verifying the effect after the introduction of a solution

For a certain period after introducing a solution, it is preferable to measure the effect of the solution, and verify whether the solution is properly selected and implemented.

Carrying out a Current-status Evaluation using the Guidebook clarifies main problems that a city should be tackled. Based on the main problems, it is preferable to set a concrete "goal" in introducing a solution. The goal in this context is not a numerical goal but writing expressions what a city will be like. You can set multiple goals if multiple effects of the solution are anticipated. If you set multiple goals, please choose the main goal.

In addition, please set a "target" to quantitatively assess the level of accomplishment, and an "indicator" to monitor the progress toward fulfilling a goal. You can set multiple "targets" and "indicators" for one goal. For example, if a goal is a reduction of waste generation, you should set a reduction target for an annual amount of waste per citizen by 30 percent compared to 10 years earlier, and set and monitor an indicator of an annual amount of waste per citizen.

Setting concrete goals, targets, and indicators should be considered based on viewpoints shown in 3.4 for your reference.

3.2 Determination of a solution

In this section, a solution applicable to the city is determined based on examples of the policy package and the technologies and systems by using the points to consider in solution selection and its consideration as above-mentioned in section 3.1. Once the solution has been implemented, it is important to verify the effect of the solution.

3.2.1 Examples of solutions

Solution examples of "policy package", which is a compilation of policy systems and measures applied by central and local governments, and "technologies and systems", a compilation of technologies and systems which have been developed, are presented for each evaluation axis in Table 1 at the end of this Guidebook.

The reference document of this Guidebook summarizes the outline of solution examples (responsible entities, expected results, points to consider for implementation). Please refer to the reference documents at the time of determining the solution.

3.2.2 Points to consider in introduction of solutions

In introduction of a determined solution, please consider the following points. It would be better to consider the points in parallel with introduction of a solution. You can also refer to specific examples of economies which have already introduced such a solution.

(1) Consideration of financing

Funds are required for introducing a solution. When you particularly introduce a large infrastructure, you need to raise large funds. Financing methods are public investments from central or municipal budgets, Official Development Assistance (ODA), assistance from international financial institutions, public financial institutions, and private funding.

Infrastructure in the resource circulation and waste management sector, which has a highly public nature, is maintained by making the public investment and collecting charges. However, it is actually difficult for the infrastructure to be financed only by the public investment. In recent years, a Public Private Partnership (PPP) which is a collaboration between a private party and a government entity is thus widely promoted. The PPP enables a city to own a facility as well as a business operator to develop and operate the facility, thereby promisingly bringing about more efficient development and operation. In addition, much more private investment will be expected if you organize a scheme to stabilize business guarantee and revenue in order to reduce risks of a business operator. Even though you utilize the PPP system, a city needs to consider standard specifications such as facility capacity. In other words, a city should not entrust the whole work to a private party, but needs to collaborate with the private party while maintaining the responsibility as a government entity.

(2) Development of operation system after introducing a solution

After introduction, a solution should be properly operated and managed. If you have neither human resources nor knowledge to properly operate or manage the solution, the introduced solution cannot exert its effect. For example, if you introduce a legal system, knowledge to review the status of enforcement, such that the system operates as expected, is required to review current status and make improvements. For another example, if you introduce equipment, human resources to manage and maintain the equipment are required to repair when it is out of order, and to maintain the best condition to operate and demonstrate the primary performance. Even though the introduction of solution makes recycling possible, you cannot continuously recycle waste unless recyclable target waste is continuously generated or unless a market for recycled products is created.

Prior to the introduction of a solution, you need to consider an operation system, get required knowledge, and foster human resources.

(3) Promotion and awareness raising

The resource circulation and waste management sector deals with waste of which citizens dispose, and therefore citizens need to understand waste appropriate treatment and the necessity of recycling. Cooperation with citizens can efficiently implement waste management and recycling. For example, teaching how to separate waste and what the separated waste resources will be recycled into, deepens people’s understanding, and promotes their cooperation. Promotion and awareness raising activities for citizens can be distribution of materials, and explanation at meetings among residents

as well as collaboration with schools and NGOs.

In addition to citizens, business operators and individuals who currently deal with waste management and recycling need to know appropriate waste management and recycling methods. In the long run, accurate knowledge and experience of the business operators and individuals who currently engage in waste management and recycling will make appropriate waste management and recycling possible, which leads to protection of environment and the health of people engaging in waste management and recycling. Examples of education and awareness raising are distribution of reference materials and explanation at meetings with stakeholders. You can also consider development of a qualification or licensing system.

In some cities, the range of individual works of municipal staff is unclear or there is no budget for their work, so that activities in the resource circulation and waste management sector may not be carried out. In that case, you should recognize the necessity and importance of activities in the sector, and conduct activities for improving capacity. Examples of capacity building are distribution of reference materials and participation in training program offered by international organization or other economies. When some economies have insufficient education infrastructure, you should start establishing infrastructure for basic and higher education.

3.3 Verification of solution after introduction

A certain period after introducing a solution, you should measure the effect, and verify whether the solution is properly selected and implemented.

As aforementioned in the points to consider in solution selection in section 3.1.2, you should monitor indicators and verify the effect based on preset goals, targets, and indicators to verify the effect after the introduction of a solution. Reference document shows the lists of points to be checked for expected effects when you review goals, targets, and indicators as well as verify the effect.

When you do not find any effects even a long enough time after the introduction of a solution, effects may not be exhibited because of inadequate introduction and operation of related policy packages, and technologies and systems. Actual cases of an economy or region which already introduced solutions may be useful.

Furthermore, when you find the effect, please continue monitoring and verifying further effects to last. In addition, other new solutions should be reviewed and introduced in order to develop into a sustainable city.

Table1. How to consider solution selection・Examples of solutions

Evaluation axis		How to consider solution selection	Examples of solutions the policy package	Examples of solutions technologies and systems
Governance		➢ It is preferable to develop legal systems for waste management and efficiently utilizing resources at the national and municipal levels. ➢ If legal systems are already developed, the implementation level should be monitored. If legal systems are not properly enforced in accordance with the objectives, reconsider the legal systems themselves or improve the enforcement capacity and management.	a. Establishing a legal system for waste management b. Establishing a legal system for efficient utilization of resources (including environmentally friendly design) c. Developing a system for promoting collection and recycling d. Supporting for technology development e. Developing an incentive system (e.g. public procurement, group collections, and preferential treatment) f. Education and awareness raising g. Establishing Eco-Towns h. Risk communication i. Waste information sharing	
Municipal waste	Generation	➢ A certain period of time is necessary to reduce waste generation. Many solutions need to be applied for a longer period. ➢ This solution may be considered in combination with solutions on other axes.	a. Promoting a waste charging system b. Establishing rules of segregated collection	a. Waste reduction technology at sources (e.g. dehydration and drying of food residue) b. Home composting
	Collection and transport	➢ Increasing a municipal waste collection rate is important. ➢ Waste collection and transport expenses account for a larger share of the total waste management cost. If they account for a larger share, measures for improving efficiency and cost structure should be reviewed.	a. An approval and license system for collection and transport operators b. Developing collection methods c. Transfer stations	a. Compaction trucks b. A vehicle dispatching system
	Sorting	➢ For efficient use of resources and for appropriate treatment of hazardous waste, it is advisable that waste is sorted prior to treatment. ➢ It is important to separate waste at source, but separate collection needs the cooperation of residents and takes a lot of time before this practice is firmly established. Thus, it is necessary to consider the acceptability to residents. ➢ Waste can be sorted either manually or mechanically. There are various kinds of mechanical sorting equipment. An approach should be selected based on such factors as the type of waste to be sorted, the efficiency of the procedure, and the ease of introduction of the sorting system.	a. Implementing segregated collection b. Installing a sorting center	a. Sorting technology
	Appropriate treatment and recycling	➢ A landfill site has limited capacity. For this reason, it is important to pretreat waste before it is landfilled. ➢ Waste can be pretreated by biological treatment or incineration. A city may adopt either of treatment methods based on such considerations as treatment quantity, waste composition, climate, industry, and awareness of residents. ➢ As most waste residue from pre-treatment is recyclable, it is advisable to make its efficient use, instead of sending it to a landfill site. ➢ When you recycle waste, you should consider creating a market for recycled products.	a. Facilitating development of appropriate treatment and recycling technologies	a. Incineration and recovery of incineration residue b. Methane fermentation c. Composting d. Feed producing technology e. Recycling technology (e.g. metal, glass, plastic, and paper) f. Fuel producing technology (e.g. carbonization, RDF, and plastic oil) g. Compression treatment h. Shredding treatment
	Landfill (Final disposa)	➢ To maintain sanitation and environment, it is important to dispose waste at a managed landfill site, not at an open dump, and construct a landfill site according to the required capacity. ➢ If residual life years of a landfill site become short, it is necessary to develop a new landfill site. However, it is also desirable to work out measures to reduce the amount of waste brought into the site (e.g. reduction in waste generation and recycling).	a. Constructing a managed landfill site b. Promoting technology for reducing amount of waste landfilled	a. Technology for designing and constructing landfill sites b. Landfill site management technology

Table1. How to consider solution selection・Examples of solutions

Evaluation axis	How to consider solution selection	Examples of solutions the policy package	Examples of solutions technologies and systems
Hazardous waste	➢ To understand the current situation, it is important to conduct a survey on generation and disposal of hazardous waste. ➢ Hazardous waste specified in the national law or the Basel Convention needs to be removed as much as possible at the time of collection and will likely be processed in a separate flow of treatment. For this purpose, it is important to increase the separate collection rate. ➢ Hazardous waste detoxification needs cost and high level technology. In addition, the amount of hazardous waste generated is less than that of non-hazardous waste. For this reason, it is often difficult to operate detoxification facilities. ➢ Acceptable technologies should be reviewed after an appropriate measure is established to store and treat hazardous waste.	a. Developing a scheme for collecting hazardous substances b. Mandatory appropriate treatment of hazardous substances	a. Hazardous waste treatment technology b. Technology for managing a hazardous waste landfill site
E-Waste	➢ To understand the current situation, it is important to conduct a survey on e-waste generation and disposal. ➢ E-waste is composed of useful resources. However, it contains hazardous substances. ➢ E-waste should be separately collected, thereby raising separate collection rate. In addition, measures to appropriately treat e-waste should be established. ➢ A scheme including a guideline through a process of inspecting, repairing, and managing end-of-life products into reusable products, should be introduced. ➢ A scheme should be established to ensure the safety of secondhand products. In addition, a wider variety of products should be reused. ➢ A scheme for appropriately treating disposable and non-reusable products should be considered. ➢ Most resources are recyclable. Waste should be recycled first if it permits easier and less expensive use of technology. ➢ When you recycle waste, you should consider creating a market for recycled products.	a. Mandatory recycling b. A system for promoting reuse of electrical and electronic equipment c. Second hand market	a. E-Waste recycling technology b. CFC recovery and treatment technology c. Compression and shredding treatment d. Advanced sorting e. Burn-in test and repair technology for reused electrical and electronic equipment
Motor vehicles	➢ To understand the current situation, it is important to conduct a survey on generation and disposal of end-of-life-vehicles. ➢ Vehicles are composed of useful resources. Most of such resources are recoverable. However, the resources contain hazardous substances. ➢ End-of-life vehicles should be collected separately, thereby raising separate collection rate. In addition, measures to appropriately treat end-of-life vehicles should be established. ➢ A scheme including a guideline through a process of inspecting, repairing, and managing end-of-life-vehicles into reusable vehicles, should be introduced. ➢ A scheme should be established to ensure the safety of secondhand vehicles. In addition, a wider variety of products should be reused. ➢ A scheme for appropriately treating disposable and non-reusable products should be considered. ➢ Most vehicle resources are recyclable. Waste should be recycled first if it permits easier and less expensive use of technology. ➢ When you recycle waste, you should consider creating a market for recycled products.	a. Mandatory recycling b. A system for promoting reuse of vehicles and the parts c. Vehicle inspection and registration system	a. Material recycling of ASR* b. Thermal recovery of ASR c. Material recycling of plastics d. CFC recovery and treatment technology e. Compression and shredding treatment f. Advanced sorting g. Inspection and assembly technology of reused parts of vehicles *ASR means an abbreviation of Automobile Shredder Residue.
Construction waste	➢ To understand the current situation, it is important to conduct a survey on generation and disposal of construction and demolition waste. ➢ Construction waste contains mixtures of various substances. It is especially important to separate waste at source. ➢ As construction waste contains hazardous substances, appropriate treatment measures should be established with top priority. ➢ In addition to the above, most resources are recyclable. Waste should be recycled first if it permits easier and less expensive use of technology. ➢ When you recycle waste, you should consider creating a market for recycled products.	a. Mandatory recycling b. Promoting long life buildings	a. Concrete and asphalt recycling technology b. Wood recycling technology c. Construction sludge recycling technology d. Compression and shredding treatment