ANNUAL REPORT

ON THE ENVIRONMENT IN JAPAN 2019

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PREFACE

The Japanese government has proposed a vision of the "Circular and Ecological Economy" in the Fifth Basic Environment Plan approved by the Cabinet in April 2018. The Circular and Ecological Economy is an idea that aims to develop self-reliant and decentralized societies by leveraging regional resources, including natural and environmental resources, and maximizing regional vitality by taking advantage of these various resources while complementing and supporting other areas, taking into account the unique characteristics of each region.

The Circular and Ecological Economy is one of the keys to the integrated improvement of the environment, the economy, and society – the three dimensions of sustainable development – and is Japan's vision for the future towards creating a decarbonized society and achieving the Sustainable Development Goals (SDGs), by unlocking the potential of mountainous, agricultural and fishing villages, and cities.

In this report, we first briefly introduce ways to create the "Circular and Ecological Economy", and then consider domestic and international circumstances and efforts to adapt to the impact of climate change, and describe resource circulation systems for plastics, including local government policies and actions by businesses.

This report is an English-language digest of parts of Japan's Annual Report on the Environment, the Sound Material-Cycle Society and Biodiversity, which was approved by the cabinet on June 7, 2019.

CREATION OF A CIRCULAR AND ECOLOGICAL ECONOMY

The environmental, economic, and social challenges which Japan faces are linked, are set to become ever more complex, and involve issues that have a major impact on regions throughout the country. Against this background, as described in the Fifth Basic Environment Plan, regions will demonstrate their strengths by utilizing their unique characteristics, thereby building a self-reliant and decentralized society where different resources are circulated within each region. Neighboring regions will complement and support each other by providing local resources, to create a Circular and Ecological Economy.

This chapter introduces work that has already begun around the country toward making the Circular and Ecological Economy a reality.

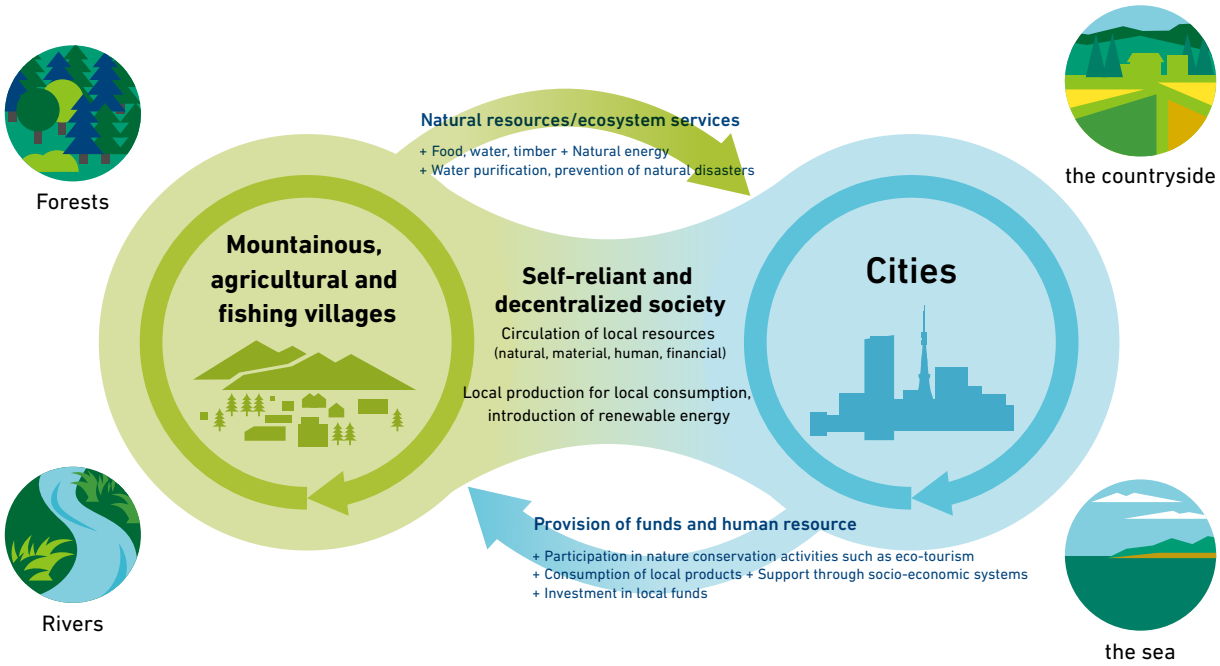
1

SUSTAINABLE COMMUNITY DEVELOPMENT THROUGH THE CREATION OF A CIRCULAR AND ECOLOGICAL ECONOMY

The Circular and Ecological Economy" is a new concept. It refers to new avenues for growth that will use local resources to create new business opportunities and improve the quality of life, for integrated improvements of the environment, economy and society. The idea is that each region will take advantage of its own resources and participate together with other regions in the formation of areas where different resources are used in a self-reliant and distributed fashion, for sustainable resource circulation. While creating innovations across all perspectives including socio-economic systems, lifestyles, and technologies, each region will carry out symbiotic exchanges with neighboring regions according to the unique characteristics of each region, to form networks across wider areas. Partnerships built via natural connections (connections among forests, the countryside, rivers and the sea) and economic connections (including human resources and funding) are needed to allow regions to support each other with their own local resources.

The creation of Circular and Ecological Economy is not only beneficial for mountainous, agricultural and fishing villages but also for cities. People in urban areas could become more aware of the fact that they are supported by agricultural, forestry, and fishing products from mountainous, agricultural and fishing villages, and other benefits from nature (ecosystem services). In other words, the Circular and Ecological Economy is a concept to maximize the vitality of all regions, making full use of mountainous, agricultural and fishing villages as well as cities.

Conceptual illustration of Circular and Ecological Economy



Source : Ministry of the Environment

CONSTRUCTION OF A CIRCULAR AND ECOLOGICAL ECONOMY

Utilization of local renewable energy

Community development can begin with the introduction of renewable energy. Profits from renewable energy projects can be devoted to programs such as child care support or the development of new industries. Relationships built up via the supply and demand for energy can encourage networking within the region and motivate exchanges between cities and mountainous, agricultural and fishing villages.

In Japan, there are many examples of local energy companies that supply energy generated from local renewable energy resources. Such local initiatives are becoming more common throughout the country. Utilizing local resources to supply electricity is efficient, because consumption is close to production, and self-sufficiency allows local capital resources to be cycled back into the region.

Regional total energy services company supports energy saving

Hamamatsu Energy Co., Ltd. is a regional power producer and supplier. It was founded in October 2015 with funding from the city of Hamamatsu and eight companies from the Hamamatsu region and elsewhere in Japan. The company began supplying electricity from renewable energy sources in April 2016, when complete liberalization of the electricity retail market in Japan came into effect.

Taking advantage of the favorable insolation (amount of solar radiation) characteristics of this region, Hamamatsu Energy supplies renewable energy from multiple solar power plants, biomass, and other sources. Purchasers include private enterprises as well as elementary schools, junior high schools, and other public customers. In October 2018, the company supplied 16,603 kW of electric power, enabling local production for local consumption.

In addition to the purchase and sale of electric power, the company dispatches energy and management experts to medium- and small-sized businesses in the city for free-of-charge advice on ways to save energy. With the goal of becoming a total energy services company, Hamamatsu Energy is working to establish decentralized and self-reliant energy systems in areas throughout the city and to coordinate the commercial launching of smart energy projects.

Hamamatsu Hamanako Solar Power Plant

Source: Hamamatsu City

Utilization of local circulating resources

Food waste, livestock waste, sewage sludge, plastic, metal, and other materials are all local resources that will be required for the creation of a Circular and Ecological Economy. Such resources must be circulated at the optimal scale for each region and type of resource.

Although appropriate processing is always a prerequisite when dealing with waste, new approaches are possible with respect to the waste itself and also with respect to local circumstances. When resources left unused up to now are circulated at optimal scales, they can be expected to result in new businesses, new jobs, and more activity in local economies.

Circulation of hydrogen from livestock

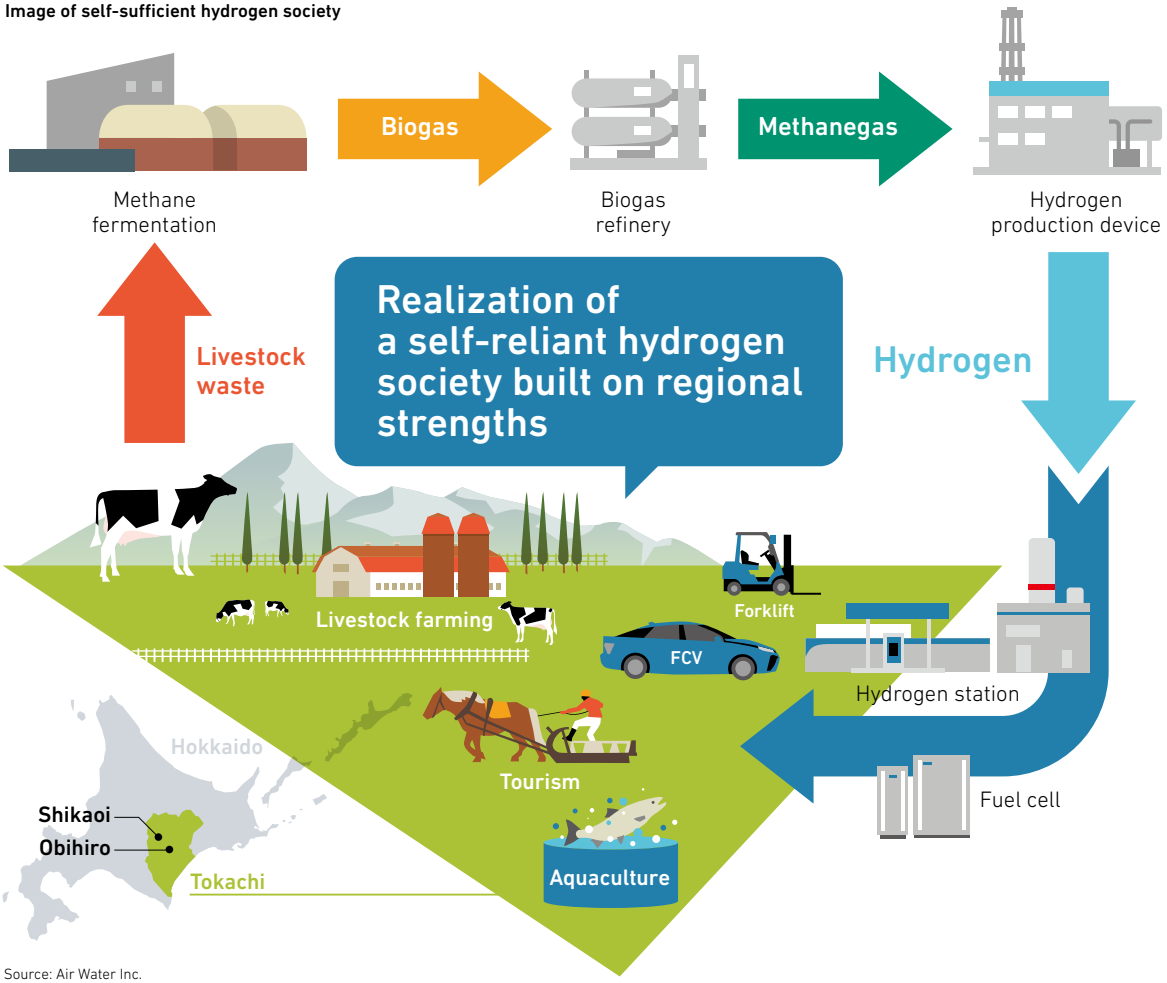
The town of Shikaoi, Hokkaido Prefecture is in a farming and dairy region that was faced with the need to process large volumes of livestock waste. It responded by introducing centralized processing in a biogas plant. The plant converts methane gas to energy, and also produces nutrient-rich fertilizer from the biogas residue. The plant lessens the burden on dairy farmers, and has a low environmental impact. Surplus heat from the facility is contributing to local industry.

Currently the plant produces hydrogen from biogas. The hydrogen is being used to power fuel cells for heat and electricity supply, and for fuel-cell autos and forklifts. Trials are underway toward establishment of a low-carbon hydrogen supply chain, with the circulation of local resources contributing to decarbonization.

Shikaoi Hydrogen Farm

Source: Air Water Inc.

Image of self-sufficient hydrogen society



Source: Air Water Inc.

Utilization of local natural resources

The rich natural bounty (ecosystem services) provided by forests, the countryside, rivers, the sea and their connectivity can be recognized as local resources. They can be used to realize cultural and local values that are unique to the area. Various activities are utilizing local natural resources to respond to demand for higher added value in local products and services.

Glamping at the national parks through tie-ups with the private sector

Glamping (glamorous camping) at the camping grounds managed by Ministry of the Environment in national parks is promoted by offering services which reflect the know-how of private companies, in cooperation with private companies and regional partners.

A model glamping project is underway at Aso-Kuju National Park, with the cooperation of Snow Peak, Inc. It features local activities and dinners of local cuisine in a dining tent. At the Yumoto Camping Ground of Nikko National Park, Wonder Wanderers Inc. is implemantig a project called "The Travelling Outdoor Hotel, The Caravan" , with local chefs and activities.

Aso Glamping
Source: Snow Peak Inc.

The Travelling Outdoor Hotel, "The Caravan"
Source: Wonder Wanderers Inc.

ADAPTING TO CLIMATE CHANGE

In recent years the impact of climate change is being felt throughout Japan. Its effects include higher surface temperature, more frequent heavy rainfall events, declining quality of agricultural products, shifting plant and animal species distributions, and a higher risk of heat illness. There is a high probability that these effects will continue and become more severe over an extended period.

To cope with climate change, protect the lives and property of the nation's citizens now and in the future, and to enable the sustainable development of society and the economy, it will be necessary to "mitigate" climate change by reducing emissions of greenhouse gases, and also to "adapt" to the effects of climate change, both those that are already apparent and those that are expected in the future, so as to avoid or reduce the damage.

This chapter will introduce Japan's efforts to adapt to the effects of climate change.

2

EXTREME WEATHER DISASTERS IN 2018

July 2018 severe rainfall

From late June through early July 2018, Japan was hit by record-breaking rainfall across wide areas, primarily in the western part of the country. These torrential rains claimed 237 lives (as of January 9, 2019) and caused extensive damage, destroying about 7,000 houses, mainly in Hiroshima, Okayama, Ehime Prefectures.

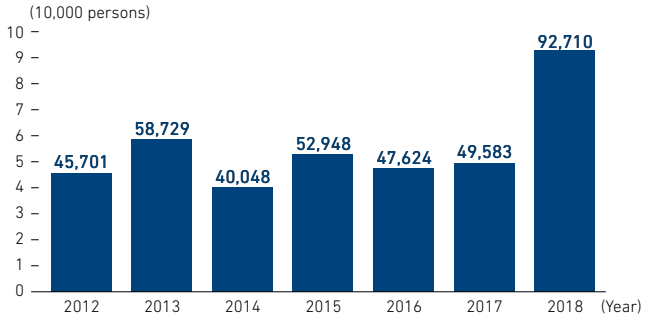
Aftermath of July 2018 severe rainfall
Source: Erosion Control Department, Hiroshima Prefecture

Intense heat

In the summer of 2018 (June through August), eastern and western Japan experienced a record-breaking heat wave. Temperatures around the country were especially high in mid to late July. On July 23, the temperature in the city of Kumagaya, Saitama Prefecture reached 41.1°C, the highest temperature ever recorded in Japan, and many other locations around Japan experienced temperatures above 40°C. In eastern Japan, the average temperature in July was the highest record since 1946 when record keeping began.

From May through September of 2018, ambulances transported 95,137 persons suffering from heat illness, showing an increase of 42,153 persons over the 52,984 persons of the previous year.

Persons transported by ambulance, by year (June through September)



Source: Fire and Disaster Management Agency

2

CLIMATE CHANGE OBSERVATIONAL EVIDENCE IN JAPAN AND FUTURE PROJECTIONS

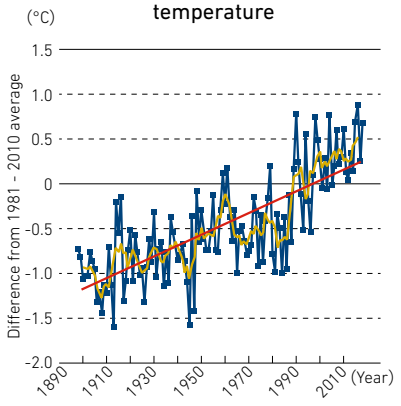
The average surface temperature is rising faster in Japan than in the rest of the world (approx. 1.21°C per 100 years vs. a global average of approx. 0.73°C). Assuming that ambitious measures are taken to achieve a low greenhouse gas concentration level (RCP2.6 scenario), temperatures at the end of the 21st century are expected to be from 0.5 to 1.7°C higher than those at the end of the 20th century. If no measures are taken (RCP8.5 scenario) they are expected to be from 3.4 to 5.4°C higher.

Days with temperatures above 30°C or 35°C have become more frequent, and are expected to become even more frequent in the future. while short heavy rainfall events have increased, the number of days without precipitation is have increased. Observational evidence and projection of future climate change effects include a further increase of events with extreme precipitation, even fewer days without precipitation , and increasing volume of precipitation during heavy rain events.

Climate change observations and future projections

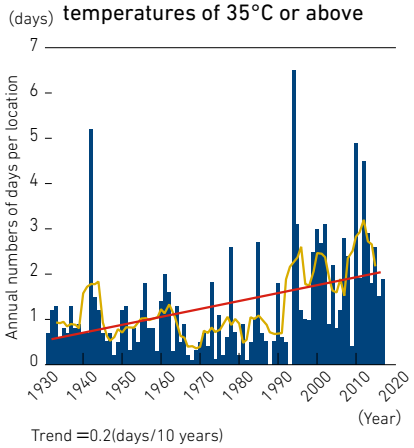
Climate change observations

Annual mean surface temperature



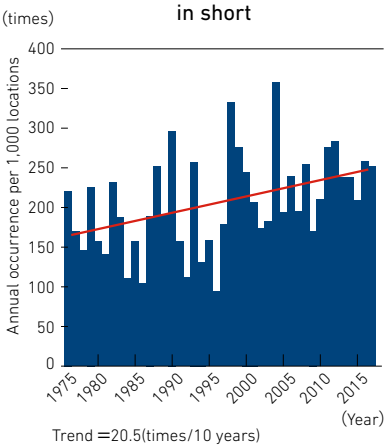
Trend = 1.21 (°C/century)
Annual mean surface temperature deviation in Japan

Number of days with a maximum temperatures of 35°C or above



Trend =0.2(days/10 years)
[Average of 13 locations] Daily maximum temperature
Number of days with a maximum temperatures of 35°C

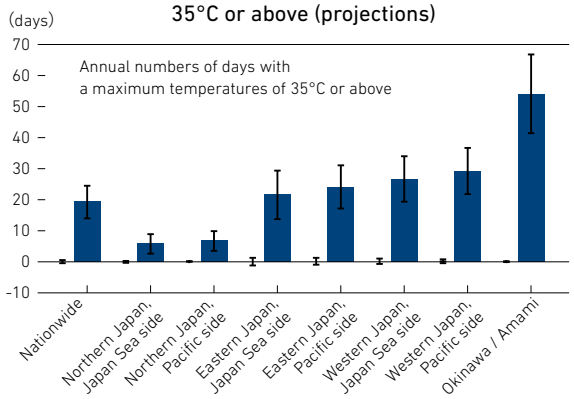
Occurrence of heavy rainfall in short



Trend =20.5(times/10 years)
[AMeDAS] Annual occurrences of 50 mm or more of rainfall per hour

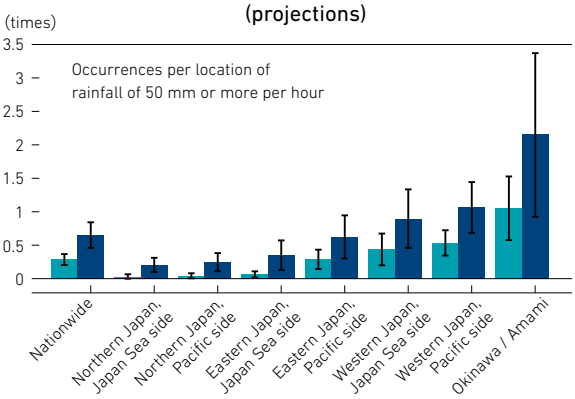
Projected climate change

Number of days with a maximum temperatures of 35°C or above (projections)



Difference between average of 1980 through 1999 and average of 2076 through 2095
Based on projection under RCP8.5 scenario

More heavy rainfall in short (projections)



average of 1980 through 1999
average of 2076 through 2095
Based on projection under RCP8.5 scenario

Source: Japan Meteorological Agency

3

IMPACT OF CLIMATE CHANGE IN JAPAN

As information about climate change is collected and evaluated, more has become known about its impact in Japan. In February 2018, four government ministries (the Ministry of the Environment; the Ministry of Education, Culture, Sports, Science and Technology; the Ministry of Agriculture, Forestry and Fisheries; and the Ministry of Land, Infrastructure, Transport and Tourism) and the Japan Meteorological Agency published a joint report entitled "Synthesis Report on Observations, Projections and Impact Assessments of Climate Change, 2018: Climate Change in Japan and Its Impacts". The impact of climate is becoming apparent not only in the environment and ecosystems, but also in various ways throughout society and the economy, although the impact varies indifferent regions. There is concern that adverse effects will spread further in the future.

Example of climate change impacts

Agriculture, forests & forestry, fisheries

Decreased growth and lower quality due to high temperatures

White immature grain in paddy field rice

Peel puffing in mandarin oranges

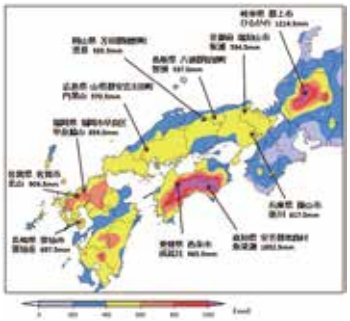
Natural ecosystems

Coral bleaching

Shrinking areas inhabited by Japanese rock ptarmigan

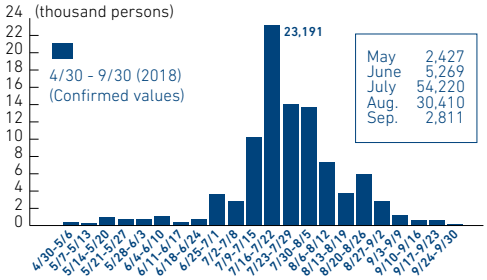
Natural disasters & coastal areas

More frequent heavy rains



Heat illness, infectious diseases

Increased risk of heat illness
Ambulance transport for heat illness patients (2018)
(Values for each week from start of survey)



Northward expansion of the Asian tiger mosquito, a transmitter of dengue fever

Sources: Ministry of Agriculture, Forestry and Fisheries; Japan Meteorological Agency; Fire and Disaster Management Agency; National Institute of Infectious Diseases

4

LONG-TERM LOW GREENHOUSE GAS EMISSION DEVELOPMENT STRATEGY

In accordance with the Paris Agreement, Japan had been considering long-term low greenhouse gas emission development strategy. The Prime Minister has established a meeting made up of experts from finance, business, academia, and local government which was charged with discussing basic policy directions.

On the basis of recommendation from the meeting, "Long-term Strategy under the Paris Agreement" was approved by the cabinet and submitted to the United Nations in June 2019. The strategy sets forth a vision of the achieving a "decarbonized society" as early as possible in the second half of this century. To enable it, realizing a "virtuous cycle of environment and growth" through business-led disruptive innovation is included as a basic concept.

5

ADAPTATION INITIATIVES BY GOVERNMENT ORGANIZATIONS

Initiatives in Japan

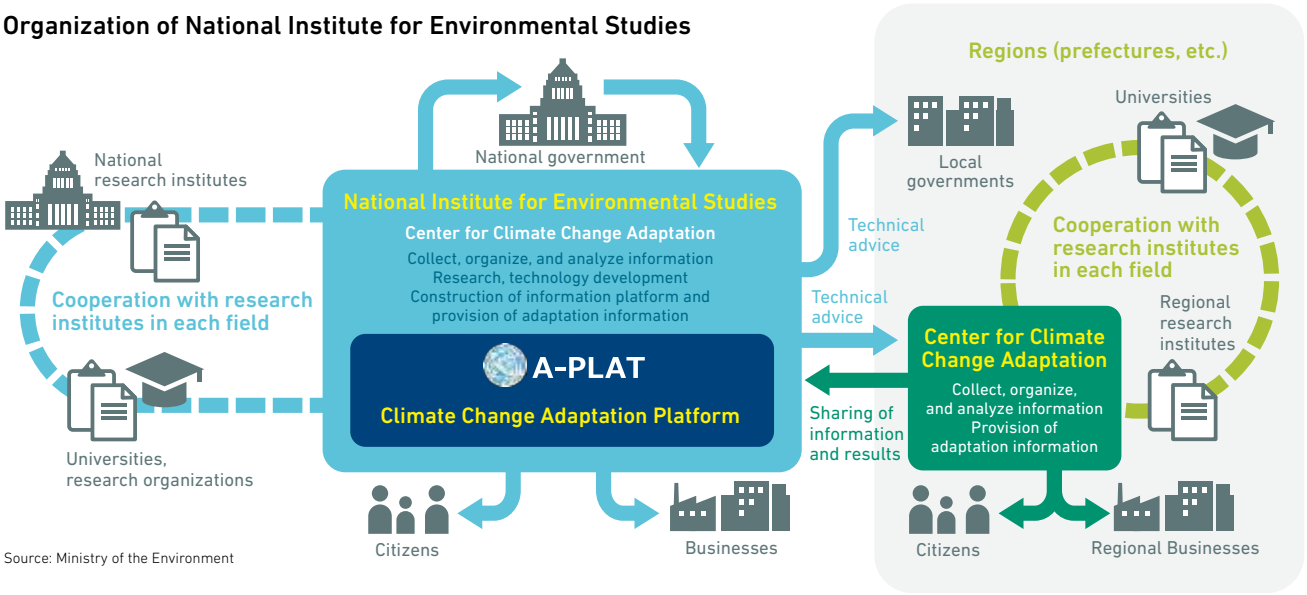
The impact of climate change is already evident in Japan. The government's National Adaptation Plan, formulated on the basis of the latest scientific findings, was approved as a cabinet resolution in November 2015. Since then, government agencies have planned and implemented adaptation measures in their various areas of responsibility, while the Ministry of the Environment has worked with other government agencies to implement basic policies.
In June 2018, the Climate Change Adaptation Act was passed by a unanimous vote of the Diet.
It came into force in December of the same year, clarifying the legal status of adaptation measures.

The Climate Change Adaptation Act 1) clarifies the roles that should be played by the national and local governments, businesses, and citizens in adapting to climate change; 2) prescribes that the government shall draw up a National Adaptation Plan to promote adaptation measures in agriculture, disaster prevention, and other fields; and 3) prescribes that the Ministry of the Environment shall evaluate the impact of climate change approximately once every five years, and amend the Plan as appropriate after a comprehensive review of the evaluation and other factors.

The government's role is to promote adaptation measures on the basis of the National Adaptation Plan in fields such as agriculture, disaster prevention, and heat illness prevention. To this end, the Act establishes a committee made up of related government agencies, chaired by the Minister of the Environment, to coordinate the promotion of adaptation measures. In December 2018, the Center for Climate Change Adaptation was established within the National Institute for Environmental Studies for the purpose of providing scientific support to actors involved in adaptation work, by collecting, organizing, analyzing and providing information related to adaptation.

Because the impact of climate change varies by region, it is also important to work in accordance with local conditions in the affected regions. The Climate Change Adaptation Act contains provisions to encourage regional and local governments to formulate their own climate change adaptation plans, and to establish local climate change adaptation centers, which will serve as centers to collect and analyze information related to local climate change impacts and adaptation.

Organization of National Institute for Environmental Studies



Source: Ministry of the Environment

International cooperation

Japan cooperates on a bilateral basis with other countries, mainly in the Asia-Pacific region, to support the assessment of climate change impacts and the formulation of National Adaptation Plans, according to the needs of each partner country. The government is working to establish a platform for the international sharing of knowledge about climate change and adaptation, with a special focus on developing countries in the Asia-Pacific region, with which Japan has close geographic and economic ties, to enable these countries to formulate and implement National Adaptation Plans based on the latest scientific findings. On June 16, 2019, at the G20 Ministerial Meeting on Energy Transitions and Global Environment for Sustainable Growth held in the town of Karuizawa, Nagano Prefecture, it announced the launch of AP-PLAT (Asia-Pacific Adaptation Information Platform), to be administered by the National Institute for Environmental Studies. Companies in Japan will be able to use AP-PLAT to make their adaptation expertise more widely available overseas.

6 ADAPTATION WORK BY BUSINESSES

Adaptation for risk management

Climate change can affect businesses in many ways, such as by flooding, supply chain disruption, crop failures, and drought. This makes it important for businesses to understand the risks they face. They need to know how to manage the risks, and how to introduce the right climate change adaptation strategies for their business operations.

National Adaptation Plans call for businesses to ensure that their operations can proceed smoothly as they prepare for climate change adaptation plans that suit the character of their business. Businesses can also contribute by cooperating with the climate change adaptation programs of national and local governments.

Stone-like water-retentive asphalt

From FY2012 through FY2017, the city of Kyoto implemented a project to bury utility lines along Ogawa-dori, a street running from north to south in the central part of the city. As part of this project, which improved the streetscape and strengthened disaster preparedness, the street was paved with stone-like water-retentive asphalt.

This pavement was created by pouring liquid cement (cement milk) over porous asphalt, then stripping off a surface layer, and finally incising a decorative pattern into the surface with a cutter. The water-retentive properties of the paving were improved by adding a mineral material that allows water to be easily absorbed and evaporated. The pavement absorbs rainfall and water sprinkled directly onto it on hot days, and keeps temperatures on the street surface down by evaporative cooling.

Ogawa-dori streetscape
Source: Kyoto City Government

Adaptation as a business opportunity

Climate change adaptation provides business opportunities through the development of adaptation technologies, products, and services. Companies involved in the adaptation business in Japan and abroad, especially in developing countries, can contribute to the climate change adaptation work of national and local governments, citizens, and other companies.

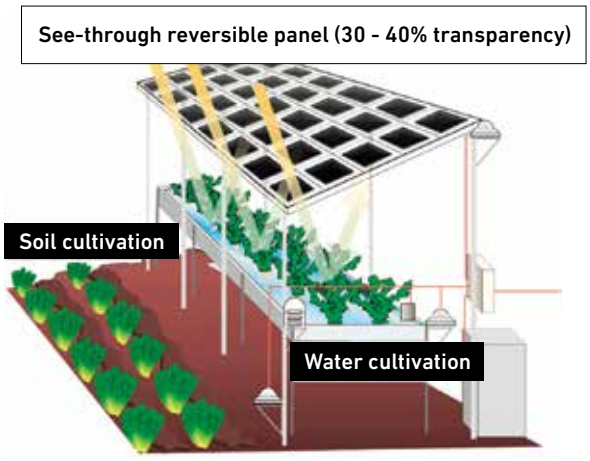
The adaptation business is the business of providing products and services to assist in the adaptation efforts of others. It can include disaster detection and warning systems, technology and products to deal with heat, and technology to help conserve water or make use of rainwater. Some Japanese companies are already helping to support mainly overseas farmers with new adaptation technologies and services. They include the use of satellite and aerial photos to help farmers to understand and analyze the state of their crops in real time, and weather index insurance for rice farmers.

Adaptation through next-generation agricultural technology and farm management systems

The Farmdo Group has introduced a high-tech agricultural system involving the generation of power by solar panels and the reclamation of abandoned fields. The system can increase yields and increase farm income through revenues from the sale of electricity.

This "Solar Farm" system installs patented translucent solar panels on greenhouses. The panels allow enough light through to grow crops underneath, and generate electricity at the same time. The system adjusts the ratio of light reaching the crops by adjusting the translucency of the solar panels. Panel adjustments are controlled automatically by IoT technology, along with temperature, moisture, and fertilizer in the greenhouse environment. The system also automatically manages the effects of the weather, enabling environmentally controlled agriculture that is not overly dependent on the climate. By giving farmers a double income, the system can help put farms on a firmer financial basis. The system has already been partially implemented in Mongolia and other overseas regions.

Solar Farm system



Solar Farm greenhouse high bench water cultivation

Source: Farmdo Holdings Co., Ltd.

3 PLASTIC POLLUTION AND THE CONSTRUCTION OF RESOURCE CIRCULATION SYSTEMS FOR PLASTICS

With their advanced functionality, plastics have contributed to the solution of many social problems, for example by reducing food waste and increasing energy efficiency. However, research indicates that because of inadequate processing practices millions of tons of plastic litter flow from land into the world's oceans every year, raising concerns over global pollution.

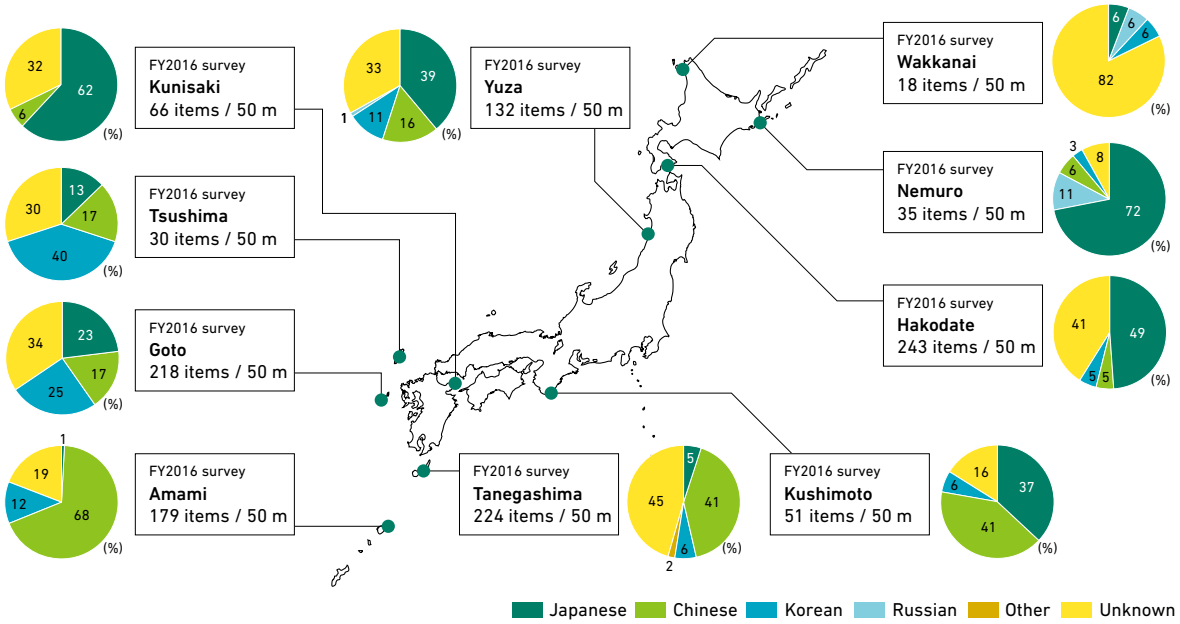
This chapter summarizes developments relating to marine plastic litter in Japan, and introduces work toward the construction of resource circulation systems for plastics.

MARINE PLASTIC LITTER - UNDERSTANDING AND ADDRESSING THE PROBLEM

Marine plastic waste causes a myriad of problems. It harms ecosystems and the marine environment. It adversely affects navigation, fishing, tourism, and the appearance and functions of shorelines. In recent years, the effect of microplastics (generally defined as plastic fragments less than 5 mm long) on marine ecosystems has become an issue of global concern.

A great deal of driftwood and marine debris washes up on the coasts of Japan. According to a FY2016 Ministry of the Environment survey of materials washed up at 10 shoreline locations around the country, natural objects accounted for the largest percentage by weight, but plastics accounted for the largest percentage by volume and by number of objects. Labels on PET bottles collected in the survey included labels in the Japanese language, indicating that the source of the debris was not limited to other countries. More needs to be done to reduce the amount of litter flowing into the seas around Japan.

PET bottle label language ratios (FY2016 survey)



Source: Ministry of the Environment

Determining the distribution of plastic litter

Many aspects of marine contamination by plastic litter are still poorly understood, including the routes over which it flows into the sea. Pirika Inc. and the Pirika Association are developing methods to measure the amount of plastic in flows of various kinds, as a first step toward understanding and solving the problem. Surveys of plastic flows must make measurements in environments such as rivers, harbors, and sewage treatment facilities. Pirika has developed a device called "Albatross" to measure the amount of plastic particles floating in water, and uses it to measure the amount of plastics in rivers, harbors, and water reclamation centers. Floating microplastic surveys extract plastic fragments from water samples. The fragments are analyzed to determine their weight, size, and composition. The results are useful in identifying likely outflow routes and devising ways to block them. Survey results are published on the Pirika website, to provide data that can help resolve the problem of microplastic waste.

Survey using "Albatross"
Source: Pirika Inc.

2

RESOURCE CIRCULATION STRATEGY FOR PLASTICS

Low reuse rates of waste plastic and the contamination of the seas by marine plastics are global problems. Japan was an early adopter of the 3Rs (reduce, reuse, and recycle) and proper processing of its own waste streams. Japan is also working to contribute internationally. On the other hand, Japan ranks second in the world in the volume of discarded containers and wrapping per person. This plastic waste must be processed domestically, because other countries in Asia are restricting imports. Against this background, Japan adopted a "Resource Circulation Strategy for Plastics" in May 2019.

The strategy is founded on the idea of "3R + Renewable" . While working to reduce both usage and emissions, it will address the problem of marine plastic litter, ahead of efforts elsewhere in the world. Japan will also export our hard and soft technologies, experience, and know-how, in an order-made packaged to suit the conditions and stage of development in the other country. It will contribute to sustainable economic development and simultaneous solutions to world problems such as resource limitations, waste management, marine plastic litter, and climate change.

Milestones

Reduce	Reuse and Recycle	Recycled and Biomass Plastics
Cumulative 25% reduction in single-use plastics by 2030	Reusable/recyclable design for all containers and packaging/products by 2025 60% rate of recycling for containers and packaging by 2030 100% effective utilization of used plastics by 2035 including circular economy	Doubled use of recycled material by 2030 Approximate 2 million ton introduction of biomass plastics by 2030

Source: Ministry of the Environment

3

PLASTICS SMART CAMPAIGN

In October 2018, the Ministry of the Environment launched a campaign entitled "Plastics Smart". It aims to mobilize individuals, local governments, NGOs, businesses, and research institutes in a movement to establish smart relationships with plastics. The campaign catalogs and publishes activities by a variety of stakeholders including:

+ Eradication of littering and illegal waste dumping
+ Collection of scattered waste
+ Reduction of single use plastics
+ Use of reusable dishware at events
+ Application of recycled/recyclable materials in the supply chain
+ R&D and application of alternative materials, such as bio-plastics and paper

Plastics Smart campaign website

Source: Ministry of the Environment

4

PROMOTING INNOVATION TOWARD THE CONSTRUCTION OF A RESOURCE CIRCULATION SYSTEMS FOR PLASTICS

Construction of resource circulation systems for plastics will reduce dependence on non-renewable resources, and encourage the use of circular and renewable resources. The introduction of natural resources will encourage capital to stay in the area instead of flowing to the outside, and will reduce the amount of waste that requires final disposal.

Growth of the circular economy can be expected to invigorate the area's economy. The following concrete examples show how a commitment to the construction of circular resource systems and the use of new technologies and local resources by private companies can help bring about a sound material-cycle society.

Paper solutions

Paper is made from wood, a renewable resource. With the recent focus on the problem of marine plastic litter, paper is expected to play a larger role as a replacement for plastic. The Nippon Paper Group is working to develop paper products for new fields that will contribute to the construction of a low-carbon, sound material-cycle society.

One of those products is SHIELDPLUS, a new paper barrier material. This product is manufactured by applying a barrier coating layer to a base paper made with 100% wood pulp, using existing technologies for manufacturing coated printing paper. This eco-friendly paper product provides a new alternative to barrier materials such as aluminum and plastic. The Group has established a paper solutions office, and is developing products such as paper drinking straws to replace plastic ones, under the slogan "Let paper do what it can do" .

Develop products that expand the application range of paper

Plastic cups	Barrier paper cups
Flexible packaging	Paper barrier material (SHIELDPLUS®)
Film packaging, plastic containers	Heat seal coating for paper, paperboard
Plastic containers, PET containers	Paper cartons
Plastic trays and containers	Paper trays
Styrofoam	Functional cardboard
Plastic straws	Paper straws
Plastic cushioning	Paper cushioning

Source: Nippon Paper Industries Co., Ltd.

Applications of SHIELDPLUS

Biodegradable plastic “BioPBS”

Mitsubishi Chemical Corporation (MCC) has developed an eco-friendly biodegradable plastic. It licenses the technology to PTT MCC Biochem, a joint venture with the PTT Group of Thailand, which produces and sells the product under the brand name “BioPBS”.
BioPBS is a plant-based biodegradable plastic that decomposes into water and carbon dioxide by the action of microorganisms that live in the soil.

Paper cups using this eco-friendly, completely biodegradable and easily recycled material became available on the market in October 2018. Applications of this material are being developed in various fields, such as food packaging and serving products (including coffee capsules, cutlery, and straws) and agricultural mulch film. The material is strong enough to replace other plastics, for example in drinking straws.

The government supports development and testing of these applications. New materials developed through cooperative public, private, and academic innovation will be vital to the evolution of plastic resource recycling. It is especially important for the high-tech materials business to be based not only in Japan but also in key markets overseas, so that Japanese technology can contribute to the emergence of a global circular economy.

Biodegradable plastic "BioPBS" applications
Source: Mitsubishi Chemical Corporation

RECONSTRUCTION AND ENVIRONMENTAL REMEDIATION AFTER THE GREAT EAST JAPAN EARTHQUAKE

On March 11, 2011, a magnitude 9.0 earthquake struck off the coast of Japan. It was the most powerful earthquake ever recorded around Japan. It generated a tsunami that caused massive damage across a wide swath of northeastern Japan, particularly along the Pacific coast. At the same time, accidents at the Tokyo Electric Power Company (TEPCO) Fukushima Daiichi Nuclear Power Plant released a large volume of radioactive materials into the environment, forcing many residents to flee to other areas.

The following examples introduce work that is being done to reconstruct and revitalize the disaster areas.

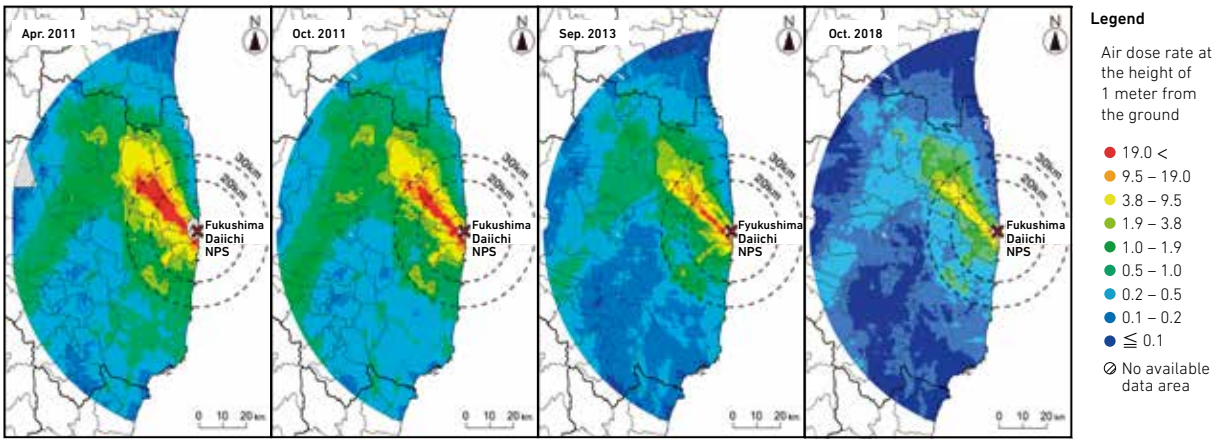
4

1

AIR DOSE RATES

According to airborne monitoring data, the air dose rate at a height of 1 m above the ground in the 80-km zone (within 80 km of TEPCO Fukushima Daiichi Nuclear Power Plant) as of October 2018 had declined by about 77% compared with that in November 2011. The radioactive materials released in TEPCO Fukushima Daiichi accident included mainly Iodine-131, Caesium-134, and Caesium-137, which have half lives of about 8 days, about 2 years, and about 30 years, respectively. From the half-lives of the radioactive materials and expected attenuation by rainfall and other natural causes, it was estimated that the amount of radiation compared with that in August 2011 would decline by about 40% after two years and about 50% after five years. Actual radiation amounts declined faster than these estimates. This is probably due to decontamination work as well as to rainfall and other natural phenomena.

Air dose rate distribution within 80 km radius of TEPCO Fukushima Daiichi Nuclear Power Plant



* The figures include air dose rate by natural radioactive nuclide.
Source: Nuclear Regulation Agency

2

ENVIRONMENTAL REMEDIATION IN AFFECTED AREAS

Decontamination of soil contaminated by radioactive materials and other remediation work

Decontamination in affected areas is mandated by law. By the end of March 2018, the national and local governments completed whole area decontamination of 100 cities, towns, and villages in eight prefectures, excluding the Difficult-to-Return-Zones (DRZ).

Soil and waste derived from the decontamination works are managed at Temporary Storage Sites (TSS). In accordance with the Guidelines on Restoration of TSS, which were approved in March 2018, TSS are restored to their original condition after removal of the contaminated soil and waste. In the DRZ, the municipalities in those areas have

drawn up plans to make reconstruction and revitalization bases, in accordance with the provisions of the Act on Special Measures for the Reconstruction and Revitalization of Fukushima, as amended in May 2017. Coordinated work under these plans include the demolition of houses and other buildings, soil decontamination, and construction of infrastructure.

The Ministry of the Environment is carrying out decontamination and demolition work in all Specified Reconstruction and Revitalization Bases: Futaba, Okuma, Namie, Tomioka, Iitate, and Katsurao.

Establishment of the Interim Storage Facility

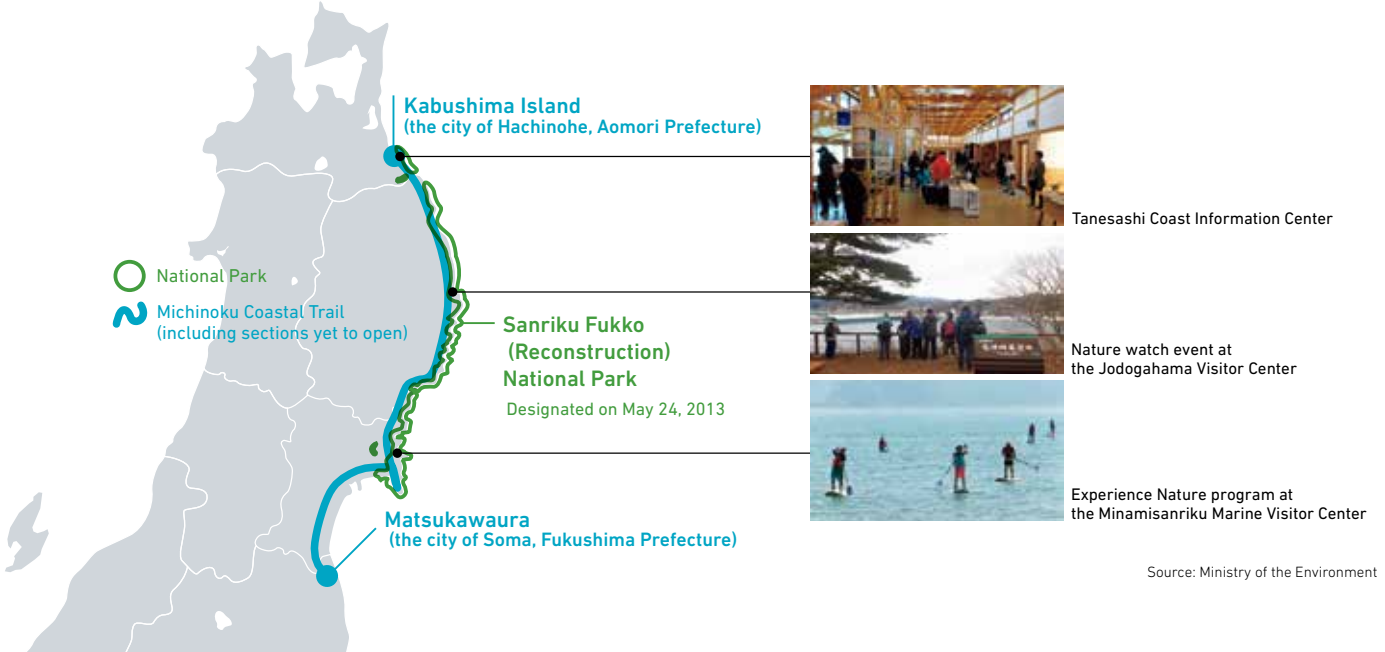
Interim Storage Facility(ISF) has been established to enable safe and centralized storage of soil containing radioactive materials that has been removed during decontamination work, and for specified waste (more than 100,000 Bq/kg of radioactive concentration) stored in Fukushima Prefecture. The ISF is used for storage until the time of final disposal. The interim storage project is guided by the "Policy on Interim Storage Facility Project in FY2019" announced in December 2018. According to this policy, transport of all removed soil and waste (except in DRZ) from TSS to the ISF will be for the most part completed by FY2021. Among the 14 million m^3 of soil and waste to be delivered to the ISF, about 2.62 million m^3 was transported by the end of FY2018. The removed soil and waste derived from decontamination works will eventually be transported for final disposal outside of Fukushima Prefecture. To this end, the Ministry of the Environment is studying ways to reduce the volume of stored soil and enable safe reuse.

Green reconstruction

The Michinoku Coastal Trail is a long nature trail that follows the Pacific coastline from city of Hachinohe in Aomori Prefecture, the northernmost prefecture on the main island of Japan, to city of Soma in Fukushima Prefecture, more than 1,000 km to the south. Sections of the trail were defined in cooperation with communities along the route. Since 2013, sections have opened one by one. The entire route opened in June 2019.

The trail passes for much of its length through the Sanriku Fukko National Park. A major objective of the project was to make the park and trail safe against natural disasters, to rebuild park facilities that were damaged by the 2011 earthquake and tsunami, and to help the disaster area recover as a tourist destination. Management of the trail is entrusted to the Michinoku Coastal Trail Natori Trail Center, established in the city of Natori in Miyagi Prefecture.

Efforts at the Sanriku Fukko (Reconstruction) National Park



Source: Ministry of the Environment

CIRCULAR and ECOLOGICAL ECONOMY（Ja

- The life-based ecosystem draws potential of people and nature i

[Self-reliance & decentralization]×[Mutual cooperation]×[Circulation & symbiosis]

= Vital **Circular a**

Ownership = Networks = Sustainability

The basis for local communities that leads growth by creating new values and bu

A life-based ecosystem by ownership & networks

Regional CES

Safe, convenient, and senior- and family-friendly transportation

Transport system that draws local attractiveness

User-friendly and attractive transportation & mobility systems

Regional CES

RE100 factories and offices

Synergy between disaster prevention infrastructure and nature with disaster prevention ability

Ownership with region and companies contributing to branding

Avoidance & reduction of damages due to the impact of climate change（Adaptation）

CASE（Connected, Autonomous, Shared & Electric）

Regional Transport business (Green-slow mobility & local public transportation)

Mobility service for elderly people

Tourism business (Ecotourism, festivals, & culture/history)

Building regional logistics hubs that can support disaster responses

Workstyle without fixed work (Remote work, VR & Workatic

Green infrastructure ECO-DRR

Vital community with integrated city planning and transportation

Regional Circu and Ecological S (Regional CE

Adaptation-related business

Disaster-resilient city planning

Regional CES

Electric distribution network underground for disaster prevention, landscape, renewable energy

Utilization of vacant buildings and spaces

Renovation and utilization of aging infrastructure

Renewable energy business (wind power)

Regional energy busine

Centers for disaster management utilizing renewable energy

Disaster-resilient energy systems and infrastructure

Heat exchanges business

Zero energy houses and buildings (ZEH/ZEB)

Hybrid electric pow by both local gr

Renewable heat energy utilization

Energy distribution and retail business

Waste to Energy & heat use

Battery & hydrogen storage

Supplying materials and products to support decarbonization

Co-generation with CO2-free gas

CO2-free gas (Hydrogen methanation technology)

Autonomous a decentralized en systems

Local production & consumption and interregional exchange of energy

Manufacturing Industry

Next generation and high quality main grid with digital technology

"Society 5.0" and improved productivity c

Green manufacturing process with The world's most advanced and the highest standards

IoT AI BIG DATA Robotics

5.0 Ultra smart society

4.0 Information society

pan's vision to realize decarbonization and SDGs)

n local communities by integrating the cyber and physical space -

nd Ecological Economy ⇒ Achieving decarbonization & SDGs, and to the world

human security and youth & women's empowerment as a basis

sinesses

Richness can be spread out nationwide as a self-reliant region having organic linkages with other regions enables people to live a healthy and lively life with happiness and pride

Local communities in harmony with water circulation

Regional CES

Regional CES

Shift in consumption from "goods" to "experiences" for a healthy, rich, and happy life

Good life with rich nature and its blessings as stock

Healthy lifestyles with a feeling of connected with nature

Creation empathy and impression (through culture, art, history & sports)

Organic business for clothes/food/housing
(easy-wear, stylish organic material clothes)
(organic cosmetics kind to skin and environment)
(local production for local consumption/direct delivery of organic produce from farming, fishing, etc.)
(Resident-friendly, long-life housing using local materials)
(vitalization of local shops using local organic goods)
Sustainable fashion

Services for families with the elderly and infants

NOASOBI (experience local nature, scenery, food & culture)

Locally-managed energy businesses
Local resource based tourism businesses

Universities, tech-colleges, and research institutions as "intellectual sources"

Inheriting and rediscovering tacit knowledge and techniques (education for next generation and interactions among generations)

Local solution-based business
(Facilitating business and tourisms by utilizing local resources incl. existing facilities and abandoned crop fields, etc. Local education and human resource development)

Health Business (local comprehensive care system, agricultural cooperation, etc.)

Creation of jobs with a feeling of fulfilled, passion, and pride

Regional CES

ular Sphere CS)

Resource circulation business (advanced recycling of waste, food, plastics, etc.)

Business support through local finance, ESG finance, and local funds

Diverse business creation

distribution ess

Creation of new value chains

Renewable energy business (biomass)

Solar sharing

EcoAction 21

Circular innovation based on restoring to original materials

er system supported id and main grid

Power aggregation business

Low carbon logistics with IoT

ESG management of small and medium businesses

Materials from CO2

Recycling from waste plastics

Renewable energy business (photovoltaics)

recycling

spinning

manufacturing

Cluster EV charge and discharge management business

Human Resources

Goods

Finance

Information

nd nergy

supports local renewable energy businesses

Next-generation distribution network of resources and products with IoT etc.

Innovative manufacturing

reate "Circular and Ecological Economy"

3.0

2.0

1.0

Industrial society

Agricultural society

Hunter/gatherer society

Biomass

CNF

CLT

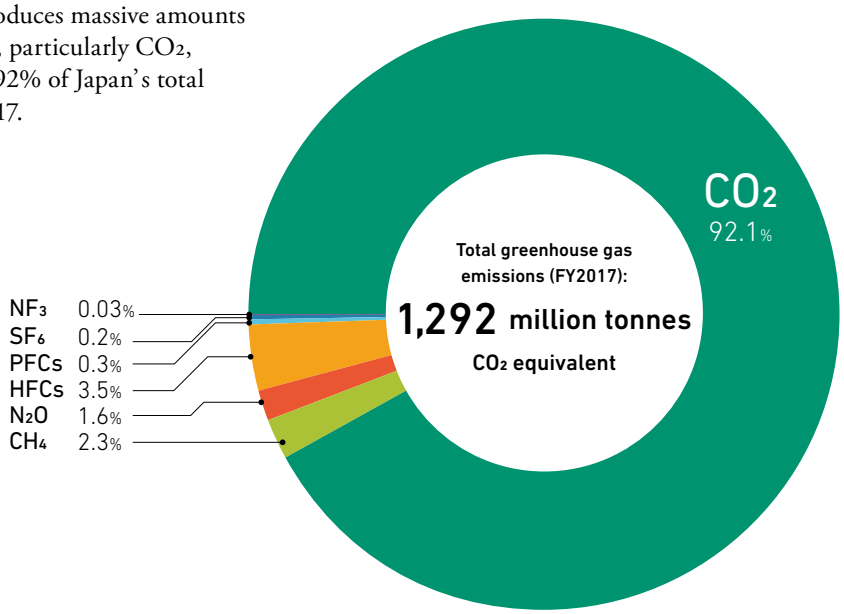
Biomass plastic

Material innovation based on organic materials

ADDITIONAL MATERIALS FROM THE 2019 ANNUAL REPORT ON THE ENVIRONMENT

Breakdown of Greenhouse Gas Emissions in Japan (FY2017)

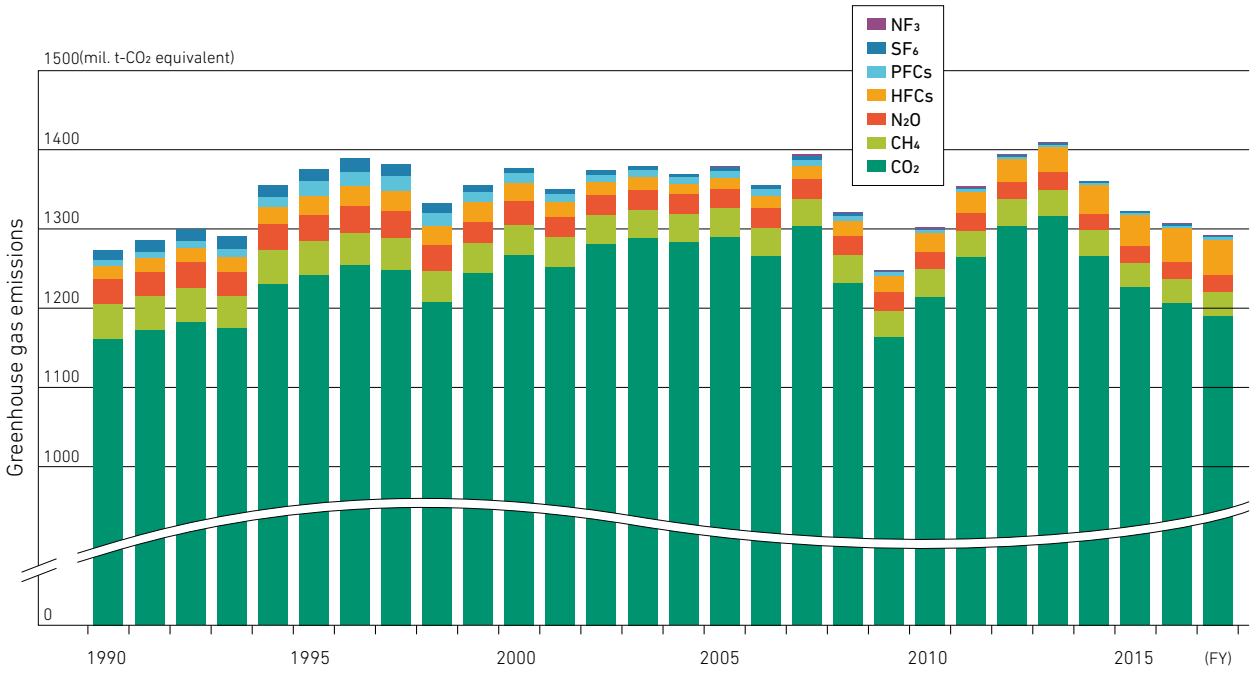
Globally, fossil fuel combustion produces massive amounts of anthropogenic greenhouse gases, particularly CO_2, which accounts for approximately 92% of Japan's total greenhouse gas emissions in FY 2017.



Source: Ministry of the Environment

Greenhouse Gas Emissions in Japan

Japan's total greenhouse gas emissions in FY 2017 were equivalent to approximately 1,292 million tonnes of CO_2, a 1.2% drop from the previous year. This was due to the decrease in energy consumption through energy conservation, and the increase in the share of non-fossil fuels within the domestic energy supply.



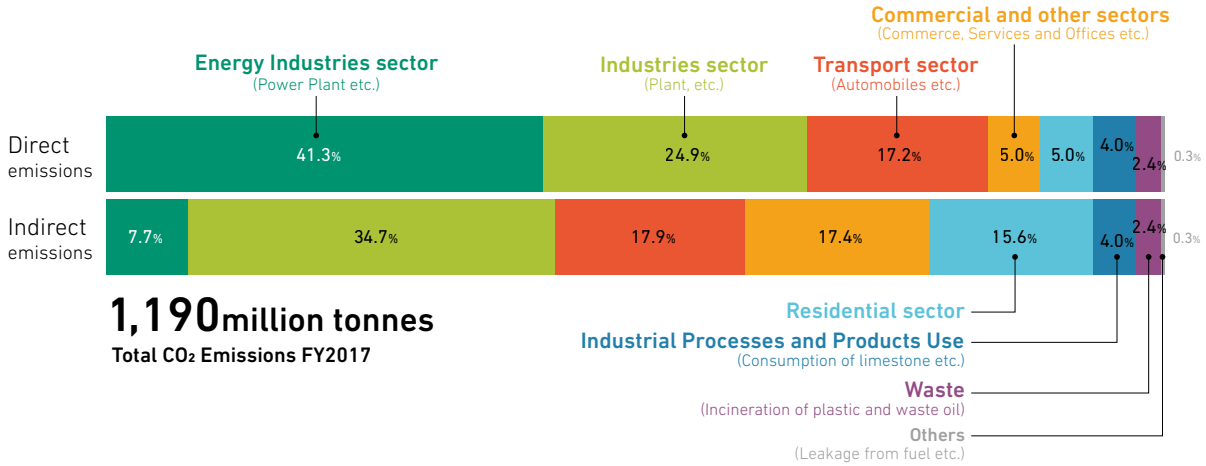
Source: Ministry of the Environment

Decarbonized society

Additional materials provide more details about the global warming issue.

Breakdown of CO_2 Emissions by Sector

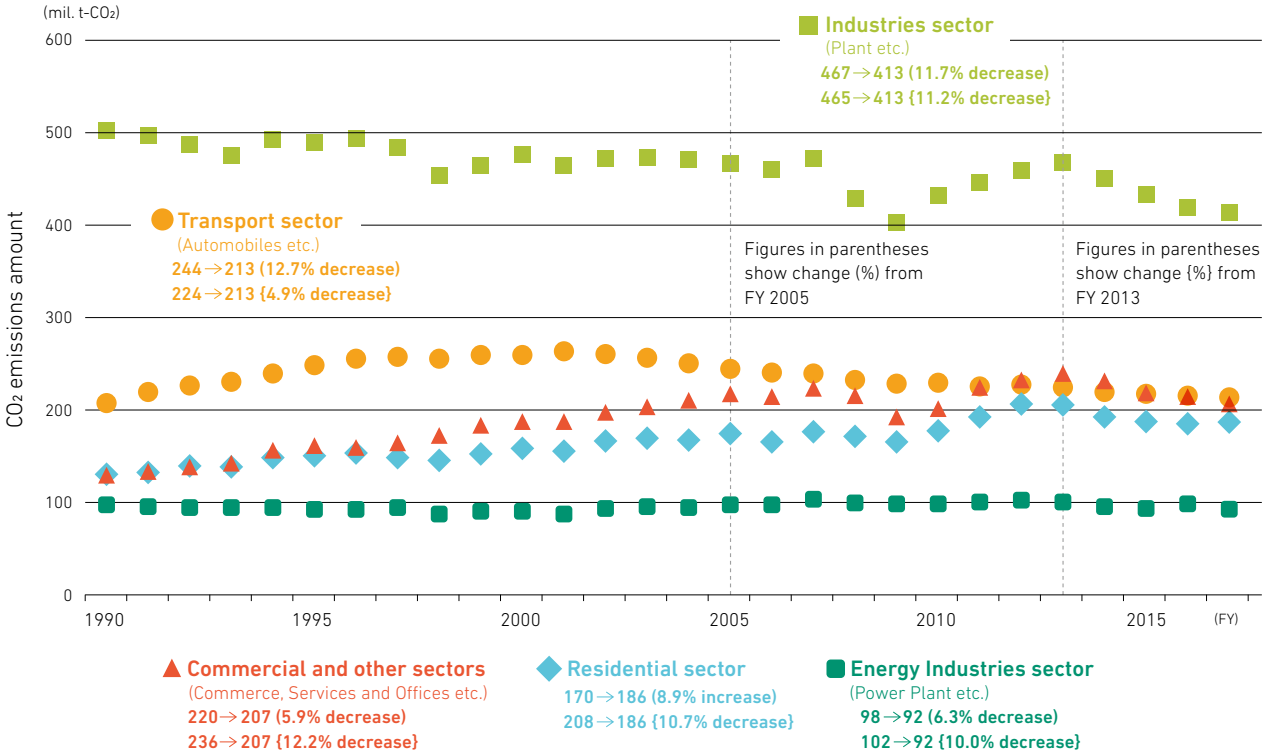
The sector with the largest CO_2 emissions in indirect emissions in FY 2017 was industries sector, accounting for approximately 34.7% of Japan's total.



Source: Ministry of the Environment

Energy originated CO_2 Emissions by Sector (Indirect Emissions)

Plotting energy originated CO_2 emissions by sector reveals that emissions in every sector decreased from FY 2013.



Source: Ministry of the Environment

ADDITIONAL MATERIALS FROM THE 2019 ANNUAL REPORT ON THE ENVIRONMENT

Threatened Species in Japan

With an increasing number of species being put on the Red List, which publicizes threatened species, it is clear that the circumstances of wild fauna and flora in Japan continue to be severe.

(Reported in Jun 2019)

	Taxon	Species Targeted for Evaluation	Extinct	Extinct in the Wild	Threatened Species			Near Threatened	Data Deficient	Total of listed species	Endangered Local Population
					Endangered Class I		Endangered Class II				
					Class IA	Class IB					
			EX	EW	CR	EN	VU	NT	DD		LP
Fauna	Mammals	160 (160)	7 (7)	0 (0)	**33(33)**		9(9)	18 (18)	5 (5)	63 (63)	23 (23)
					24(24)						
					12(12)	12(12)					
	Birds	Approx. 700 (Approx. 700)	15 (15)	0 (1)	**98(97)**		43(43)	21 (21)	17 (17)	151 (151)	2 (2)
					55(54)						
					24(23)	31(31)					
	Reptiles	100 (100)	0 (0)	0 (0)	**37(37)**		23(23)	17 (17)	4 (4)	58 (58)	5 (5)
					14(14)						
					5(5)	9(9)					
	Amphibians	76 (76)	0 (0)	0 (0)	**29(29)**		12(12)	22 (22)	1 (1)	52 (52)	0 (0)
					17(17)						
					4(4)	13(13)					
	Brackish water and freshwater fish	Approx. 400 (Approx. 400)	3 (3)	1 (1)	**169(169)**		44(44)	35 (35)	37 (37)	245 (245)	15 (15)
					125(125)						
					71(71)	54(54)					
	Insects	Approx. 32,000 (Approx. 32,000)	4 (4)	0 (0)	**363(363)**		186(186)	350 (350)	153 (153)	870 (870)	2 (2)
					177(177)						
					71(71)	106(106)					
	Shellfish	Approx. 3,200 (Approx. 3,200)	19 (19)	0 (0)	**616(616)**		328(328)	445 (445)	89 (89)	1169 (1169)	13 (13)
					288(288)						
					33(33)	16(16)					
	Other invertebrates	Approx. 5,300 (Approx. 5,300)	0 (0)	0 (1)	**65(65)**		43(43)	42 (42)	44 (43)	151 (151)	0 (0)
					22(22)						
					0(0)	2(2)					
	Subtotal of Fauna		48 (48)	1 (3)	**1410(1409)**		688(688)	950 (950)	350 (349)	2759 (2759)	60 (60)
					722(721)						
Flora	Vascular plants	Approx. 7,000 (Approx. 7,000)	28 (28)	11 (11)	**1786(1786)**		741(741)	297 (297)	37 (37)	2159 (2159)	0 (0)
					1045(1045)						
					525(525)	520(520)					
	Bryophytes	Approx. 1,800 (Approx. 1,800)	0 (0)	0 (0)	**241(241)**		103(103)	21 (21)	21 (21)	283 (283)	0 (0)
					138(138)						
	Algae	Approx. 3,000 (Approx. 3,000)	4 (4)	1 (1)	**116(116)**		21(21)	41 (41)	40 (40)	202 (202)	0 (0)
					95(95)						
	Lichens	Approx. 1,600 (Approx. 1,600)	4 (4)	0 (0)	**61(61)**		20(20)	41 (41)	46 (46)	152 (152)	0 (0)
					41(41)						
	Fungi	Approx. 3,000 (Approx. 3,000)	26 (26)	1 (1)	**62(62)**		23(23)	21 (21)	50 (50)	160 (160)	0 (0)
					39(39)						
	Subtotal of Flora		62 (62)	13 (13)	**2266(2266)**		908(908)	421 (421)	194 (194)	2956 (2956)	0 (0)
					1358(1358)						
	Total of thirteen taxonomic groups		110 (110)	14 (16)	**3676(3675)**		1596(1596)	1371 (1371)	544 (543)	5715 (5715)	60 (60)
					2080(2079)						

* Numerals within parentheses indicate the respective numbers of species (including subspecies, variety (only for flora) and form (only for algae and fungi)) from the Red List 2018. The numbers in the LP column are the numbers of local population. ** The number of species excluding those that cannot be evaluated by the naked eye.

The categories are considered as follows:

Extinct [EX]: Species that are likely to already be extinct / Extinct in the Wild [EW]: Species that exist only in captivity or as a naturalized population outside its natural habitat / Endangered Class I (Critically Endangered + Endangered) [CR+EN]: Species that are threatened to extinction / Endangered Class I A (Critically Endangered) [CR]: Species that are facing an extremely high risk of extinction in the wild in the near future / Endangered Class I B (Endangered) [EN]: Species that are facing a high risk of extinction in the wild in the near future / Endangered Class II (Vulnerable) [VU]: Species with and increasing risk of extinction / Near Threatened [NT]: Species that are not currently endangered, but may possibly qualify for "endangered" status with changes in their habitat conditions / Data Deficient [DD]: Species with data insufficient for adequate evaluation / Endangered Local Population [LP]: Species with a population isolated regionally, and face a high risk of extinction

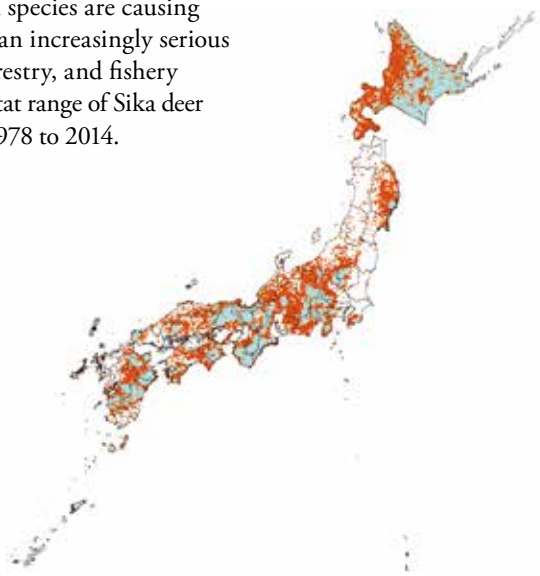
Source: Red List 2019 by the Ministry of the Environment

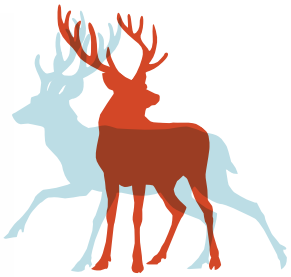
Biodiversity

Additional materials provide more details about biodiversity in Japan.

Growing Range of Sika Deer

While certain flora and fauna are endangered, there are also issues with other species, such as Sika deer and wild boar, that are rapidly expanding their range of habitat and growing their populations. Such species are causing increasing damage, resulting in an increasingly serious situation for the agricultural, forestry, and fishery industries. For example, the habitat range of Sika deer expanded approx. 2.5 fold from 1978 to 2014.





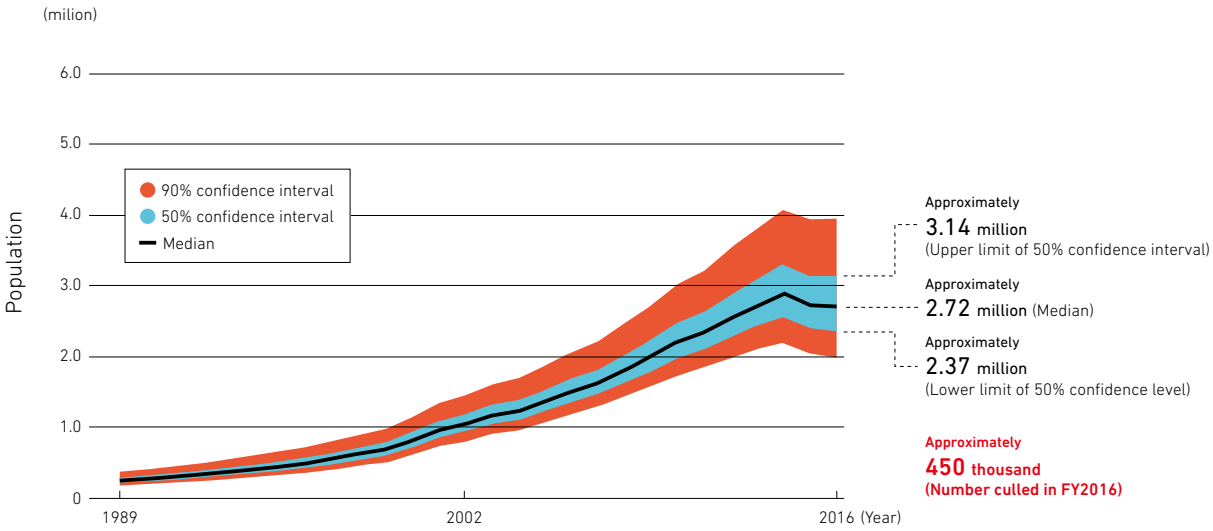
Range of distribution of Sika deer

- Range of distribution in 1978
- Expanded range of distribution by 2014

Source: Ministry of the Environment

Estimated Number of Sika Deer in Japan (excluding Hokkaido prefecture*)

By implementation of various approaches, the number of capturing of sika deer increases, and the estimated number of individuals tends to decrease.



*: In FY 2016, estimated number in Hokkaido was approx. 450,000, and number culled was approx. 120,000 (Hokkaido data).

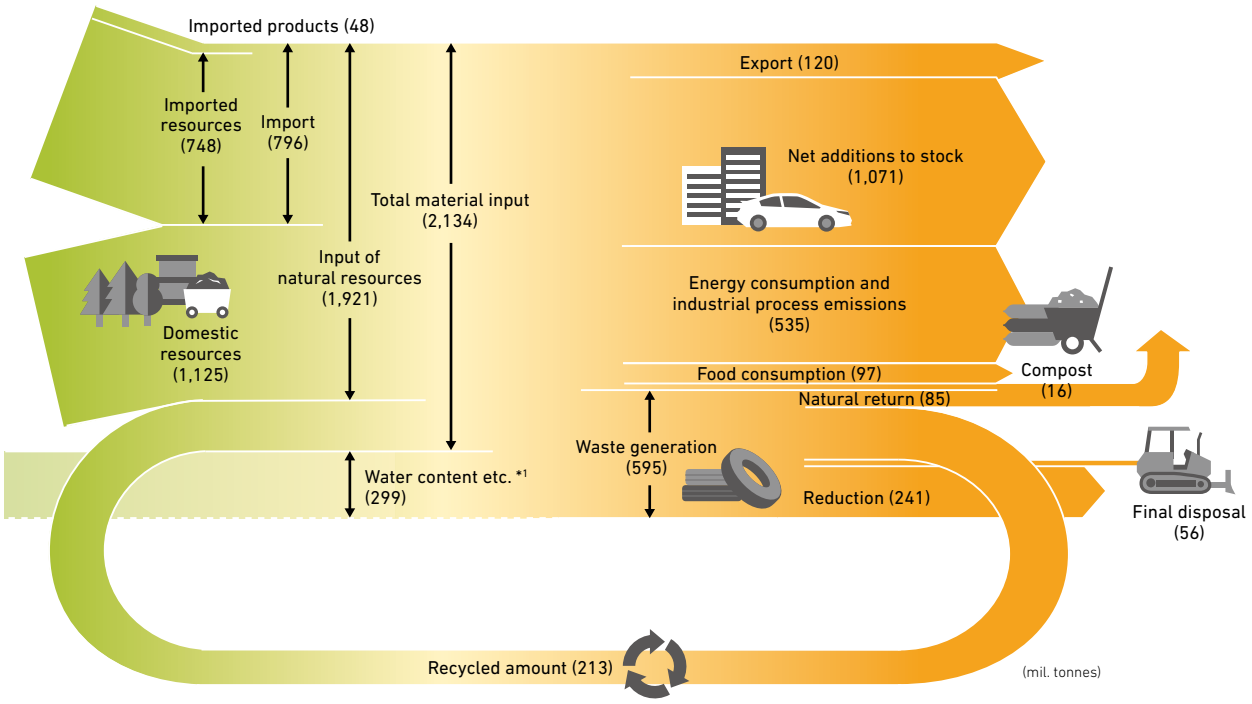
Source: Ministry of the Environment

ADDITIONAL MATERIALS FROM THE 2019 ANNUAL REPORT ON THE ENVIRONMENT

Material Flow in Japan

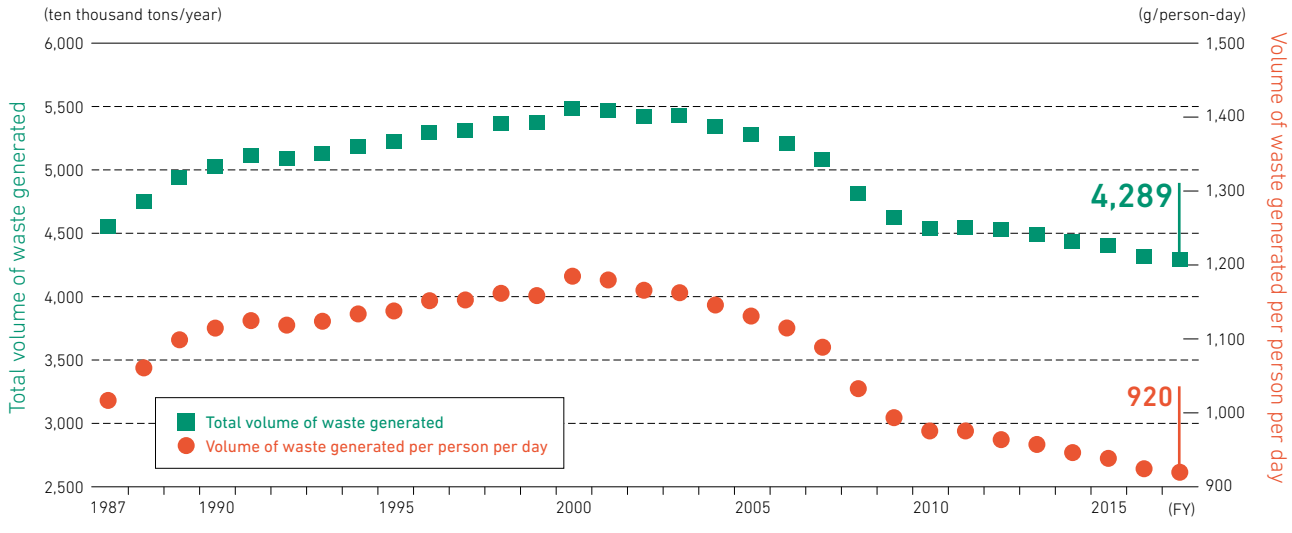
In order to establish a sound material-cycle society, it is necessary to comprehend material flows (or substance flows) to understand the extent of material extraction, consumption, and disposal in Japan. Japan uses material flows to determine targets for the four indicators of resource productivity, cyclical use rate(resource base), cyclical use rate (waste base), and final disposal amount.

FY2000 (for reference)



Total Volume of Waste Generation and Waste Volume Per Person Per Day

Total generated waste and waste generated per person per day are declining year by year.



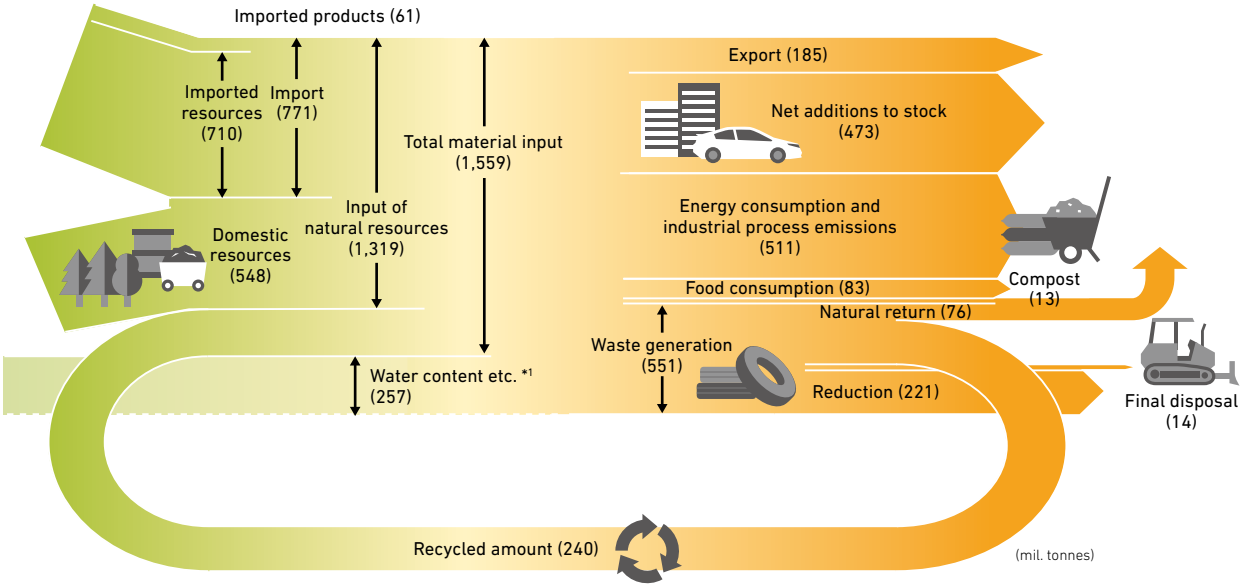
Source: Ministry of the Environment

Sound material-cycle society

Additional materials provide more information about current efforts to form a sound material-cycle society.

*1 Water content: water contents of wastes (sludge, livestock waste, night soil, waste acid, waste alkali) and sediments dumped in association with the process of economic activities (sludge in mining, construction and in waterworks as well as slag)

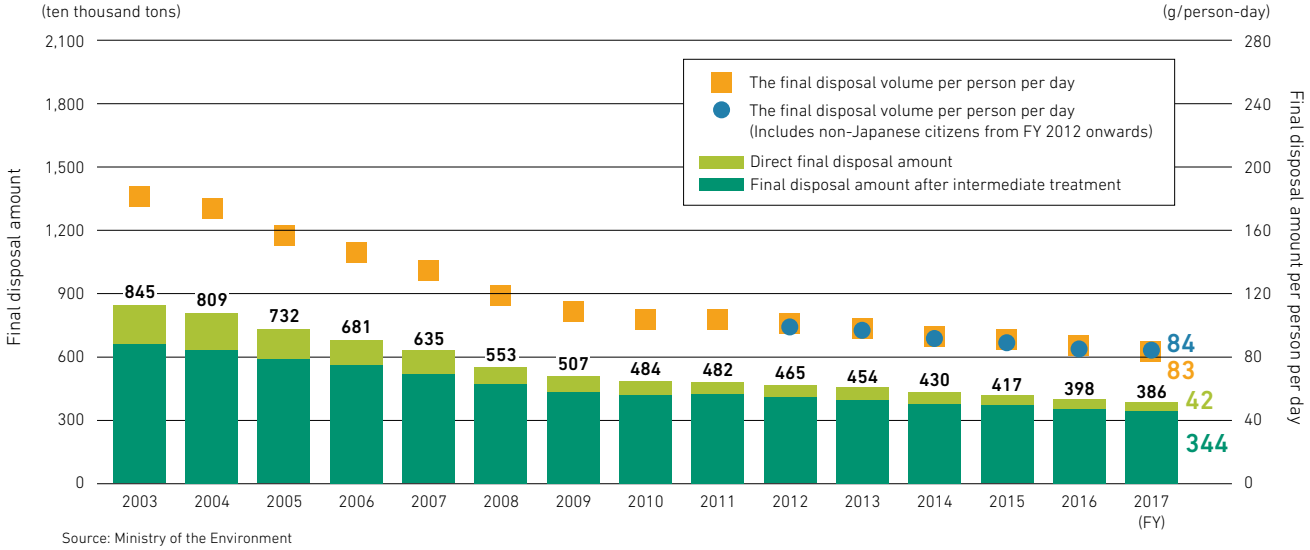
FY2016



Source: Ministry of the Environment

Final Disposal Amount and Final Disposal Amount Per Person

Final disposal amount of waste and final disposal amount per person per day are trending downwards.



Source: Ministry of the Environment

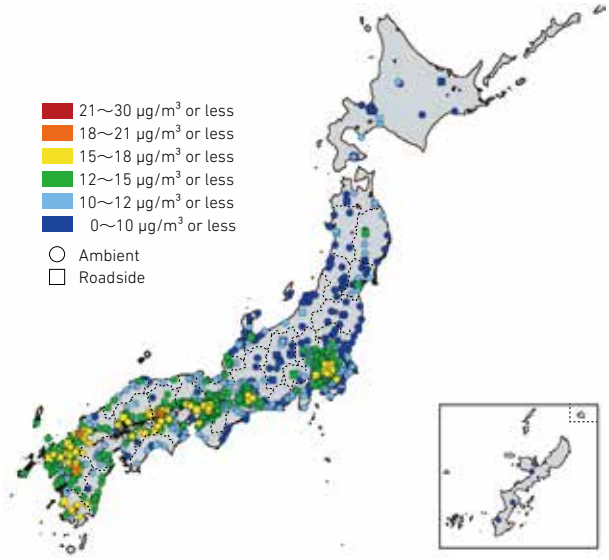
ADDITIONAL MATERIALS FROM THE 2019 ANNUAL REPORT ON THE ENVIRONMENT

Fine particulate matter

In FY2017, the rate of compliance with ambient air quality standards for fine particulate matter (PM 2.5) was 89.9% for ambient air pollution monitoring stations and 86.2% for roadside air pollution monitoring stations throughout Japan. The annual average was 11.6 μg/m³ for ambient air pollution monitoring stations and 12.5 μg/m³ for roadside air pollution monitoring stations. By region, the rate of compliance with environmental standards remains lower in mainly urban areas of the Kanto and Kansai regions, in parts of the Chugoku and Shikoku regions that face the Inland Sea, and in Kyushu.

Fiscal year		2012	2013	2014	2015	2016	2017
No. of vaild stations							
	Ambient	312	492	672	765	785	814
	Roadside	123	181	198	219	223	224
No. of vaild stations compliant with ambient air quality standards							
	Ambient	135	79	254	570	696	732
		43.3%	16.1%	37.8%	74.5%	88.7%	89.9%
	Roadside	41	24	51	128	197	193
		33.3%	13.3%	25.8%	58.4%	88.3%	86.2%

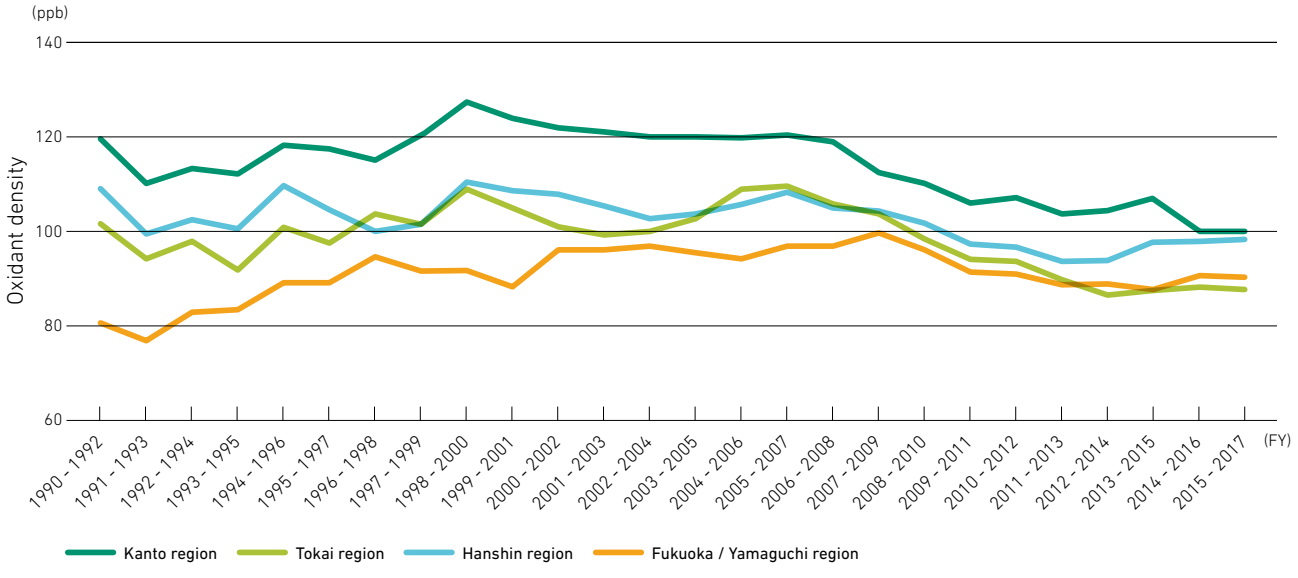
Source: Ministry of the Environment



Source: Ministry of the Environment

Photochemical oxidants

Photochemical oxidant densities (the highest value within a region of the 3-year average of the 99th percentile values of highest 8-hour daily values) had been tending to decline since around FY2006 to FY2008, but in recent years they have tended to be almost flat.



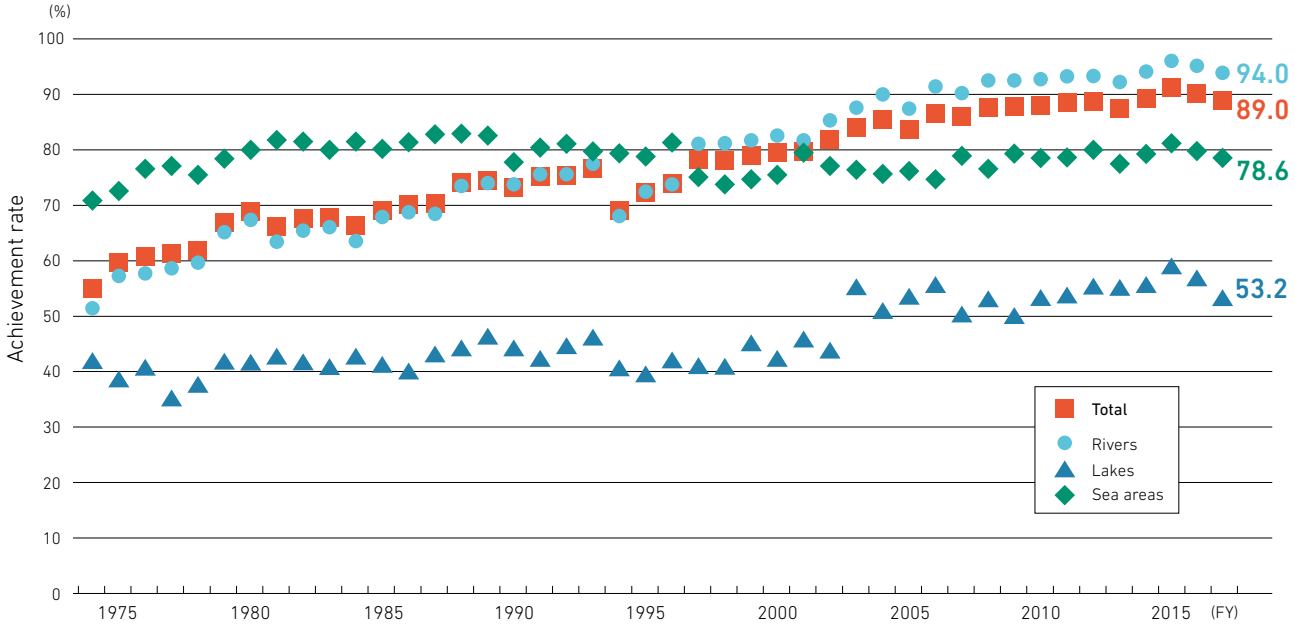
Source: Ministry of the Environment

Atmospheric and water environments

Additional materials provide more information about atmospheric and water environments.

Achievement of Environmental Standards (BOD or COD)

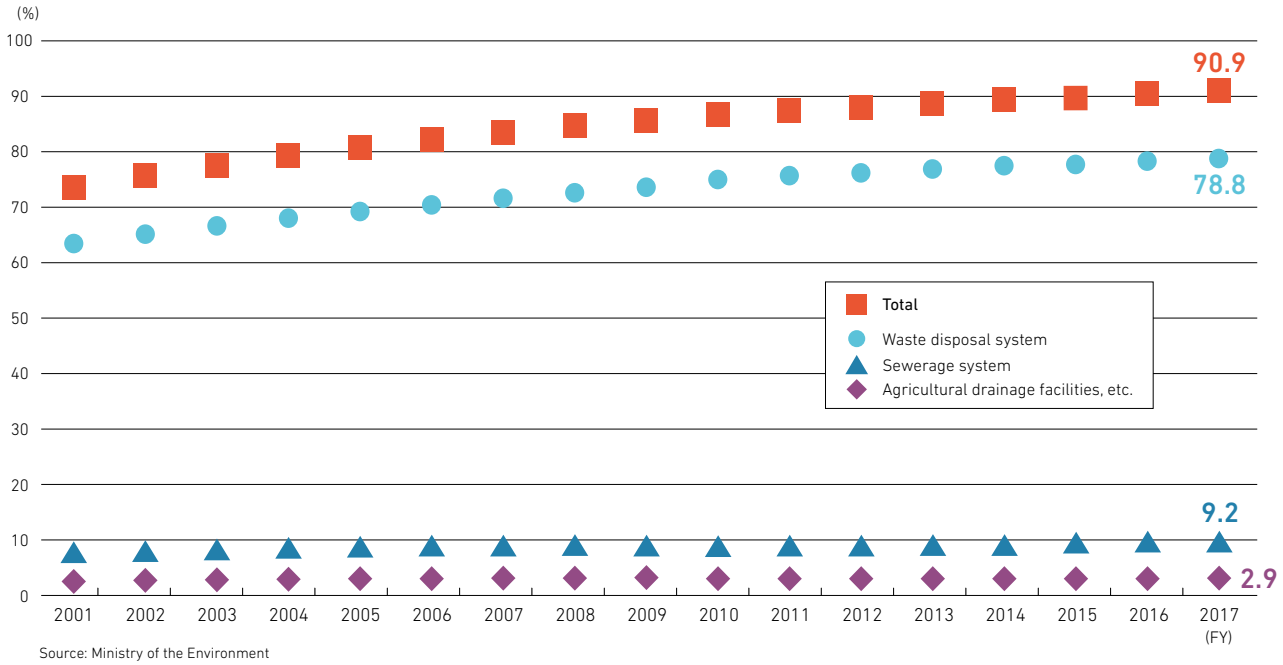
An overall level of 89% has been achieved for the biochemical oxygen demand (BOD) and chemical oxygen demand (COD) environmental standards relating to the maintenance of living environments. BOD and COD are leading indicators of water quality in respect of organic pollution.



Source: Ministry of the Environment

Coverage of Population Served by Waste Disposal System

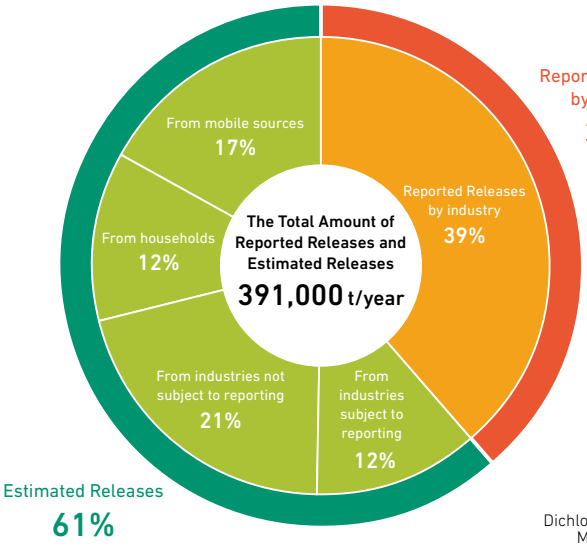
The population coverage of wastewater treatment systems in Japan is 90.9%. Wastewater treatment facilities are being installed to cover the population not yet served by the wastewater treatment systems.



Source: Ministry of the Environment

ADDITIONAL MATERIALS FROM THE 2019 ANNUAL REPORT ON THE ENVIRONMENT

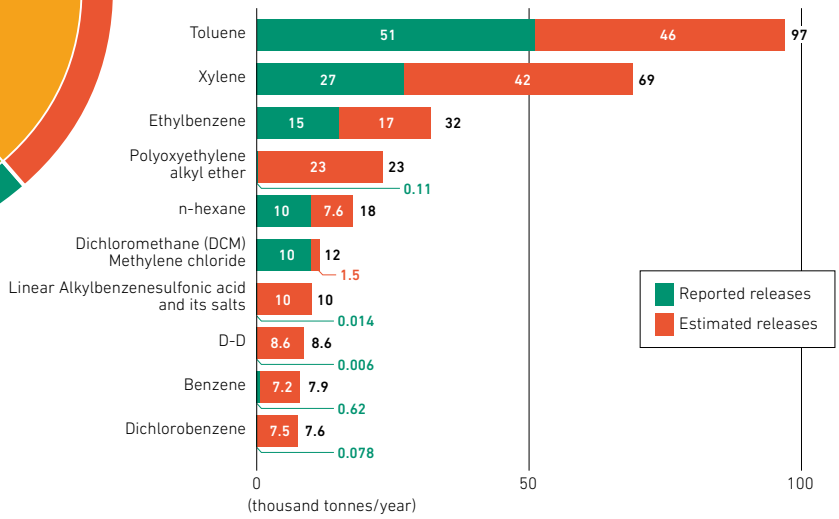
Breakdown of Reported Releases by Industry and Estimated Releases of Chemical Substances in FY 2017



Notes: The reported releases are from the business entities categorized as subjected to reporting. Releases are estimated for businesses that do not meet the reporting requirements, such as number of employees, annual handling quantity, etc., and are exempted from reporting.

Source: Ministry of Economy, Trade and Industry and Ministry of the Environment

Top 10 Chemicals with High-volume of Reported Releases and Estimated Releases (FY 2017)



Source: Ministry of Economy, Trade and Industry and Ministry of the Environment

In March 2019, the government compiled data reported from businesses concerned on release and transfer of chemical substances complying with the Act on Confirmation, etc. of Release Amounts of Specific Chemical Substances in the Environment and Promotion of Improvements to the Management Thereof (PRTR Law). Releases that were not subject to reporting were estimated.

Cover: Setonaikai National Park

Setonaikai National Park is one of the three oldest national parks in Japan. It was designated in 1934, along with the Unzen and Kirishima National Parks. Its outstanding attraction is the landscape, made up of a multitude of islands large and small. This area, also known as the Inland Sea, has been a cradle of culture since ancient times. The terraced fields on the slopes of the islands and the picturesque port towns where people wait for the tides to change are reminders of life in tune with nature.

Oyster farming in Mushiage Bay in the city of Setouchi, Okayama Prefecture, is a local industry that shows how people and nature can thrive by living in harmony.

Alveopora japonica

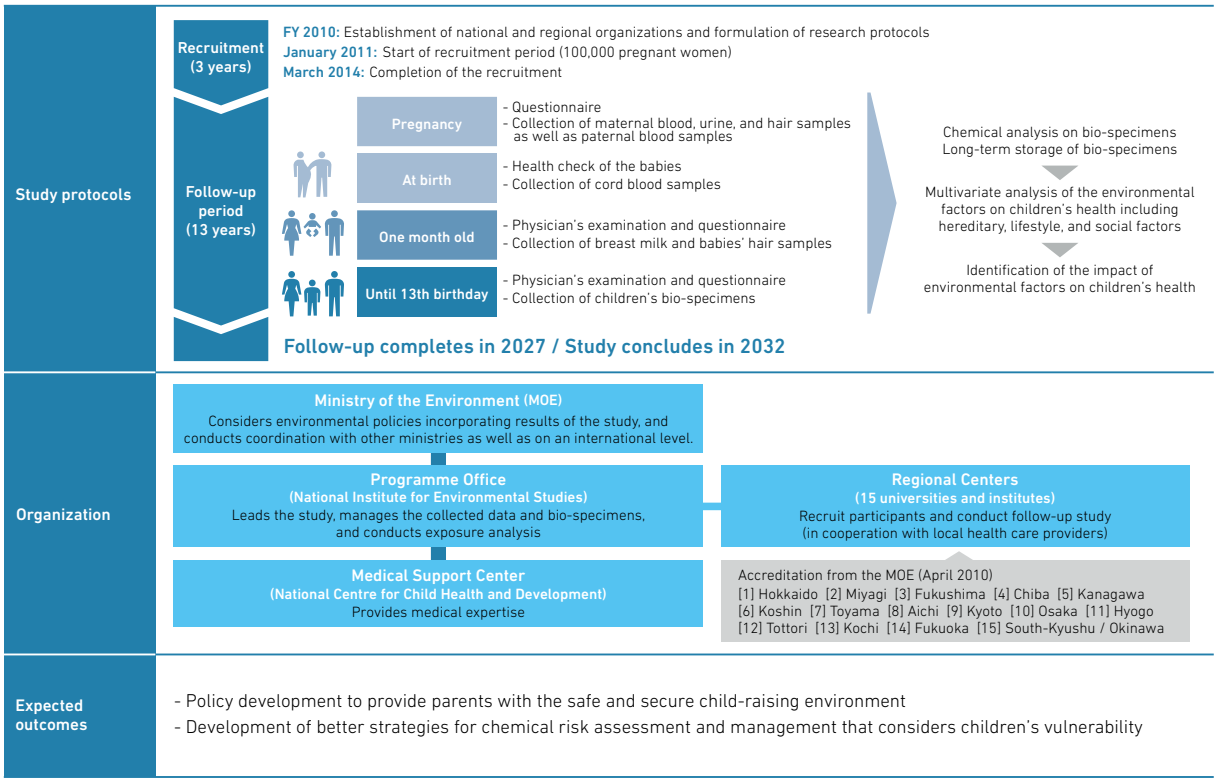
Environmental risks of chemical substances

The following data provides information on action regarding chemical substance emissions into the environment and initiatives for children's environmental health.

The Japan Environment and Children's Study (JECS)

The Japan Environment and Children's Study (JECS), a large-scale, long-term national birth cohort study involving 100,000 mother-child pairs, was launched in FY 2010. The Sub-cohort study, which includes home visits for environmental measurements, medical examinations and children's bio-specimen collection, began in November 2015, involving 5,000 participants selected from the Main Study.

JECS is a large-scale, long-term prospective cohort study to examine the impact of the exposure to chemical substances during pregnancy and childhood on children's health.



Source: Ministry of the Environment

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