
**Japan's Third National
Communication Under
the United Nations Framework
Convention on Climate Change**

The Government of Japan
2002

Contents

Executive Summary

Chapter 1: National Circumstances Relevant to Greenhouse Gas Emissions and Removals.....	1
1.1 National Land Use	1
1.2 Climate	2
1.3 Population and Households	3
1.4 Houses and Commercial Facilities	6
1.5 Japan's Industry and Economy	8
1.6 Transport	12
1.7 Energy	18
1.8 Waste	24
1.9 Agriculture	26
1.10 Forestry	27
1.11 Information and Telecommunications	29
1.12 Government Administration and Finances	29
Chapter 2: Greenhouse Gas Inventory Information	34
2.1 Outline	34
2.2 Carbon Dioxide (CO ₂)	37
2.3 Methane (CH ₄)	44
2.4 Nitrous Oxide (N ₂ O)	47
2.5 Hydrofluorocarbons (HFCs)	50
2.6 Perfluorocarbons (PFCs)	52
2.7 Sulfur Hexafluoride (SF ₆)	54
2.8 Nitrogen Oxide (NO _x)	56
2.9 Carbon Monoxide (CO)	58
2.10 Non-Methane Volatile Organic Compounds (NMVOC)	61
2.11 Sulfur Dioxide (SO ₂)	64

Chapter 3: Policies and Measures	70
3.1 Background and Significance of Review of Guideline for Measures to Prevent Global Warming	70
3.2 Basic Policies for Measures to Prevent Global Warming	74
3.3 Policies Aimed at Achieving the Commitment to a 6% Reduction	76
3.4 Promotion of Measures to Prevent Global Warming for Achievement of 6% Reduction Commitment	77
Chapter 4: Projections and the Total Effect of Policies and Measures	132
4.1 Basic approach	132
4.2 Future Outlook	133
4.3 Estimation methods	145
4.4 Future outlook for CO ₂ emissions from international bunker fuel sold in Japan	148
Chapter 5: Vulnerability Assessment, Climate Change Impacts and Adaptation Measures	151
5.1 Impacts on Japan's Climate	152
5.2 Impacts on Agriculture, Forestry and Fisheries	153
5.3 Impacts on Hydrological Conditions and Water Resources	155
5.4 Impacts on Social Infrastructure and Economy	155
5.5 Impacts on Nature	157
5.6 Impacts on Human Health	160
5.7 Adaptive Measures	161
Chapter 6: Financial Resources and Transfer of Technology	163
6.1 Measures Concerning New and Additional Financial Resources pursuant to Article 4.3 of the Convention	164
6.2 Assistance for Developing Countries that are Particularly Vulnerable to Adverse Effects of Climate Change	164
6.3 Financial Resources related to the implementation of the Convention .	167
6.4 Measures Related to Transfer of Technologies	167
6.5 Promoting International Cooperation in the Private Sector	175

6.6 Other	176
Chapter 7: Research and Systematic Observation	192
7.1 Comprehensive Government Policies and Fundraising for Research and Systematic Observation	192
7.2 Research	193
7.3 Systematic Observations	197
Chapter 8: Education, Training, and Public Awareness	203
8.1 Approaches to Policies and Measures	203
8.2 Promotion of Environmental Education and Study	203
8.3 Activities for Promoting the Prevention of Global Warming	205
8.4 Support for Environment NGOs	208

Executive Summary

Chapter 1: National Circumstances Relevant to Greenhouse Gas Emissions and Removals

Japan is an archipelago stretching approximately between latitudes 24° and 46° north, and consists of four major islands as well as more than 6,800 smaller islands. Japanese territory extends over 37,790,000 hectares, or about 0.3 percent of the earth's terrestrial surface, of which about 80 percent is either forested or agricultural land. Japan stretches over a great distance from north to south with a vast range of climatic zones and has distinct defined seasons.

As of 2000, Japan's population was 127 million, and the population density was 340 inhabitants per square kilometer. The ratio of the elderly amongst the population has rapidly increased at a higher rate than ever, and the population segment aged 65 or older was 17%. The number of households has increased consistently combined with declining of the average size of households, there were 46.78 million households in Japan in 2000. In line with the general shift of the Japanese economy towards the tertiary industries, the amount of floor space devoted to the business sector has steadily increased. Since 1965, it has increased at an average of 4.1% annually.

From fiscal 1970 to fiscal 1998, Japan's gross domestic product (GDP) increased by 2.6 times to 481 trillion yen. However, in the early 1990s, the prices of land, securities, and other assets nose-dived. Combined with an adjustment in consumer durables and capital stock, and reductions in expenditure on consumables led to the stagnation of economic activities. Since fiscal 1992, growth of less than 1 percent or negative growth has continued except for in fiscal 1995 and 1996. In particular, since fall 1997, economic status is getting worse further while the aftereffects of the 'bubble economy' have predominated.

In terms of the industrial structure, the yen continued to appreciate from the spring of 1990 through the spring of 1995, influencing the processing and assembly industries and spurring on a structural shift among Japanese firms towards greater overseas production. On the other hand, the information, telecommunications, and other nascent industries recorded large growth.

Domestic passenger and freight traffic grew significantly with growth of economic, throughout the period of rapid economic growth of the 1960's. The growth rate of passenger and freight traffic during the early 1980's lowerd, but it suddenly increased in the latter 1980's along with the economic expansion. On the other hand, road traffic's share has increased. In the 1990's, however, traffic volumes and the shares of each transportation mode have remained almost constant. The number and total travel distance of passenger car has increased since the 1960's. From 1995, however, its increase rate has slowed down. Since 1980 until the present, preferences have shifted to saloon cars and recreational vehicles (RVs) and the average weight of light weight cars has been increasing following legislation to improve their safety, and the ratio of heavy vehicles has increased accordingly.

Final energy consumption continued to increase significantly with the Japanese economy's rapid growth during the 1960's and until the first oil crisis in 1973, after which it leveled off and eventually decreased. From 1986 onwards, however, the economic pickup primed new growth in energy consumption, equivalent to $15,565 \times 10^{15}$ J in fiscal 1999. These trends from 1990 can be summarized for different sectors as follows. Energy consumption leveled off in the industrial sector. On the other hand, it has significantly increased in the residential and commercial sector. In transport sector, it has significantly increased between 1990 and 1995, however, its increase rate has slowed down over 1995.

Japan's dependence on foreign sources peaked in fiscal 1973 at 89.4 percent of its energy supply; since then, this dependence has been reduced by efforts to find substitutes for oil; in recent years, foreign dependence has remained about 80 percent, putting the nation in an extremely vulnerable energy-supply situation. In fiscal 1999, the shares of the total primary energy supply for oil, coal, natural gas and nuclear

power are 52%, 19%, 13% and 13%, respectively. The shares of natural gas and nuclear power have swiftly increased from the fiscal year 1973.

Japan's total primary energy supply per capita as of 1999 is 181×10^9 J, a level that has remained steady recently. Japan's total primary energy supply per unit of GDP has improved significantly brought about by the oil crisis, but it has remained static during the 1990's.

Chapter 2: Greenhouse Gas Inventory Information

On the basis of the United Nations Framework Convention on Climate Change, all Parties to the Convention are required to submit national inventories of greenhouse gas emissions and removals to the Secretariat of the Convention every year.

The calculation methods and the reporting format of the inventory are in accordance with the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, prepared by the IPCC (Intergovernmental Panel on Climate Change) (hereafter, 'Revised 1996 IPCC Guidelines'). In 2000, a 'Good Practice and Uncertainty Management' report was drawn up in which was described calculation selection methods that take into consideration the different circumstances of each country and quantitative assessment methods for uncertainties.

Japan's inventory was also calculated and reported in accordance with the Revised 1996 IPCC Guidelines. However, some portions were calculated using methods that differ from the methods indicated in the Revised 1996 IPCC Guidelines in order to ensure that the results would reflect national circumstance of Japan. Application of the 'Good Practice and Uncertainty Management' report is being examined and has not yet been applied to the inventory submitted in 2001.

Total emissions of greenhouse gases (calculated by multiplying each greenhouse gas emissions by global warming potentials (GWP), and aggregate them) in fiscal year 1999 is 1,307 million tons of carbon dioxide equivalents. It had increased by about 6.8 % compared to emissions (1,224 million tons) in the base year (1990 for CO₂, CH₄, and N₂O, while 1995 for HFCs, PFCs and SF₆) under the Kyoto Protocol, and also increased by about 2.1 % compared to previous year.

Table 1 Changes in emissions of each greenhouse gas

	GWP	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Carbon dioxide (CO ₂)	1	1,124.4	1,124.4	1,147.8	1,162.2	1,144.0	1,214.1	1,217.8	1,236.2	1,233.5	1,187.0	1,225.0
Methane (CH ₄)	21	30.5	30.5	30.3	30.1	30.0	29.7	29.5	28.9	27.7	27.3	27.0
Nitrous oxide (N ₂ O)	310	20.8	20.8	20.3	20.4	20.3	21.5	21.8	22.8	23.5	22.3	16.5
Hydrofluoro-carbon (HFCs)	HFC-134a :1300, etc	20.0						20.0	19.7	19.6	19.0	19.5
Perfluoro-carbon (PFCs)	PFC-14 :6500, etc	11.4						11.4	11.2	14.0	12.4	11.0
Sulfur Hexafluoride (SF ₆)	23,900	16.7						16.7	17.2	14.4	12.8	8.4
Total		1,223.8	1,175.6	1,198.4	1,212.7	1,194.2	1,265.2	1,317.3	1,335.9	1,332.7	1,280.8	1,307.4

Chapter 3: Policies and Measures

In Japan, the Global Warming Prevention Headquarters was established in December 1997 by order of the Cabinet to implement specific and effective countermeasures against global warming in reaction to the Third Session of the Conference of the Parties to the UNFCCC (COP3, also known as the "Kyoto Conference on Global Warming Prevention"). The "Guideline for Measures to Prevent Global Warming" was drawn up in June 1998 by the headquarters.

Subsequently, new “Guideline for Measures to Prevent Global Warming” was concluded on 19th March 2002, as additional measures need to be promoted to achieve the commitment stipulated in the Kyoto Protocol as emissions continue to increase.

This chapter is based on Chapters 1 through 4 of this new Guideline.

1. Basic Policies

- We are endeavoring to prepare and establish a mechanism to ensure contribution to both the environment and economy by make the best use of technological innovation and innovative ideas in economic circles to link the various measures to prevent global warming and to create labor opportunities by stimulating the economy in Japan. (“**Contribution to both the Environment and Economy**”)
- The progress of domestic policies and measures and the state of greenhouse gases emissions shall be assessed and reviewed periodically (2004, 2007) to consider necessity of additional policies and measures. (“**Step-by-Step Approach**”)
- It will not be easy to achieve the commitment stipulated in the Kyoto Protocol, cooperation between all parties is indispensable, by having the government, local authorities, businesses, and citizens each playing their roles. We continue to promote the voluntary action of businesses, and in particular, measures for residential/commercial sector and transport sector strongly. (“**Shared Responsibility**”)
- Japan continues its maximum efforts for the establishment of a common rule in which all countries including the USA and developing countries participate. (“**Ensuring international cooperation for measures to prevent global warming**”)

2. Main Points of the new Guideline

- This new Guideline show an overview of the specific measures with details of how to achieve the 6% reduction commitment stipulated in the Kyoto Protocol. This Guideline stipulates more than 100 domestic measures and policies to achieve the commitment. The statutory Kyoto Protocol Target Achievement Plan shall be drafted based on the new Guideline according to the Bill for revising a part of the Law Concerning the Promotion of Measures to Cope with Global Warming.
- We shall try to achieve the 6% reduction commitment stipulated in the Kyoto Protocol based on the following targets for the time being. Even if adequate progress is expected for targets ①-⑤ within the first commitment period, further emission reductions shall be promoted as well as continuously and steadily promoting earlier measures without allowing any complacency. Furthermore, Japan shall study the utilization of the Kyoto mechanisms while taking account of international situation and bearing in mind the commitment achievement responsibility and the general rule that Kyoto mechanisms stipulated in the Kyoto Protocol are supplementary to domestic measures.
- The Global Warming Prevention Headquarters shall conduct assessment and review of the Guideline in 2004 and 2007. In carrying out the above, the Headquarters shall comprehensively assess and review the various economic frames assuming this Guideline to review measures and policies flexibly.
- We have just established this Guideline bearing in mind public comments and the deliberation results of the Relevant Advisory Councils. In order to establish the Kyoto Protocol Target Achievement Plan based on this Guideline, we shall listen to the various opinions from various sectors and layers of the public.

3. Measures for each of greenhouse gases and other segments (main examples)

① CO₂ emissions from energy source (±0.0%)

Targets: total amount of emissions will be ±0% compared to the base year in this segment

	Industrial Sector	Residential and Commercial Sector	Transport Sector
Energy Conservation measures reduction amounts of additional measures (The following is the same) [22 Mt-CO ₂]	<ul style="list-style-type: none"> Steady implementation and follow-up of the voluntary action plan (Target of the Keidanren Voluntary Action Plan on the Environment is to reduce CO₂ emissions for 2010 to no more than 1990 levels.) Technological development and diffusion of its results, such as Highly efficient boilers and lasers Promoting introduction of high performance industrial furnaces 	<ul style="list-style-type: none"> Energy management system that applies to large-scale factories is adopted for large-scale office buildings through revision of the Law Concerning the Rational Use of Energy. Gas equipment, etc. that were not previously targeted are added based on the Top Runner Approach. Promotion of distribution of high efficiency water heater Promoting distribution of the HEMS and BEMS 	<ul style="list-style-type: none"> Rapid introduction of vehicles that meet Top Runner Approach, and accelerating the development and distribution of low emission vehicles including clean energy vehicles Measures on the traffic flow by Promotion of Intelligent Transport Systems (ITS), etc. Improving efficiency of freight services including promotion of modal shift to shipping, etc. Promoting use of public transportation
New Energy measures [34Mt-CO ₂]	<ul style="list-style-type: none"> Placement biomass energy and snow ice cryogenic energy in the Law Concerning Promotion of the Use of New Energy Proposal to establish the Bill Concerning the Use of New Energy by Electric Utilities Promotion of introduction support for photovoltaic power generation, solar thermal utilization, wind power generation, waste power generation, and biomass energy, etc. Strengthening the support for technological developments and demonstration tests, etc. concerning fuel cells, photovoltaic power generation, and biomass energy, etc. 		
Fuel switching, etc. [18Mt-CO ₂]	<ul style="list-style-type: none"> Subsidization towards part of the cost of converting old coal fired power generations to natural gas power generations Subsidization towards part of the cost of fuel switching such as industrial boilers Preparation of safety standards for natural gas pipelines 		
Promotion of nuclear power	<ul style="list-style-type: none"> Promotion of nuclear power generation with giving priority to safety Promotion of the Power Sited Regions Promotion Measures related to location of nuclear fuel cycle facilities 		
(*1)	Approx. 462Mt-CO ₂ (▲7%)	Approx. 260Mt-CO ₂ (▲2%)	Approx. 250Mt-CO ₂ (+17%)

(*1) () is percentage of reduction compared to base year 1990 of each sector

※The emission reduction targets in each sector are set as benchmarks estimated to be achievable in the event that the measures on the energy supply side and demand side achieve their intended effect as economic growth in Japan is achieved in line with the latent growth rate.

※It is appropriate to evaluate measures with a certain degree of flexibility from an overall viewpoint for the energy supply and demand structure while adopting the reduction and implementation target amounts.

※The Kyoto mechanisms also allow the participation of private sectors. Therefore, it is expected that these mechanisms will be used by them to achieve their own emission reduction target more cost-effectively.

②Emissions of CO₂ from non-energy sources, CH₄, and N₂O (▲0.5%)

Target : reduction amount will be 0.5% compared to the total GHG emissions in the base year

CO ₂ from non-energy sources	Setting up National targets in waste management policy based on the Waste Management and Public Cleansing Law and related individual recycling regulations Expansion of the utilization of timber and wood materials Promotion of compost deoxidization and green manure cultivation in farmland
CH ₄	Trying to halve the volume of waste disposed in landfills based on Food Recycling Law, etc. Improvement of farmland management Development of technologies to reduce greenhouse gas emissions from agricultural sector
N ₂ O	Sophistication of combustion for wastewater sludge based on the sewerage facility plan, etc.

③Development of innovative technology and further extensive efforts by the public (▲2.0%)

Target : reduction amount will be 2.0% compared to the total GHG emissions in the base year

Strengthening research and development of advanced and innovative energy- and environment-related technologies	Promotion of Research and Development of energy efficient new steel production process, energy efficient new chemical process, material for lighter vehicles, energy efficient electric appliances, and low energy loss electric distribution system
Further Activities to prevent Global Warming carried out by various sectors and layers of the public	Changing incandescent lamps to fluorescent lighting, Reduction in upwards luminous lux of outdoor lighting in the evening, Efficient use of refrigerator, Introduction of water-saving shower head, Temporarily turning off lights in offices, Reduction in wasteful copies

④Emissions of HFCs, PFCs, SF₆ (+2.0%)

Target : increase amount will be +2% compared to the total GHG emissions in the base year

total emissions is controlled to increase in +2% from increase in +5% on business as usual case

<ul style="list-style-type: none"> ▪ Follows up progress of voluntary action plans of industries ▪ Research and development of new alternative substances ▪ Development of inexpensive and compact fluorocarbon recycling and destruction technologies ▪ Appropriate enforcement of Home Appliance Recycling Law and Fluorocarbon Recovery and Destruction Law
--

⑤Sinks(▲3.9%)

Target: ensure removals of about 3.9% compared to the total greenhouse gas emissions in the base year as agreed at COP7 through sink activities in Japan

Sound forest management including planting, weeding, and thinning, etc., Promotion of utilization of timber and wood biomass, Promotion of Urban Greening

Chapter 4: Projections and the Total Effect of Policies and Measures

In Japan, the Guideline of Measures to Prevent Global Warming (“old Guideline”) was established in 1998 and the government have been implementing the measures for the purpose of reducing greenhouse gases. When the old Guideline was established, it was estimated that greenhouse gas emissions would increase significantly if no special measures were taken. As a result of promoting various measures based on the old Guideline, total greenhouse gas emissions in 2010 is estimated at about 1,320 million tons of CO₂, and it is expected to be reduced to about a 7% increase compared to the base year.

On the other hand, our total greenhouse gas emissions in the base year is 1,229 million tons of CO₂. In order to achieve the 6% reduction commitment for Japan stipulated in the Kyoto Protocol, we must also strive to reduce emissions by about 13% (approximately 165 million tons of CO₂) over and above existing measures.

Therefore, a reexamination of global warming countermeasures was promoted by the concerned government ministries beginning in 2000 and, by March 2002, new Guideline of Measures to Prevent Global Warming were established setting forth quantitative targets for each measure. In this task, emissions were predicted as of 2010, the central year of the first commitment period, premised on currently existing measures and additional measures were formulated and examined to cover insufficiencies in the goals set for each sector. The total estimated amounts for emission reduction by the additional policies and measures is 144 million tons of CO₂ in 2010.

Table 4.2. Actual emissions and future outlook for greenhouse gases by sector
(unit: million tons of CO₂)

Sector	Actual emissions			2010 projection			
	Base year	1999	% Change	Without measures	With measures	With additional measures	% Change
CO ₂ from energy sources	1,053	1,148	9.0%	※2	1,126	1,052	-0.1%
Following 3 substances	128 (123)	127 (121)	-0.1%	140	122※3	122※3	-4.8%
CO ₂ from non-energy sources	77 (72)	77 (77)	-0.3%	88	85	85	10.1%
CH ₄	29 (30)	25 (27)	-12.4%	25	24	24	-18.2%
N ₂ O	22 (21)	25 (17)	10.6%	27	16	16	-27.1%
Other greenhouse gases	48	39	-19.3%	107	73	73	51.4%
HFC	20	19	-2.7%				
PFC	11	11	-3.4%				
SF ₆	17	8	-50.1%				
Development of innovative technology, further extensive efforts by the public	—	—	—		-4	-26	—
Sinks	—	—	—		—	-48	—
Total	1,229 (1,224)	1,314 (1,307)	6.9% (6.8%)		1,317	1,173	-4.6%

※1 : Figures in parentheses () are the reported values (Chapter 2) of the inventory submitted in 2001 (refer to the footnote of 4.2. Future outlook)

※2 : Forecast for 2010 of CO₂ from energy sources (case without measures) has not been carried out.

※3 : The reason why it is 3 million tons of CO₂ less than total CO₂ from non-energy sources, CH₄ and N₂O is because there is considered to be a reduction of 2.60 million tons of CO₂ due to measures that do not specify the amount of reductions resulting from the expanded use of mixed cement, etc., in this sector in the Guideline.

Chapter 5: Vulnerability Assessment, Climate Change Impacts and Adaptation Measures

This chapter reviews the results of research being conducted on climate change in Japan and presents quantitative evaluations of the projected impacts.

Research to date indicates that climate change may have a major effect on Japan's agriculture, forestry, fisheries, water resources, coastal management, natural ecosystems, and human health.

For example, it is estimated that, due to global warming, the number of typhoons will decrease and their maximum intensity will increase slightly. In terms of rice cultivation in paddy fields, it is estimated that the production volume will increase in upper latitudes while problems may occur with growth due to higher temperatures in lower latitudes. It is thought that demand for water supply will increase by 1.2 ~ 3.2 percent per 3°C increase in temperature. Furthermore, it is thought that heat stress will increase due to higher temperatures in summer, with effects also seen on human health due to increased vectors and improved growth conditions for pathogenic organs and parasites.

Meanwhile, several important items are considered to be issues for future research but are not addressed in this report. These include forecasting climate change per area, and indirect effects on Japan's socioeconomic system such as problems with importing foodstuffs, energy, and other resources. It is also clear that climate change will have a massive effect on natural ecosystems, but at present it is extremely difficult to quantitatively assess such an effect.

The Framework Convention calls for measures to mitigate the adverse effects of climate change and for adaptive measures that will facilitate adaptation to climate change. Japan is studying adaptive measures related to coastal areas, social infrastructure, and agricultural production.

Chapter 6: Financial Resources and Transfer of Technology

The government of Japan identifies environmental conservation as a basic philosophy of Japan's Official Development Assistance (ODA) and states that "the pursuit of environmental conservation and development in tandem" must be one of the basic principles of ODA. The government of Japan tries to realize sustainable development on a global scale through assisting the self-help efforts of developing countries.

In particular concerning global-warming issue, the government of Japan announced the Kyoto Initiative on aid for global warming programs in developing countries during the COP3 in December 1997. Under the Initiative, the government of Japan provides active support for global warming programs and projects. Specifically, as a cooperation in Capacity Development, about 4,600 people have already been fostered during the three years from fiscal 1998 to fiscal 2000 through training courses both in Japan and developing countries, and by the experts and JOCV members dispatched by Japan. Also, the government of Japan has provided ODA loans on the most concessional terms (interest rate: 0.75%; repayment period: 40 years) available internationally primarily with regard to energy saving technologies, new and renewable energy sources, forest conservation and afforestation, and air pollution-related measures in order to achieve sustainable development while dealing with global warming issues. Approximately ¥580 billion has been committed from December 1997 to March 2001. In addition, the government of Japan will support developing countries efforts by using technology and know-how acquired in the process of combating its own pollution and energy problems, and developing and transferring such global warming-related know-how as best suited to the actual status in developing countries, as well as sending survey groups and holding workshops.

Other support is being provided through comprehensive project-type technical cooperation that includes dispatch of experts, acceptance of trainees, and provision of equipment, Grant Aid for Global Environment to support in the energy-related and afforestation fields which lead to reduce and limit the emission of greenhouse gases, and F/S projects for CDM and JI.

Chapter 7 Research and Systematic Observation

The Council of Ministers for Global Environment Conservation draws up a Comprehensive Program for the Promotion of Global Environmental Research, Monitoring and Technological Development each fiscal year. The program comprehensively promotes surveys, research, observation, monitoring, and technological development for the protection of the global environment and follows up on the implementation of efforts in these fields.

In August 1990, the 'Basic Program for Research and Development in Global Science and Technology', which was approved by the Prime minister, was made up. The program specifies that Japan shall prioritize international activities for research and development. Also, promote studies of prediction of global change comprehensively, including global warming, under cooperation with various universities, ministries and agencies concerned.

In December 2000, the Cabinet drew up a new Basic Environment Plan in accordance with the Basic Environment Law. This states the promotion of global warming-related measures as one of its strategic programs, and also specifies measures for the government to take in this field by including sections on 'adequate surveys, research, monitoring, and observation, and promotion of proper technologies' and 'ensuring international cooperation for surveys, research, monitoring, and observation, etc.'

1. Research

While giving full consideration to the United Nations Framework Convention on Climate Change and the Kyoto Protocol, the Government of Japan is comprehensively promoting surveys and research to better understand the present condition and predict the future impacts of global warming, to fix, isolate, and reduce greenhouse gases, and to draw up appropriate countermeasures. And cooperating with the activities of the Inter-governmental Panel on Climate Change (IPCC), the Government of Japan will contribute to establish guidelines for the implementation of the Kyoto Protocol and methods for assessing the removal of greenhouse gases by forests, and so on. Moreover, the government will prioritize the promotion of relevant research to contribute to the IPCC Fourth Assessment Report, the preparation of which is scheduled to begin in the near future. In addition, based on the 'Global Warming Research Initiative' included in the promotion strategy of environmental sciences decided by the Council for Science and Technology Policy in September 2001, individual research projects should be integrated into the research programs such as climate change prediction, impacts and risks assessment, control policy research, and so on, and research and development is promoted under collaboration among industry, academia, and government.

Japan participates and cooperates in the World Climate Research Programme (WCRP), the International Geosphere-Biosphere Programme (IGBP), the International Human Dimensions Programme of Global Environmental Change (IHDP), and other international global environmental research programs, conducts surveys and research based upon an appropriate international division of tasks, and otherwise promotes joint research and other initiatives together with overseas research organs. Also, Japan is promoting research on global environmental change in the Asia-Pacific region in cooperation with researchers from throughout the area, as well as developing a regional research network on global environmental change.

2. Systematic Observation

The Government of Japan promotes the 'Comprehensive monitoring program for global warming' included in the 'Global warming research initiative', for placing special priority on promoting the observation and monitoring to identify the status, causes, and impacts of global warming and climate change. And more, the Government participates and cooperates in the Global Environmental Monitoring System (GEMS), the Global Atmosphere Watch (GAW) Program, the Global Climate Observing System (GCOS), the Global Ocean Observing System (GOOS) and other international observation and monitoring programs, and plans to facilitate implementation of observation and monitoring throughout the Asia-Pacific region. In addition, Japan has been promoting the 'Integrated Global Observing Strategy Partnership (IGOS-P)' that cooperates with and coordinates international study programs, observation systems, and international organizations, etc. Moreover, for global observation by satellites, the Government is actively participating in the activities of the Committee

on Earth Observation Satellites (CEOS) and other international forums and is promoting the development, launch, and operation of satellites in conformity with these activities.

Chapter 8 Education, Training, and Public Awareness

Carbon dioxide emissions have been consistently increasing in recent years in the residential/commercial and transport sectors, which are closely related to the lifestyles of citizen. To mitigate global warming, all citizens must shift from the mass consumption and disposal lifestyle to resource and energy conservation. At the same time, consideration should be given for the usage of non-fossil fuel energy, including new and renewable energy and nuclear energy. To that end, opportunities to learn about the global warming issue, as well as the energy issues closely involved with it, are provided for homes, schools, and society at large. Japan is also trying to develop the Prefecture Centers for Climate Change Actions nationwide, and promotes improved awareness through advertising in the mass media, distribution of pamphlets, and the holding of symposiums, etc. Also, Japan is committed to increasing the support for environmental NGOs, which promise to play a leading role as advisors in citizen efforts to address the global warming problem.

Chapter 1

National Circumstances Relevant to Greenhouse Gas Emissions and Removals

1.1 National Land Use

Japan is located on the east side of Eurasia, and an archipelago stretching approximately between latitudes 24° and 46° north, and consists of four major islands – namely (north to south) Hokkaido, Honshu, Shikoku, and Kyushu – as well as more than 6,800 smaller islands.

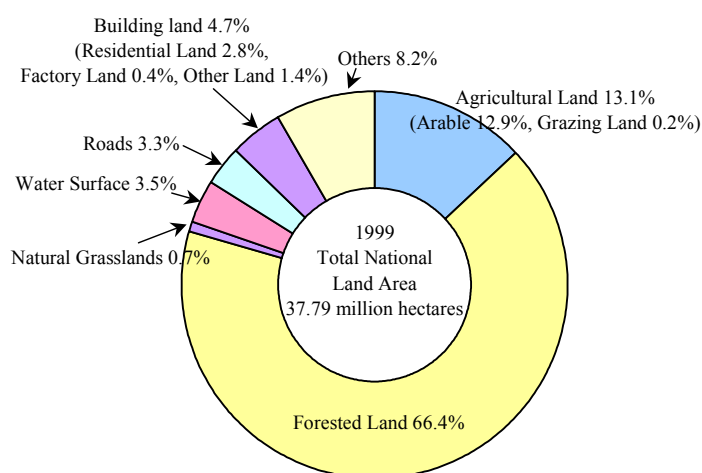


Figure 1.1 Land Use in Japan

Source: 'FY2000 Annual Report on Land Usage Trends'

Notes: The term 'Roads' includes agricultural and forestry roads in addition to ordinary roads. All data is derived from estimates based on readily available statistics from different sources compiled by the Ministry of Land, Infrastructure and Transportation.

Japanese territory as of 1999 extends over 37,790,000 hectares, or about 0.3 percent of the earth's terrestrial surface, of which about 80 percent is either forested (25.11 million hectares (66.4%)) or agricultural land (4.95 million hectares (13.1%)). In recent years, the total area devoted to forestry or agricultural purposes has diminished, while that used for buildings and roads has increased.

1.2 Climate

Japan stretches over a great distance from north to south with a vast range of climatic zones and has distinct four seasons. The mountain ranges forming the backbone of Japan's main islands also serve to enhance the climatic varieties in different regions of Japan. In winter, northerly cold winds from Siberia (winter monsoon), bring a large amount of snowfall to the coast areas of the Japan Sea, while southerly winds (summer monsoon) make summer hot and wet almost over Japan except Hokkaido.

With such varied natural environments, Japan fosters home to a wide variety of species. With regard to fauna, about 1,400 vertebrates and about 35,000 invertebrates have been identified, while amongst the flora, some 7,000 vascular plants (tracheophytes), 5,500 algae, 1,800 mosses, 1,000 lichens, and about 16,500 fungi (excluding marine species) have been found.

The climate statistics (1971-2000 period average) are shown in Table 1.1 based on report from several meteorological stations, which are considered affected only slightly by urbanization.

Table 1.1 Climate of Japan

		Latitude	Longitude	Elevation	Annual Mean Temperature	Annual Mean of Daily Maximum Temperature	Annual Mean of Daily Minimum Temperature	Annual Precipitation
		(N)	(E)	(meters)	(°C)	(°C)	(°C)	(mm)
Northern Japan	Abashiri	44°01.0'	144°17.0'	37.6	6.2	10.0	2.6	801.9
	Nemuro	43°19.7'	145°35.4'	25.2	6.1	9.4	3.0	1,030.0
	Yamagata	38°15.2'	140°20.9'	152.5	11.5	16.4	7.2	1,125.0
	Ishinomaki	38°25.5'	141°18.2'	42.5	11.4	15.3	7.9	1,064.5
Eastern Japan	Fushiki	36°47.3'	137°03.4'	11.6	13.7	17.7	10.3	2,196.4
	Mito	36°22.6'	140°28.2'	29.3	13.4	18.5	8.9	1,326.0
	Iida	35°30.6'	137°50.3'	482.3	12.5	18.6	7.5	1,606.7
	Hamamatsu	34°42.4'	137°43.4'	31.7	16.0	20.2	12.4	1,875.5
Western Japan	Sakai	35°32.5'	133°14.2'	2.0	14.9	19.0	11.1	1,894.9
	Hamada	34°53.6'	132°04.4'	19.0	15.2	19.1	11.5	1,705.7
	Hikone	35°16.4'	136°14.8'	87.3	14.4	18.5	10.8	1,617.9
	Miyazaki	31°56.1'	131°25.0'	9.2	17.3	22.0	13.1	2,457.0
	Tadotsu	34°16.4'	133°45.3'	3.7	16.0	20.0	12.2	1,090.7
Nansei Islands	Naze	28°22.6'	129°29.9'	2.8	21.5	24.7	18.6	2,913.5
	Ishigakijima	24°19.9'	124°09.8'	5.7	24.0	26.6	21.9	2,061.0

Source: Japan Meteorological Agency, 'Climate Table of Japan'

Note: Annual mean temperatures, annual means of daily maximum, and minimum temperatures are obtained by averaging monthly mean normals calculated for the 1971-2000 base period.

Annual mean temperatures over Japan, which were relatively cool condition except around 1960, began to rise in the early 1990s to reach the warmest condition for more than 10 years. The 1990s has been the warmest decade in the past 100 years. As regards precipitation, annual number of days with less than 1 mm precipitation has been increasing, and the potential of occurrence of drought has become larger.

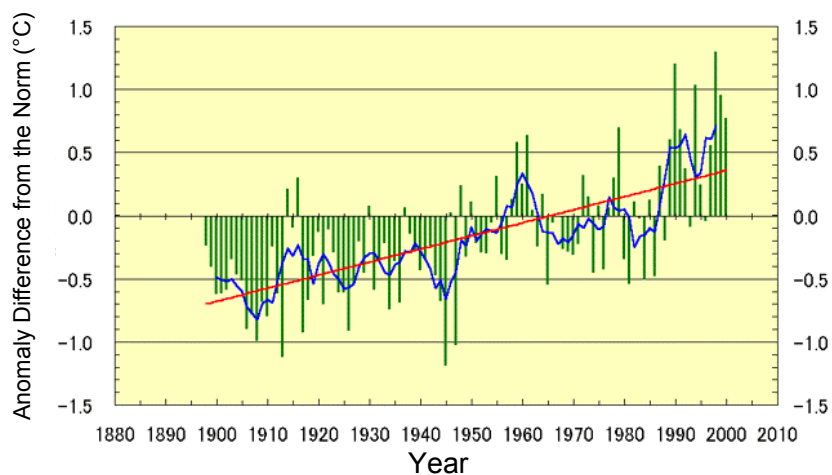


Figure 1.2 Annual mean surface temperature variations in Japan from 1898-2000

Source: Japan Meteorological Agency – 'Climate Change Monitoring Report 2000'

Note: The ordinate shows the annual mean surface temperature anomalies, which are deviations from 1961-1990 period normals averaged for the 15 stations presented in Table 1.1. The bars indicate annual anomalies. The solid line indicates the five-year running mean. The inclined pale line indicates the long-term linear trend.

1.3 Population and Households

According to the latest population census, as of October 1st 2000, Japan's population was 126,925,843, representing a 1.1% increase over the previous census (October 1995). The population density was 340 inhabitants per square kilometer. In line with the falling birthrate and increased average longevity, the ratio of the elderly amongst the population has rapidly increased at a higher rate than ever, and the population segment aged 65 or older as of 2000 was 17%. This rate is the highest of all the developed countries.

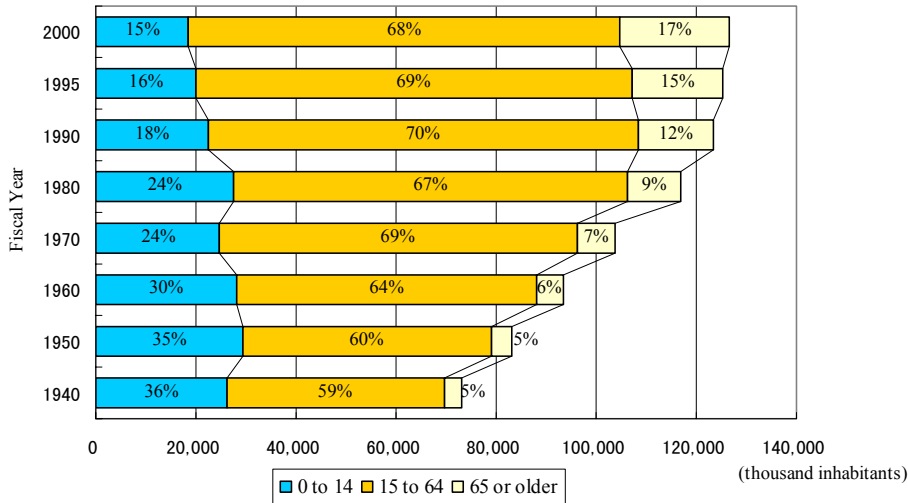


Figure 1.3 Age Distribution of the Japanese Population

Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications – ‘Population Census’

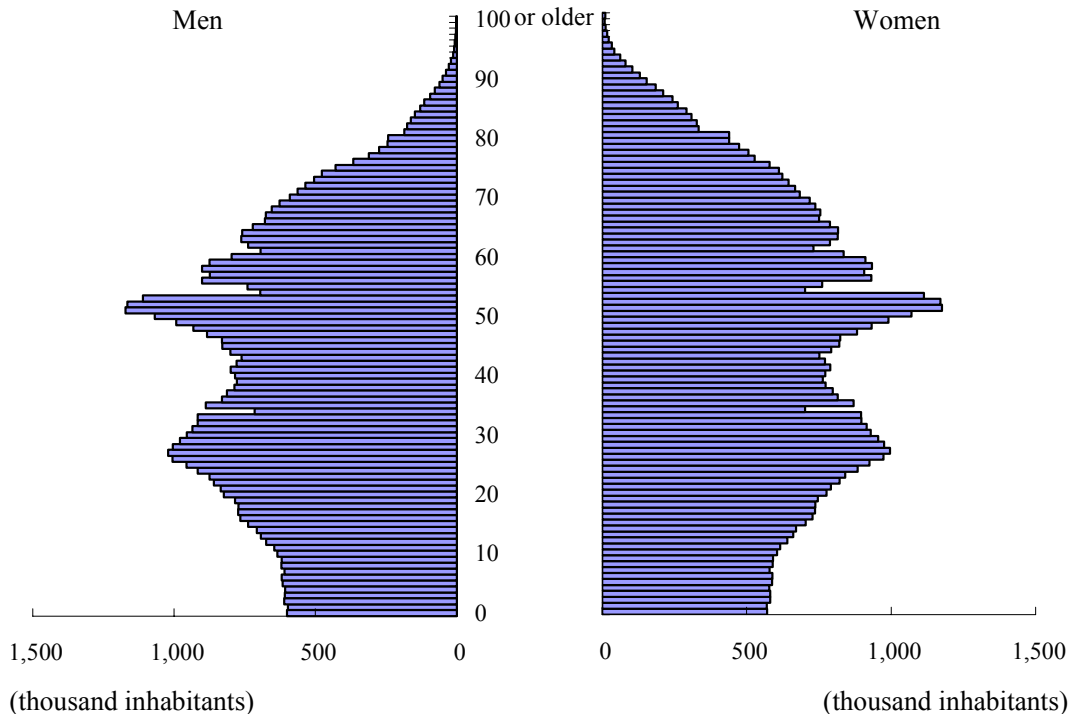


Figure 1.4 Japanese Population Pyramid in 2000

Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications – ‘Population Census’

During the 1960s, the years of the so-called Japanese economic miracle when the economy grew very rapidly, the number of people migrating into Japan’s three metropolitan areas substantially exceeded the number leaving, with a net immigration into such areas of approximately 500,000 people per year. But this net immigration into the three metropolises decreased in the 1970s. In nationwide scale, however, as of October 2000, 65 percent of the population lived in the densely inhabited districts (=DIDs) *, showing the continued concentration of the population in metropolitan areas.

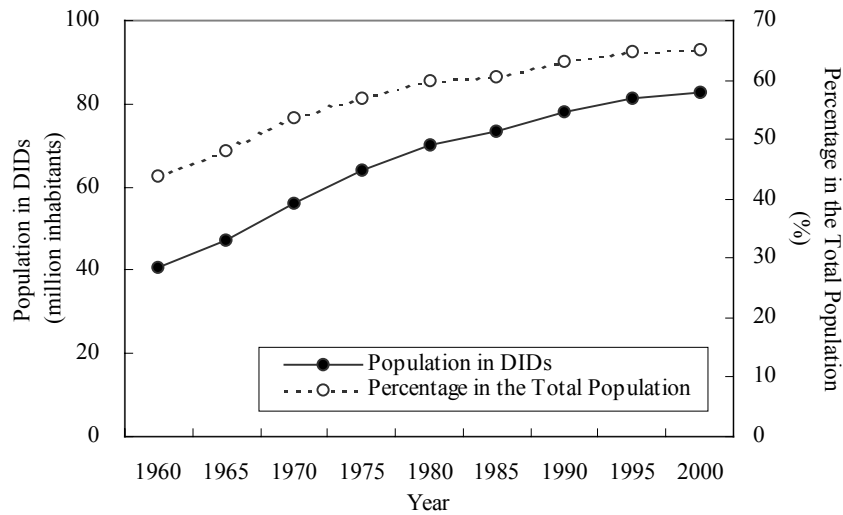


Figure 1.5 Population Residing in Densely Inhabited Districts

Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications – ‘Population Census’

*) DIDs: Indicates areas adjacent to the basic unit district with high population density (as a general rule, population density of 4,000 or more inhabitants per square kilometer) within a city, ward, town or village boundary, and whose population is 5,000 or more.

In 2000, there were 46,780,000 households in Japan, 6.6 percent more than in 1995. The average size of households is 2.67 persons in 2000. Since 1970, the number of households has continued to increase and the average size of households continued to decline, reflecting changes in household formation patterns, such as changing from extended family systems to nuclear families and increased numbers of solitary-person households, as well as a reduction in the number of children reflecting the falling birthrate.

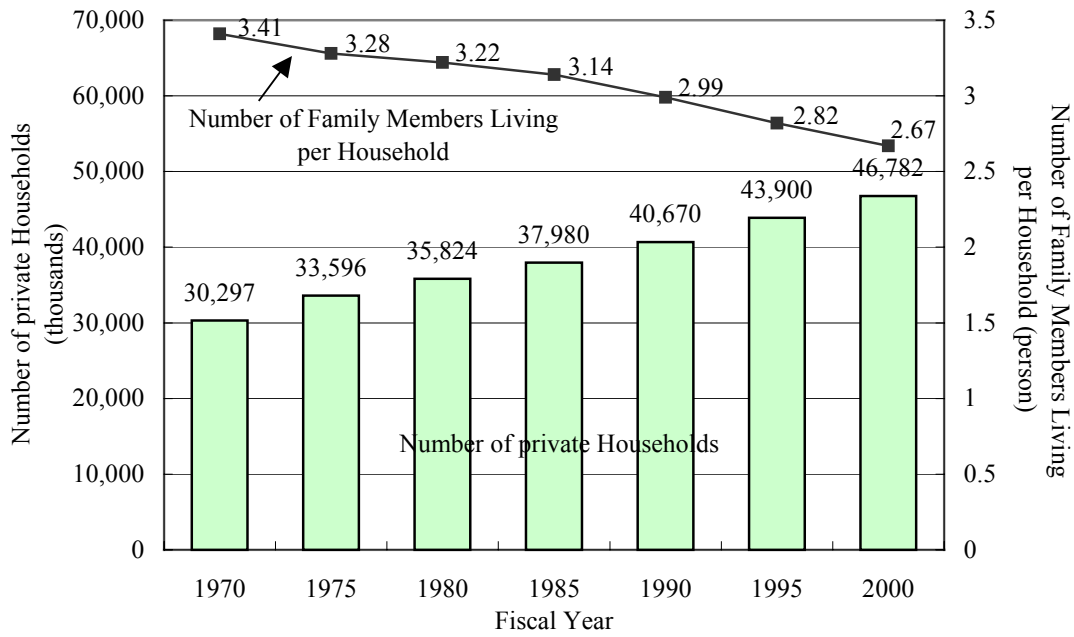


Figure 1.6 The Number and Average Size of Japanese Households

Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications — ‘Population Census’

1.4 Houses and Commercial Facilities

According to the ‘Housing and Land Survey of Japan’ in 1998, the total number of houses has reached 50.25 million for a total of 44.36 million households. As a result, the number of houses per household has reached 1.13, representing a continued improvement.

In terms of the quality of such accommodation, the average area of floor space per home has risen to 92.4m², demonstrating a steady improvement overall, but when the details are analyzed, a stark contrast can be seen between owned houses (122.7m²) and rented houses (44.5m²), illustrating the number of small rented houses.

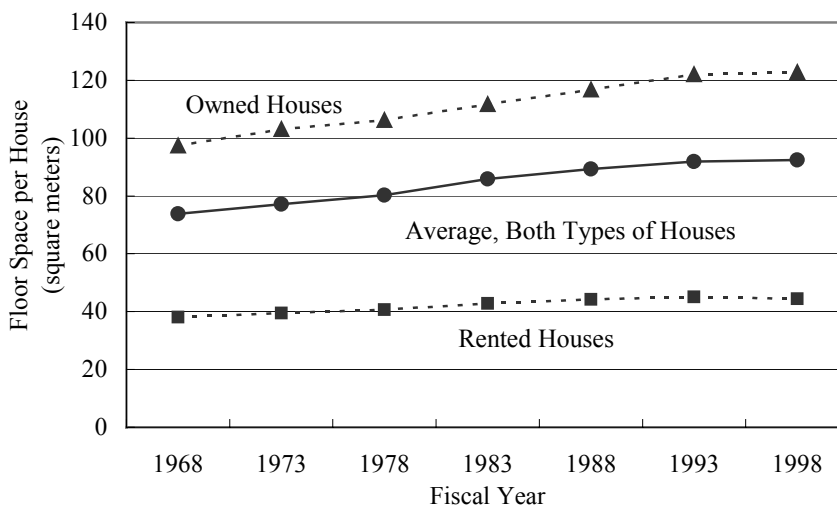


Figure 1.7 Floor Space Areas per House

Source: Ministry of Public Management, Home Affairs, Posts and Telecommunications – ‘Housing and Land Survey of Japan’

In Japan, since the period of economic rapid growth, the ratio of tertiary industries, concerning the industrial structure, and in particular the employment structure, has increased. The importance of technology, information, planning and design, etc., for each industry has also increased, and the weight of indirect sectors has increased. In line with the general shift of the Japanese economy towards the tertiary industries as indicated above, the amount of floor space devoted to the business sector has steadily increased. Since 1965, it has increased at an average of 4.1% annually. As a result, the amount of floor space for business sectors in 1999 was approximately quadruple that of 1965.

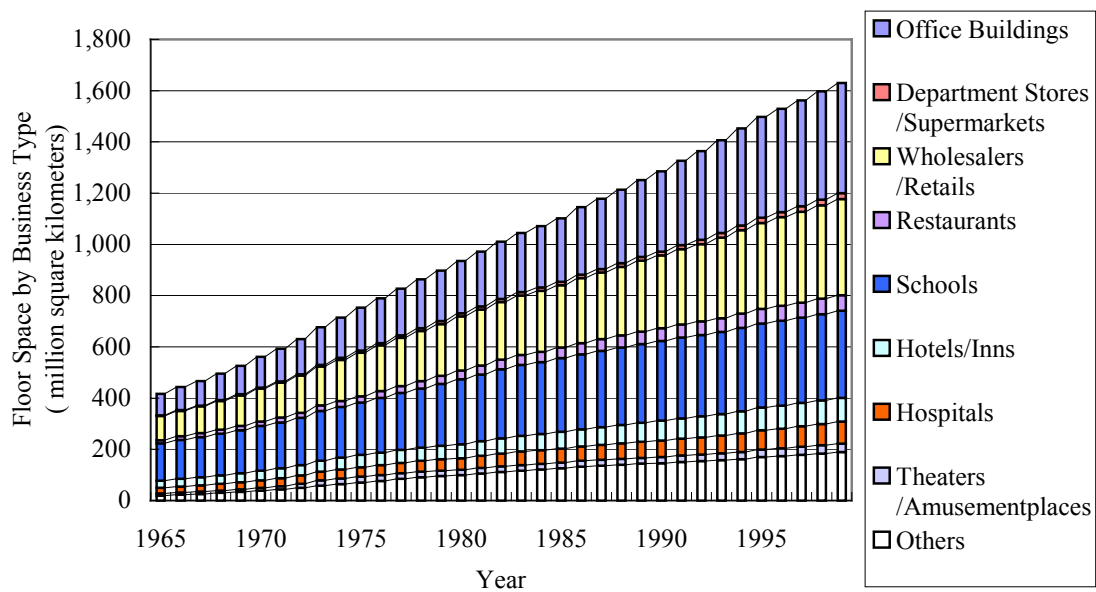


Figure 1.8 Change in Amount of Floor Space by Business Type

Source: The Institute of Energy Economics, Japan – ‘Handbook of Energy & Economic Statistics in Japan’

1.5 Japan’s Industry and Economy

From fiscal 1970 to fiscal 1998, Japan’s gross domestic product (GDP) increased by 2.6 times to 481 trillion yen. During the same period, per capita real GDP increased by about 2.1 times from 1.82 million to 3.8 million yen. The growth process of the Japanese economy by present is explained below.

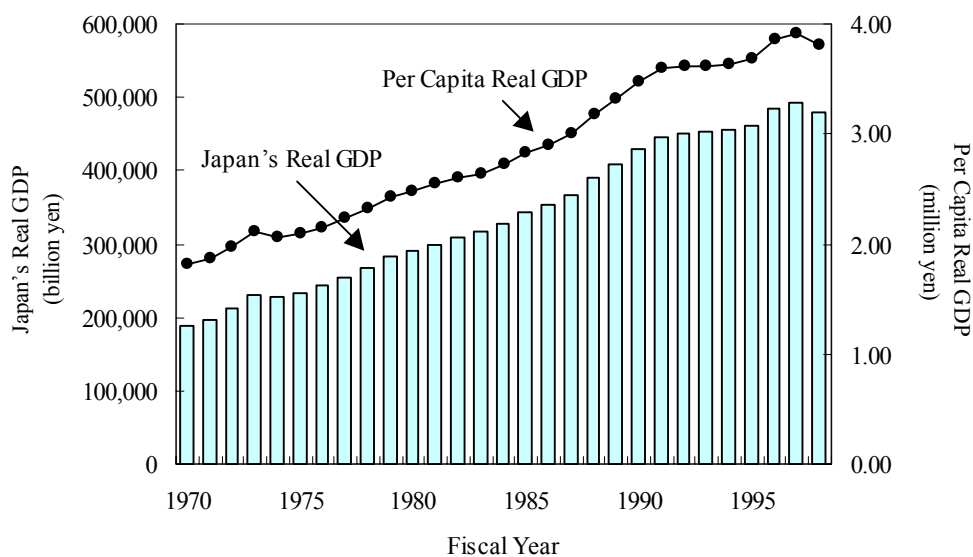


Figure 1.9 Gross Domestic Product from Fiscal 1970 based on 1990 Market Prices

Source: Economic Planning Agency – ‘Annual Report on National Accounts’

Japan’s economy grew extremely rapidly in the 1960s resulting in the development of heavy industry, mainly producing such essentials as steel and petrochemical materials. Synchronously with this, the Japanese economy consumed a large amount of resources and energy. During the same period, the workforce shifted from primary to secondary and tertiary industries. Agricultural production increased despite a reduction in the number of agricultural laborers. Nevertheless, because of the growing income gap compared with other industries, depopulation and other factors, the number of younger laborers working in agriculture villages decreased while the average age of the nation’s farmers increased. At that time, Japanese forestry was primarily practiced by well-dispersed, extremely small businesses operating in steep mountainous areas. It was difficult to improve labor productivity, so forestry faced various problems including a price differential versus imported lumber and other industries. As a result, depopulation of mountain villages continued, the average age of forestry workers increased, and production stagnated. In the 1970s, following the first oil crisis (1973), in 1974 Japan’s economy recorded its first contraction since the Second World War. Economic growth remained sluggish for some time thereafter. At the same time, the nation’s manufacturing focus shifted from energy-intensive basic industries such as the steel and petrochemical industries to high value-added processing and assembly industries such as electrical appliances and machinery. As income levels rose, the growth of the economy’s services and software components expanded. Tertiary industry (services) came to account for over 50 percent of gross domestic product and total employment. In agriculture, the consistent shares of vegetables and dairy products increased as Japanese dietary habits changed and the nation produced a surplus of rice and other items. Following the Plaza Accord of 1985, the yen began to grow ever stronger on exchange markets, severely hurting Japanese industry, which was generally very dependent on exports. With the subsequent structural adjustment of the Japanese economy, however, domestic demand expanded, business boomed, the sectorial shares of the financial, wholesale, and retail industries increased, and the prices of land, securities, and other assets skyrocketed. Then, in the early 1990s, the prices of land, securities, and other assets nose-dived due to monetary tightening and other factors. Combined with an adjustment in consumer durables and capital stock, and reductions in expenditure on consumables from this asset deflation led to the stagnation of economic activities and to a large volume of irrecoverable debts amongst the nation’s financial institutions. Since fiscal 1992, growth of less than 1 percent or negative growth has continued except for in fiscal 1995 and 1996. In particular, since fall 1997, a number of financial organizations have gone bankrupt while the aftereffects of the ‘bubble economy’ have predominated as well as the negative effects of the Asian economic and currency crises, and the reputation of the financial system has been downgraded, resulting in

a worsening of the already tough economic status. In terms of the industrial structure, the yen continued to appreciate from the spring of 1990 through the spring of 1995, influencing the processing and assembly industries and spurring on a structural shift among Japanese firms towards greater overseas production. On the other hand, the information, telecommunications, and other nascent industries recorded large growth. In agriculture, competition with foreign producers intensified as the volume of imports increased sharply. In response, Japanese farmers have been strengthening their operations by moving towards larger-scale production and pursuing other rationalization measures. In terms of the trade balance, black figures of between 10 and 15 trillion yen have been achieved since the 1980s, but the ratio of the nominal GDP has tended to decline from a peak in 1986.

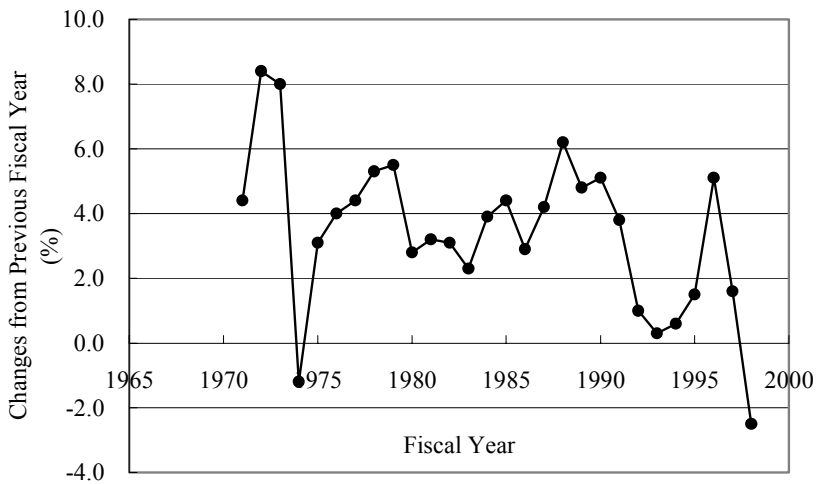


Figure 1.10 Change in Real Gross Domestic Product at 1990 Market Prices

Source: Economic Planning Agency – ‘Annual Report on National Accounts’

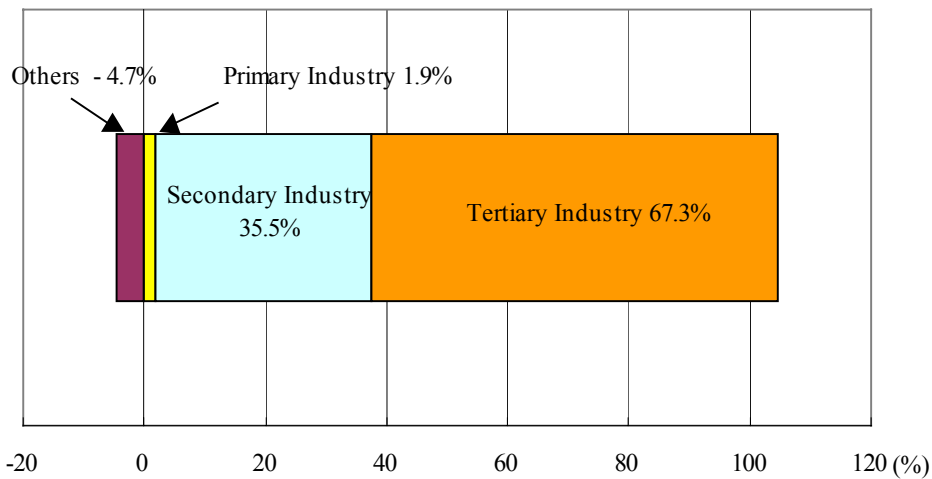


Figure 1.11 Composition Ratio of Real Gross Domestic Product by Economic Activity Type in 1998 at 1990 Market Prices

Source: Economic Planning Agency – ‘Annual Report on National Accounts.’

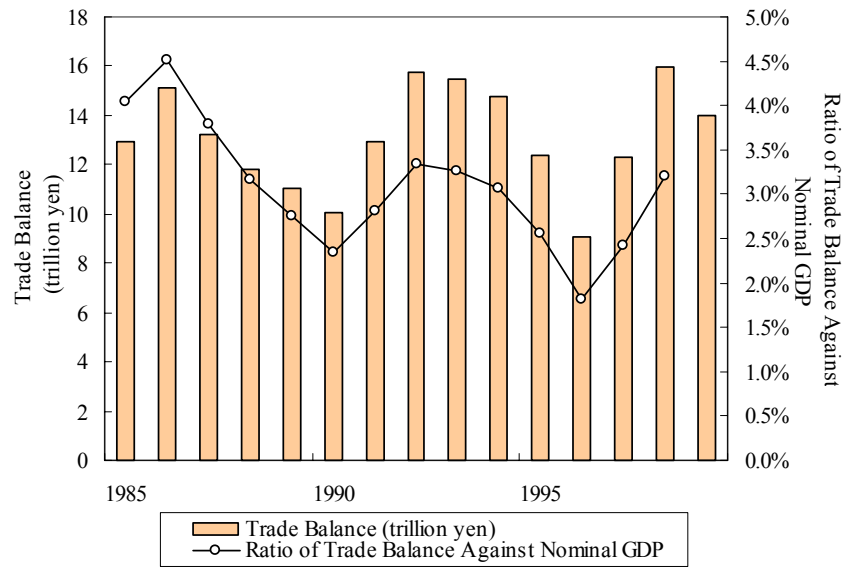


Figure 1.12 Changes in Trade Balance

Sources: Bank of Japan – ‘Balance of Payments Monthly’; Economic Planning Agency – ‘Annual Report on National Accounts

1.6 Transport

1.6.1 Passenger Transport

Domestic passenger traffic grew significantly throughout the period of rapid economic growth as a result of the popularization of automobiles, improvements to the rapid and comfortable transport system with great mobility and the reduction of traveling time with the network expansion. In particular, private automobile ownership began to grow from about 1960 in line with the growth of income level. As a result, rail traffic's share decreased as road traffic's share increased significantly in the 1960s. Air traffic represented a small fraction of the whole traffic, but its transport volume grew significantly, as its timesaving features and the growth of air transport services with the introduction of jet aircraft in domestic airlines.

Following the first oil crisis, the growth in the whole domestic passenger traffic shrank, but the rise in the standard of living and the increase of recreational time pushed up the passenger travel by motorcar. The introduction of jumbo jets, relatively low airfares and a growing preference for faster modes of transportation caused increase in the volume of air traffic and its share. On the other hand, the share of railways decreased and, it decreased to mere above 40% in the end of the 1970's, which was 75% in 1960.

The growth rate of passenger traffic during the early 1980's lowered, but it suddenly increased in the latter 1980's along with the economic boom (bubble economy). In the 1990's, however, passenger traffic volume and the share of each transportation mode has remained almost constant.

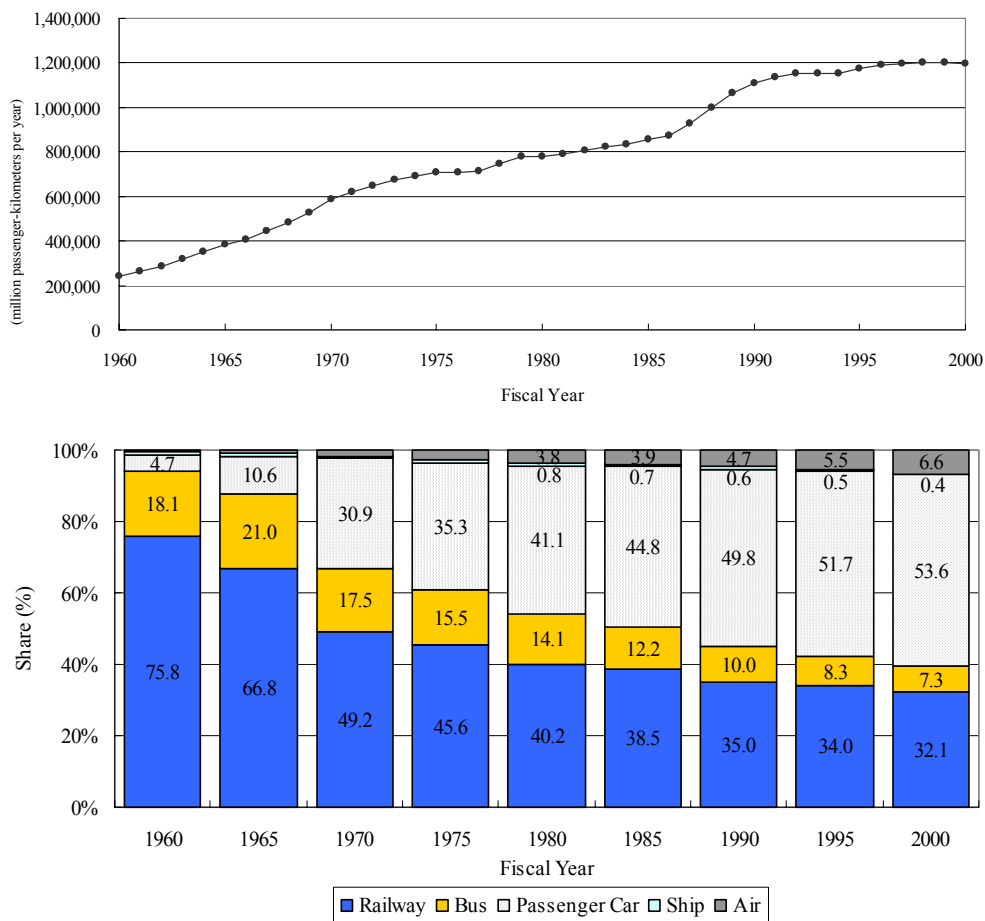


Figure 1.13 Volume of Domestic Passenger Traffic (above) and Modal Shares (below) in Passenger-Kilometers

Source: Ministry of Land, Infrastructure and Transport – ‘Domestic Transportation Statistics Handbook’

Notes: Passenger cars do not include light motor vehicles and private use trucks. Numeric data on passenger cars for fiscal 1994 does not include figures for Hyogo prefecture between January and March 1995 due to the Great Hanshin-Awaji earthquake.

1.6.2 Freight Transport

Domestic freight traffic followed the same upward path as the economic growth during the period of rapid economic growth. Freight road transport showed especially rapid growth, because of increasing demand for transportation of processing components, whose weight are relatively light. Trucking also benefited from the demand for short-distance transport along with the development of industrial complexes in coastal areas near major cities. With the shift of the energy source from coal to oil and the development of heavy industry in coastal areas, domestic sea freight traffic of raw materials for petrochemical, steel and cement industries and other key heavy industries grew. In contrast, the growth of freight traffic by rail barely increased.

The first oil crisis in 1973 sharply decreased domestic freight traffic in fiscal 1974 and 1975. Freight traffic then gradually increased until fiscal 1979, primarily led by higher demand for civil engineering and construction-related cargos because expenditures for public works increased as part of policies to stimulate the economy. When the second oil crisis struck in 1979, however, domestic demands and shipments of basic and material industries again stagnated and freight traffic shrank as oil consumption decreased with the conversion from oil to other forms of energy.

From the 1980s, Japan experienced industrial restructuring, including a shift from basic materials to processing and assembly, the growth of knowledge-intensive industries, and the transformation of the industrial structure towards tertiary industries. Import demand generated through industrial activities has been reduced in line with the shift to a service-oriented economy. As a result, freight traffic remained flat during this period, decoupled from the economic growth. In the latter half of 1980's, freight traffic turned to increase by a major, domestic, demand-led economic expansion. The modal share of road freight traffic recorded over 50 percent in 1987, as the characteristics of truck transport met the need for small-lot, high-frequency transportation brought on by the advance of the small-volume production of a wide variety of products, and small packet delivery services were upgraded. As a result of the decline in the basic material industries, growth of domestic sea transportation remained rather slack, but it showed some growth with the economic expansion in the late 80's, the domestic sea shipment exceeded their second-oil crisis freight traffic level in fiscal 1990. As the share of airfreight was small, it has been growing to meet the demand for shipping relatively small, light items including machine parts, fresh foods and books. The share of rail freight transportation has steadily declined, but the advance of containerized transport slowed down this decline.

The total freight volume has remained flat since 1991 due to the recession following the collapse of the bubble economy.

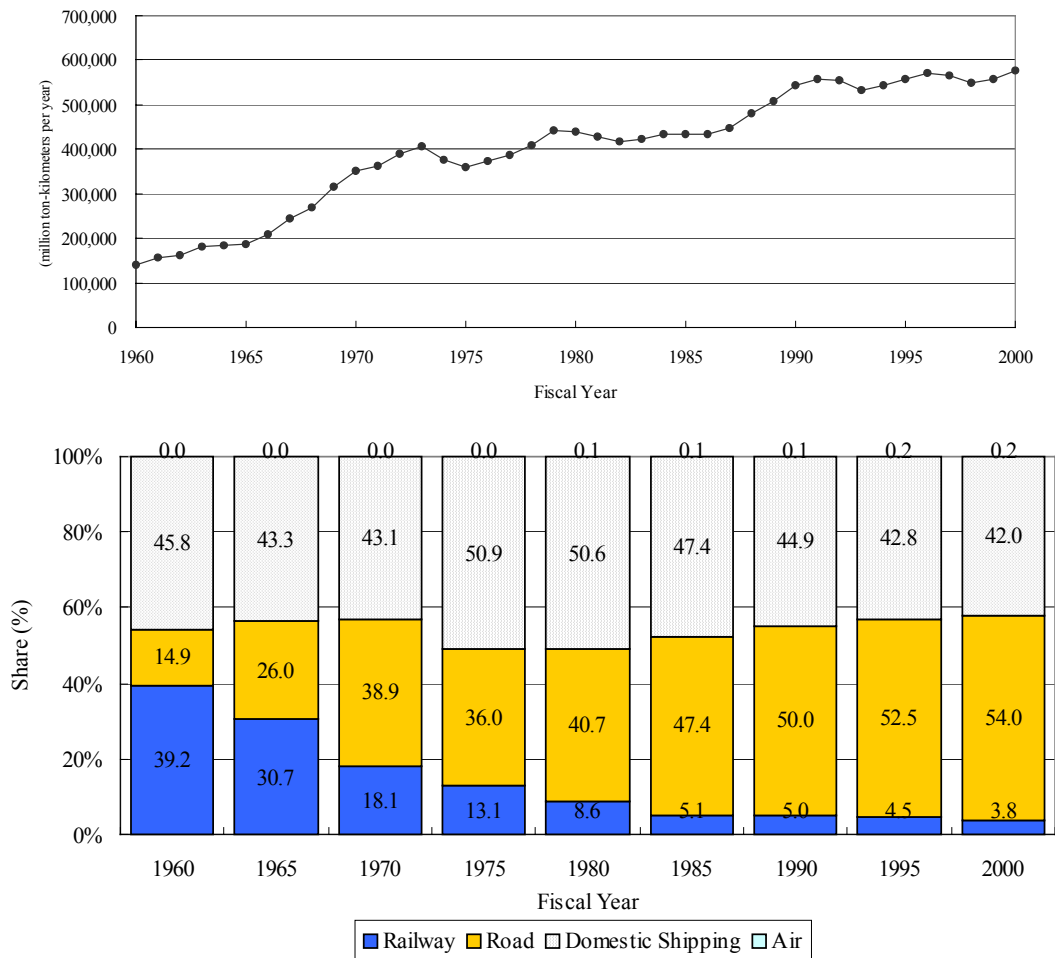


Figure 1.14 Domestic Freight Traffic (above) and Modal Shares (below) in Ton-Kilometers

Source: Ministry of Land, Infrastructure and Transport – ‘Domestic Transportation Statistics Handbook’

Notes: Passenger cars do not include light motor vehicles. Numeric data on passenger cars for fiscal 1994 does not include figures for Hyogo prefecture between January and March 1995 due to the Great Hanshin-Awaji Earthquake.

1.6.3 Motor Vehicle Traffic

Road transport accounts for a large proportion of both passenger and freight traffic. In this section, the number of motor vehicle ownership and vehicle mileage are explained.

Total motor vehicle ownership has increased consistently since the 1960s.

The number of passenger car in fiscal 2000 has increased by 50% since fiscal 1990. However, as the number in fiscal 2000 increased by just 17% over fiscal 1995, its increase rate has slowed down.

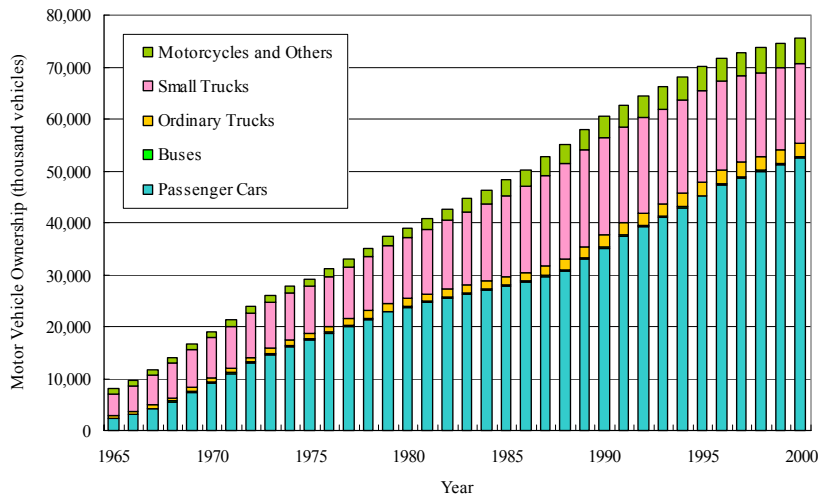


Figure 1.15 Motor Vehicle Ownership

- Note 1: Passenger cars includes light weight cars(the engine displacement is 660 cc or less).
 2: Small trucks includes light weight trucks(the engine displacement is 660 cc or less).
 3: Small special categories of vehicle, scooter (type I) and scooter (type II) are not included
 Source: Ministry of Land, Infrastructure and Transport

The total travel distance of trucks, business passenger cars, and buses declined in fiscal 2000 compared to fiscal 1990. The travel distance of private passenger cars significantly increased by around 42% in fiscal 2000 compared to fiscal 1990. However, as the increase in fiscal 2000 was just 15% from fiscal 1995.

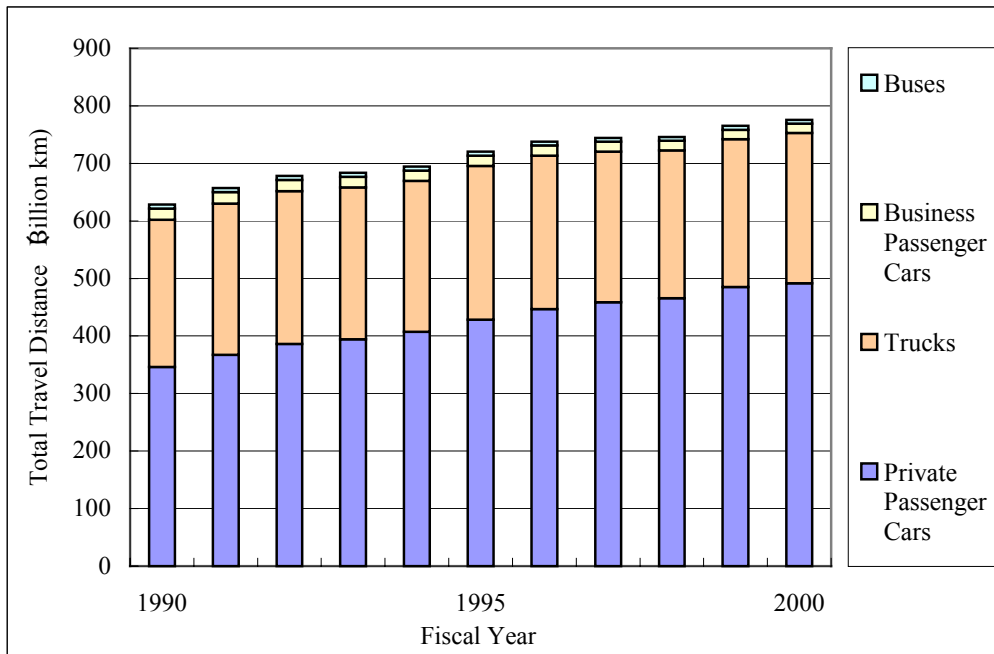


Figure 1.16 Changes in Vehicle Total Travel Distance

Source: Ministry of Land, Infrastructure and Transportation – ‘Annual Statistical Report for Car Transportation’

With regard to private and business passenger cars, which account for a large proportion in the total fleet, preferences have shifted to saloon cars and recreational vehicles (RVs) since 1980, and the ratio of heavy vehicles has increased accordingly. In addition, the average weight of light weight cars (the engine displacement is 660 cc or less) has been increasing following legislation to improve their safety implemented in 1994.

Sales amount of light weight and small vehicles has increased recently, and the preference seems to be separated into two types. However, the preference for large vehicles has still been continued in general, and the number of vehicles whose weight is 1,000kg or less in fiscal 2000 decreased by around 45% compared to fiscal 1980. In the same period, the total number of passenger cars in the 1,001 to 1,500 kilograms category has increased threefold, while those of 1,501 kilograms or more has increased by about 60 times. Thus, the average weight of passenger cars has increased by about 37% over the last 20 years from 942 kilograms in fiscal 1980 to 1,293 kilograms in fiscal 2000.

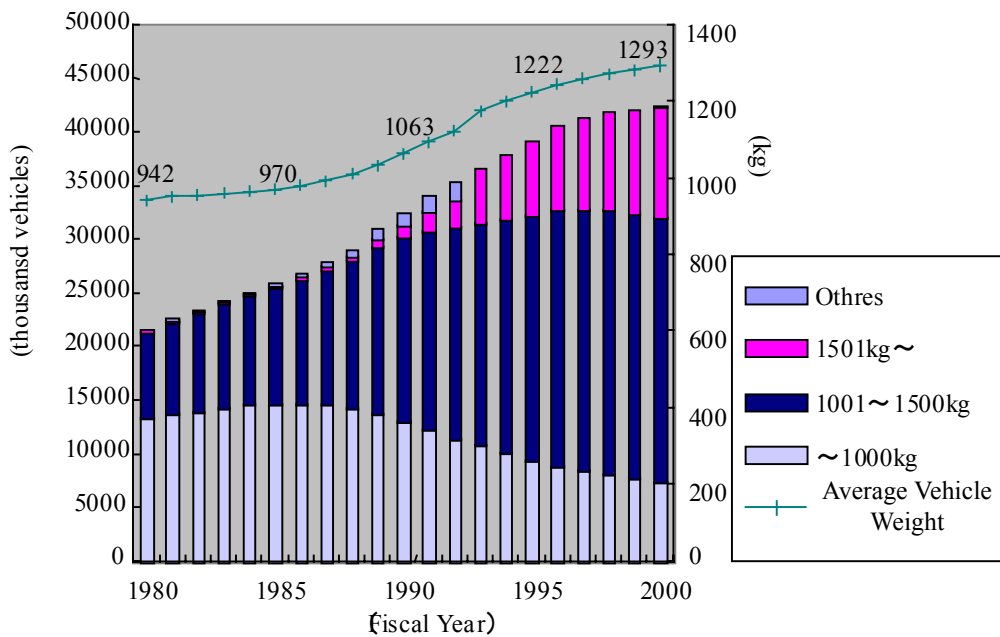


Figure 1.17 Increase in Size (Weight) of Passenger Cars

Source: Car ownership by category (from Ministry of Land, Infrastructure and Transport and Automobile Inspection and Registration Association)

Note 1: Light weight cars (the engine displacement is 660 cc or less) are not included.

2: Multi passenger vehicles (MPV) and minivans that weigh 1,501 kg or more were included under 'Others' until 1992, but they are categorized by weight from 1993 onwards.

1.7 Energy

1.7.1 Consumption

Final energy consumption continued to increase significantly with the Japanese economy's rapid growth during the 1960s and until the first oil crisis in 1973 (Phase I), after which it leveled off and eventually decreased (Phase II). From 1986 onwards (Phase III), however, the economic pickup primed new growth in energy consumption, equivalent to $15,565 \times 10^{15}$ J in fiscal 1999.

These trends can be summarized for different sectors as follows. Until the first oil crisis in 1973 (Phase I), industrial, residential and commercial, and transport sector energy consumption grew rapidly. From fiscal 1973 until 1986 (Phase II), residential and commercial, and transport sector energy consumption continued to grow, but industrial energy consumption began to decrease. After 1986 (Phase III), the strong economy in the latter half of 1980s boosted energy consumption in the industrial sector for a while, but it leveled off in 1990s. On the other hand, energy consumption in the residential and commercial has significantly

increased. In transport sector, it has significantly increased between 1990 and 1995, however, its increase rate has slowed down over 1995. In fiscal 1999, the industrial sector's share of the total energy consumption in Japan (including non-energy use) was 49%; while the residential and commercial sector's was 26%; and transport's 25%.

Energy consumption trends differ according to the type of energy in question. Electricity and gas consumption have grown uninterruptedly; in fiscal 1999, they were respectively 2.3 times and 3.1 times their fiscal 1973 levels. Coal consumption has been increasing, albeit very gradually. Oil consumption grew rapidly during Phase I, leveled off during Phase II, and has begun to rise again since Japan entered Phase III. Recent growth in demand has been higher for electricity than for other forms of energy consumed by end-users: as a result, the proportion of energy consumed to generate electricity rose from 27 percent of the total primary energy supply in fiscal 1973 to 41% in fiscal 1999.

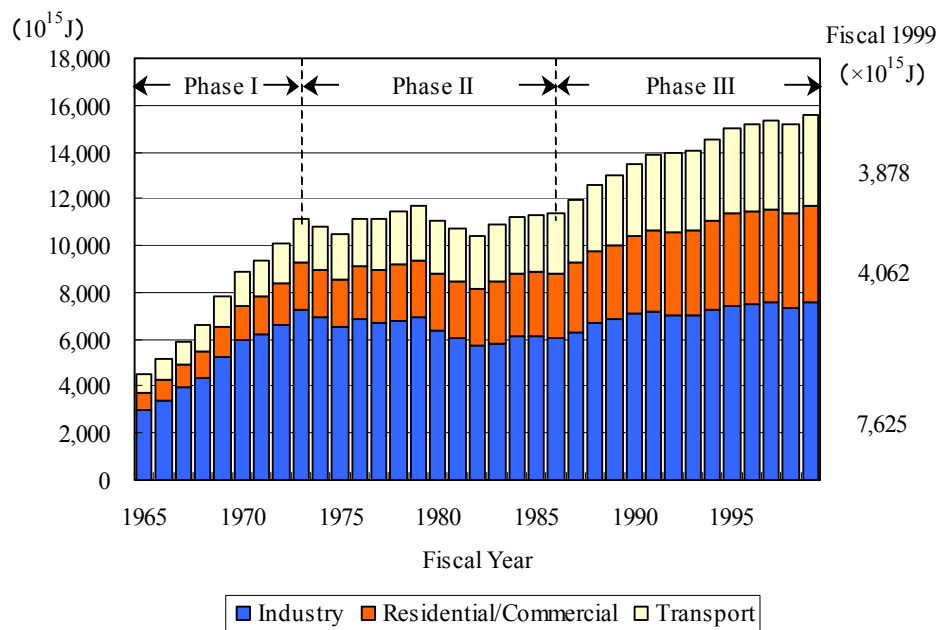


Figure 1.18 Final Consumer Energy Consumption

Source: Agency of Natural Resources and Energy – ‘General Energy Statistics ’

Note: Industrial sector figures include non-energy use.

1.7.2 Supplies

Japan has almost no domestic fossil fuel resources. The ratio of domestic production volumes for the total various fossil fuel supply volume is coal: 2.3%; crude oil: 0.3%; natural gas: 3.3% (all data as of fiscal 1999). Its dependence on foreign sources peaked in fiscal 1973 at 89.4 percent of its energy supply; since then, this dependence has been reduced by efforts to find substitutes for oil; in recent years, foreign dependence has remained about 80 percent, putting the nation in an extremely vulnerable energy-supply situation.

Japan's total primary energy supplies reflect increases in final energy consumption; supplies continued to grow at a substantial rate until fiscal 1973 but leveled off after the first oil crisis, and after 1986 there was again a surge of growth. In fiscal 1999, Japan's total primary energy supply was $22,967 \times 10^{15}$ J.

Oil supplies grew continually during Phase I, shrank during Phase II, and again grew steadily during Phase III. Coal supplies are increasing very gradually. Supplies of natural gas and nuclear energy are growing at a substantial rate. Different energy sources contribute different shares of the total primary energy supply: during Phase I, oil increased its share while coal and hydroelectric power decreased theirs. As a result, oil's share of total primary energy (the ‘oil dependency’ rate) rose to its peak at 77 percent in fiscal 1973. Oil's share then began to decrease during Phase II, and leveled off during Phase III, but recently, decreased

again and as of fiscal 1999, it was 52%. Coal gradually increased its share following the second oil crisis in 1979 – it was 19 percent in fiscal 1985 – but since then, its share has been reduced or remained level; in fiscal 1999, it accounted for 17 percent. The introduction of alternatives to oil beginning in fiscal 1973 swiftly increased the shares of natural gas and nuclear power, to 13 percent each in fiscal 1999 from two percent and one percent in fiscal 1973, and contributed to Energy Security of Japan.

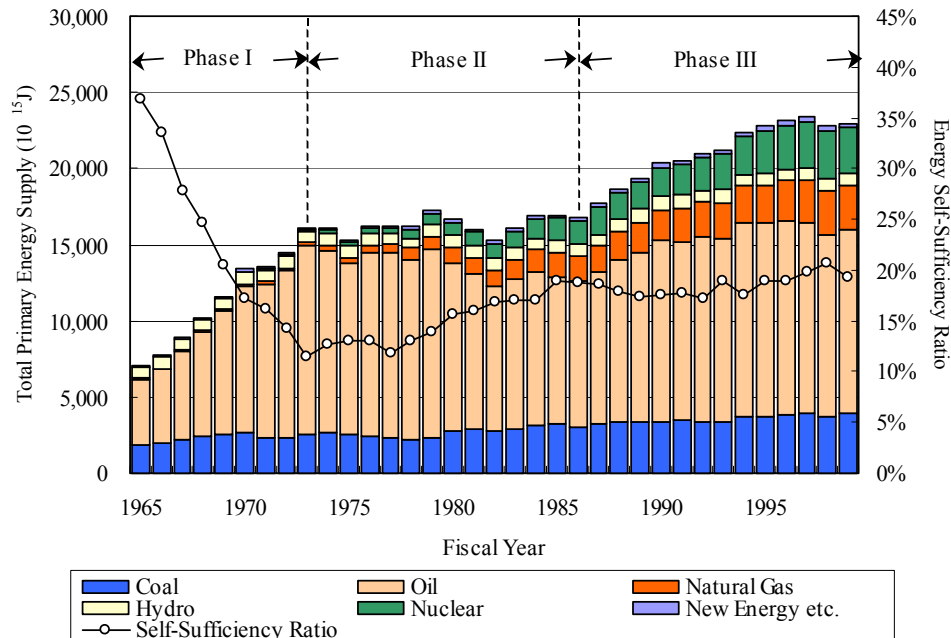


Figure 1.19 Total Primary Energy Supply and Self-Sufficiency Ratio

Source: Agency of Natural Resources and Energy – ‘General Energy Statistics’

Note: ‘New energy , etc.’ includes geothermal energy.

The total of electric power generation increased by about 24% in fiscal 1990 compared to fiscal 1999, nuclear power by about 57%, thermal power by about 13%. As for thermal power generation, coal increased by about 113% and LNG by about 47%, on the other hand, oil decreased by about 46% in the same period.

1.7.3 Per Capita Total Primary Energy Supply and Total Primary Energy Supply per Unit of GDP

Japan’s total primary energy supply per capita as of 1999 is $181 \times 10^9 \text{J}$, a level that has remained steady recently.

Japan’s total primary energy supply per unit of GDP (total primary energy supply per gross domestic production) increased (worsened) during Phase I, but has improved significantly since Phase II as a result of the world-leading introductions of energy-saving facilities and technologies brought about by the oil crisis. Though it has tended to improve during Phase III as well, it has remained static during the 1990s. This is due both to the significant contribution of industry’s massive energy-saving investments in reductions that have already been achieved in energy input per unit of output and to the increase in residential and commercial and transport and vehicles energy consumption due to greater national affluence and a higher standard of living.

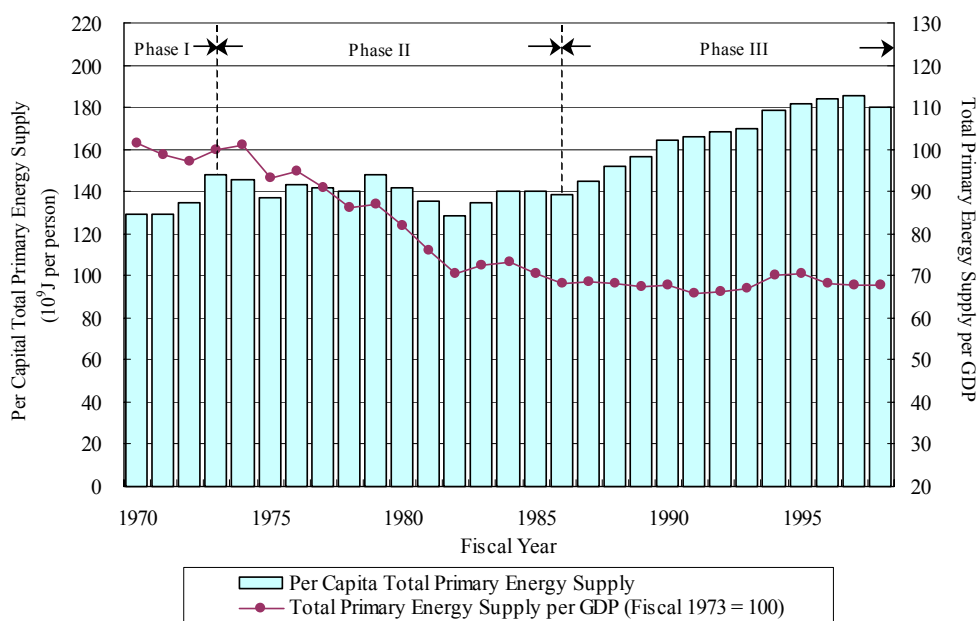


Figure 1.20 Per Capita Total Primary Energy Supply and Total Primary Energy Supply per GDP

Sources: Agency of Natural Resources and Energy – ‘General Energy Statistics’;
 Economic Planning Agency – ‘Annual Report on National Accounts’;
 Ministry of Public Management, Home Affairs, Posts and Telecommunications
 – ‘Population Census’ and ‘The Annual Report on Current Population Estimates’.

1.7.4 Prices

Imported energy was cheap and supplies plentiful during Phase I; prices skyrocketed as a result of the two oil crises, peaking in fiscal 1981 then began to fall, and have been steady since fiscal 1986. The fiscal 1990 yen-denominated price of crude oil* (partially due to the substantial appreciation of the yen) is only slightly higher than it was prior to the oil crisis.

Crude oil prices did shoot up temporarily when the Gulf crisis broke out in 1990 but then returned to the levels prevailing prior to the Gulf War. In 1996, however, the price of crude oil topped \$20 a barrel because of the strong growth of worldwide oil demand, the low inventory system for crude oil and oil products adopted by Western petroleum companies in an effort to reduce costs, coupled with the unstable political situation in the Persian gulf region.

As per the above description, in the first half of the 1990s, the price per barrel changed to around \$20, but the crude oil price fell to \$10 per barrel because global oil stocks had increased in line with a dulling in the increase rate of demand mainly in Asia resulting from the faltering Asian economy due to financial and currency crises from 1997 to 1998.

However, it has skyrocketed to over \$30 in 2000 following the recovery of the Asian economy and OPEC’s decision to cut crude production thereafter. OPEC increased production four times in 2000, and as a result, the crude oil price started to decline from the end of the year, and fell below \$20 for a while. Under these circumstances, OPEC decided to cut production in February 2001 to try to curtail the price crash. Since then, they initiated reduced production additionally from April and September to try to hold the OPEC basket price within \$22 ~ \$28. However, oil prices dropped again due to concern that oil demand may fall due to a global economic slowdown following the September 11th terrorist attacks in USA. In November, the price fell as low as \$16 for a while (Dubai crude oil). As a result of reduced oil prices, OPEC decided to cut production further from January 2002 after receiving signs of reduced production from the non-OPEC oil producers.

*: Crude oil prices are adjusted to correct for price fluctuations caused by exchange rate changes after converting the dollar-based crude oil price to yen in the period concerned.

1.7.5 National Energy Budget and Taxation System

Today, Japan finds it necessary to reform its energy supply and demand structure in order to increase national energy security and positively address global environmental problems.

On the demand side, the government is trying to promote thoroughly efficient energy usage, beginning with energy conservation measures. In terms of supply, efforts are being made to promote the introduction of oil alternative energy such as new energy resources and to strengthen measures to secure a stable supply of oil. In order to further advance these policies, the funds for energy-related measures in the national budget are secured via special accounts. For example, the fiscal 2002 budget allocates 211.3 billion yen (an increase of 23.6 percent over the previous year) for the following the more sophisticated structure of demand and supply of energy policies: technological development of oil alternative energy such as new energy and energy conservation; the conversion to facilities of oil alternative energy such as new energy and of energy conservation, and the spread of them.

Table 1.2 Special Accounts for Coal, Petroleum and the More Sophisticated Structure of Demand and Supply of Energy Policies

(Units: hundred million yen)

Account name	Fiscal 2001 Budget	Fiscal 2002 Budget	Year-on-Year Growth	
Coal Account	1,406	(Note)	-	-
Petroleum and the More Sophisticated Structure of Demand and Supply of Energy Policies	6,298	6,195	-103	-1.6%
Petroleum Policy	4,589	4,082	-507	-11.0%
The More Sophisticated Structure of Demand and Supply of Energy Policy	1,709	2,113	+403	+23.6%
Total	7,704	6,195	-1,510	-19.6%

Sources: Ministry of Finance; Ministry of Economy, Trade and Industry

Note: On the coal account, appropriation of political expenditure ended in fiscal 2001. For fiscal 2002, it will be an estimated account that only seeks to redeem the principal on the original loan (¥8.4 billion).

Table 1.3 Special Accounts for Electric Power Development Promotion Policy

(Units: hundred million yen)

Account name	Fiscal 2001 Budget	Fiscal 2002 Budget	Year-on-Year Growth	
Electric Power Siting Account	2,437	2,446	+10	+0.4%
Electric Power Source Diversification Account	2,425	2,481	+55	+2.3%
Total	4,862	4,927	+65	+1.3%

Source: Ministry of Finance; Ministry of Economy, Trade and Industry

Japan has a system of energy-related taxes that include petroleum tax, and promotion of power-resources development tax. Revenues from petroleum tax are allocated for oil measures, energy conservation measures and new energy measures; while revenues from promotion of power-resources development tax

are allocated for measures for siting power generation facilities and the like, and new energy measures through power generation.

An investment promotion tax system on basis energy has been implemented in Japan since fiscal 1981.

In fiscal 1992, Japan also introduced a tax system to promote investment aimed at reforming the energy supply-demand structure. This system provides tax incentives to promote the introduction of energy conservation and new energy equipment.

1.8 Waste

Waste mainly falls into two categories, namely, municipal solid waste and industrial waste. Industrial waste refers to that generated through enterprising activities and is comprised of 20 types specified by cabinet order. Municipal solid waste covers those other than industrial waste, and includes night soil, other household waste disposed of by families, as well as business waste disposed of from offices and restaurants.

Even though the total amount of municipal solid waste and the waste disposed per capita per day have decreased after the second oil crisis (1979), it rapidly increased again during the bubble economy period since around 1985, and has been relatively flat from 1989 to 1999. The total amount of municipal solid waste disposed is 51.45 million tons, which equates to about 1.1 kilograms per capita per day in 1999. This is comprised of 34 percent business waste and 66 percent household waste. In terms of the disposal methods, most is incinerated (78%), some is recycled (15%) and the rest buried as direct landfill (7%).

The amount of industrial waste disposed of has not changed significantly since 1990, but has remained fairly static. The total amount of industrial waste disposed of in 1999 was about 400 million tons. After such industrial waste is disposed of, about 171 million tons (43%) is recycled and about 50 million tons (12%) are finally disposed.

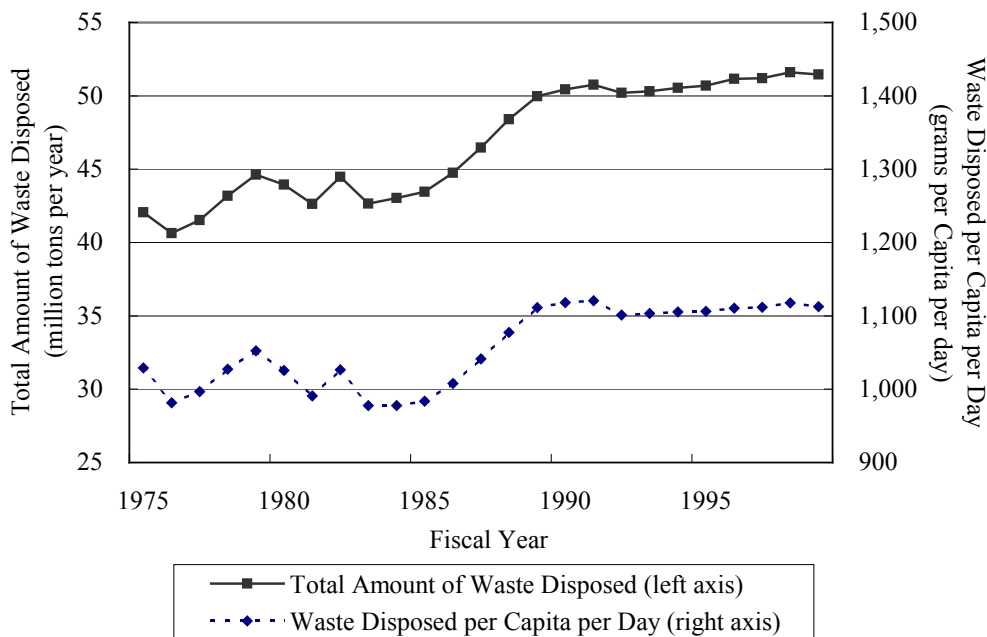


Figure 1.21 Changes in Amount of Municipal Solid Waste Disposed

Source: Ministry of the Environment – ‘Status of Municipal Solid Waste Discharge and Disposal’

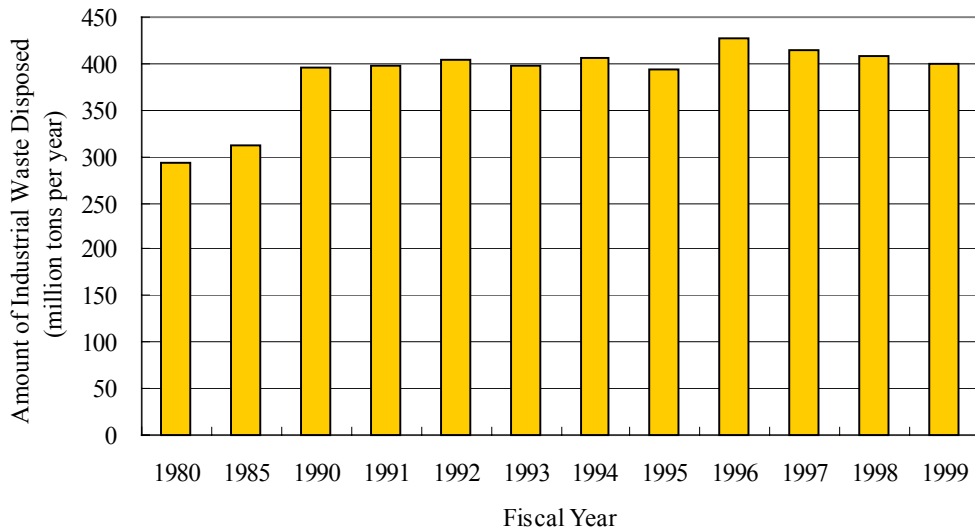


Figure 1.22 Changes in Amounts of Industrial Waste Disposed

Source: Ministry of the Environment – ‘Status of Industrial Waste Discharge and Disposal’

1.9 Agriculture

In Japan, which falls within the Asian Monsoon region, rice cultivation in paddy fields has long formed part of the agricultural system suited to the humid and rainy summer condition. In order to develop paddy field cultivation, measures to improve paddy field irrigation have been implemented, and, as a result, the ratio of irrigated paddy fields out of the total agricultural area in Japan (54.4 percent) is quite high compared to other countries.

However, as Japan is mountainous and does not have much plains (the mountain area accounts for 61 percent of the national land), the conflict among different types of land use has been long observed. The ratio used for agriculture within the national land is about 14 percent and the cultivated field per household is small (approximately 1.6 hectares). Furthermore, the cultivated area has been decreasing year by year, and in 2000, it has fallen to about 20 percent (4.83 million hectares) of the peak period. In terms of paddy fields, new development of paddy fields was restricted in 1969, and since then the total area has declined by the rate of 1 percent per year due to the conversion to other crop field and/or non-agricultural land use. Since the latter half of the 1980s, farmland development has been reduced, with a trend for farmland to be left uncultivated mainly in hilly and mountainous regions, and as a result, the total area under cultivation has also reduced. Such tendency still remains today.

Japan’s food self-sufficiency ratio has also fallen significantly. During the period from 1965 to 1999, the food self-sufficiency ratio in terms of calorie base* decreased from 73% to 40%, or 62% to 27% in terms of grain base. The main long-term cause for the decrease is significant change of Japanese eating habits, including increased consumption of meat and fat which rely on imported feed grain and oilseeds due to restrictions on the national land.

*: Food self-sufficiency ratio in terms of calorie base: Ratio of calorific value of food produced domestically over the total calorific value of food (including feed grain) supplied to the total population.

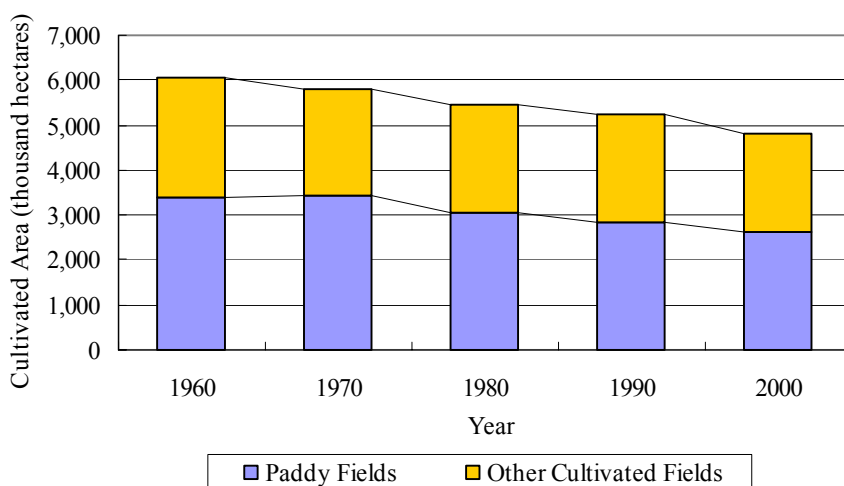


Figure 1.23 Changes in Cultivated Areas

Source: Ministry of Agriculture, Forestry and Fisheries of Japan– ‘Statistics on Cultivated land and Planted Area’

1.10 Forestry

Forestry plays an important role in Japan in maintaining functions for the public benefit such as national land conservation through forestry activities such as thinning and tending as well as providing products such as timber.

Recently, forest cover about 25 million hectares or about 70% of Japan's national land area. It is comprised of national forest: approximately 7.8 million hectares (31%) and non-national forest: 17.3 million hectares (69%). Approximately 10 million hectares (41%) of forest in Japan are planted while the other 15 million hectares (59%) is natural. In terms of the growing stock of forest, its area has roughly doubled since 30 years ago through the active plantation in the 1960s, and has been increasing by about 80 million cubic meters per year, mainly in the area of planted forests.

On the other hand, wood demand in Japan is stable recently around 100 million cubic meters per year. In terms of the specifics, the domestic wood supply has been decreasing, and its supply ratio has become about 20 percent in 1999.

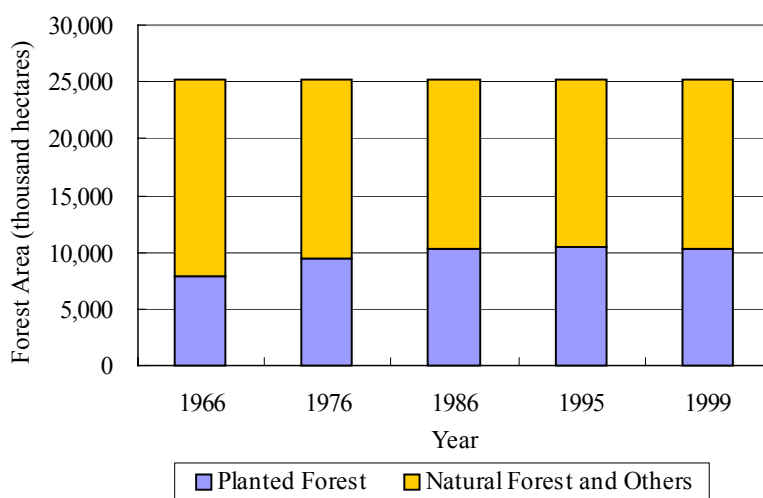


Figure 1.24 Changes in Forested Area

Source: Forestry Agency – ‘Annual Report on Trends of Forestry’

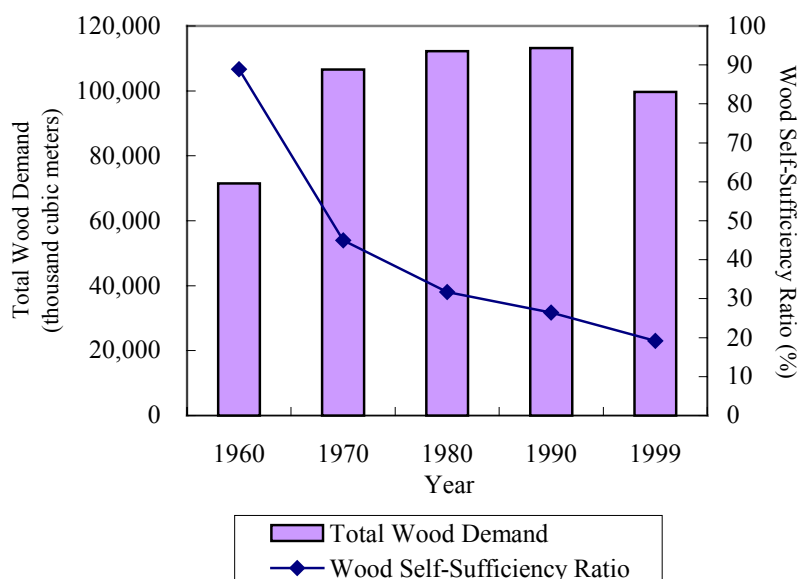


Figure 1.25 Change in Total Wood Demand and Wood Self-Sufficiency Ratio

Source: Forestry Agency – ‘Demand and Supply of Woods’

1.11 Information and Telecommunications

In Japan, the Internet has become more popular since the first half of the 1990s. Recently, the number of users has increased explosively, and it is estimated that as of the end of 2000, that number had reached 47.08 million (74 percent increase over the previous year). In addition to a steady increase in the number of users accessing via PCs, those using mobile phones services that began in 1999 have also rapidly increased.

In line with such an increase, the amount of information provided by companies and government offices that used to be carried out mainly via paper media (such as pamphlets) has shifted to electronic data provision via the Internet. Private and inter-company data exchange and provision have also shifted from paper to electronic media such as e-mail. Furthermore, the market scale for utilizing electronic information (electronic commerce) has rapidly expanded. The value of Business to Business (B-to-B) transactions in 2000 was about 22 trillion yen (a 250 percent increase) while Business to Consumers (B-to-C) deals were worth about 820 billion yen (also a 250 percent over the previous year).

In order to establish an advanced communications network society to meet information and telecommunications requirements that will doubtless increase, high-speed and large volume network foundations will be required throughout Japan. Currently, an optical fiber network has been prepared and is being expanded. As of the end of 1999, preparation rate for optical fiber network averages 36 percent nationwide. The government is trying to complete preparation of an optical fiber network by 2005.

1.12 Administration and Finances

1.12.1 Administration

Under the Japanese Constitution enacted in 1947, sovereign power resides with the people while the judicial, legislative, and executive powers of government are vested, respectively, in the mutually independent Supreme Court, Diet, and Cabinet. The Constitution establishes a parliamentary cabinet

linking the Cabinet to the Diet; the Diet designates the Prime Minister; the Prime Minister and a majority of the Ministers of State must be Diet members; and the Cabinet is collectively responsible to the Diet.

Organs of national administration under Cabinet jurisdiction are established – the Cabinet Office and ten ministries: namely The Ministries of Public Management, Home Affairs, Post & Telecommunications; Justice; Foreign Affairs; Finance; Education, Culture, Sports, Science and Technology; Health, Labour and Welfare; Agriculture, Forestry, and Fisheries; Economy, Trade and Industry; Land, Infrastructure and Transport; and Environment. As the chief ministers of state, the Prime Minister and the individual ministers divide responsibility for national administrative duties. Councils are among the representative organs established under law with the object of ensuring that expert opinions and the views of the people are reflected in administrative actions. The main duty of the councils and other advisory bodies is to investigate and deliberate on the jurisdiction and stipulation of laws and to inform administrative organs of their views. As of April 2001, there were 106 councils and similar organs in existence.

Global environmental problems, including global warming, are addressed by closely coordinating policies among the administrative organs concerned. To insure effective overall coordination, the Cabinet convened the Council of Ministers for Global Environment Conservation in May 1989. This Council decided the ‘Action Program to Arrest Global Warming’ in October 1990. Under this program, progress of the action was reported every year to the Council and discussed to further promote the action program. In December 1997, the Cabinet convened ‘Global Warming Prevention Headquarters’ to realize specific and effective global warming countermeasures taking the opportunity offered by the Third Session of the Conference of the Parties to the UNFCCC (COP3, the Kyoto Conference). This headquarters decided the ‘Guideline of Measures to Prevent Global Warming’ in June 1998, tried to strengthen measures to encourage various sectors and layers of the public to become involved in and cooperate towards the 2010 target, and decided to promote comprehensive measures deliberately to steadily achieve a 6 percent reduction commitment as per the Kyoto Protocol by using all manner of political means. The headquarters annually checks the level of progress of the specified measures for ways to address global warming.

In October 1998, the ‘Law Concerning the Promotion of the Measures to Cope with Global Warming’ was enacted (enforced in April 1999), outlining the implementation of global warming countermeasures in cooperation with the government, local public organizations, businesses and citizens through the adoption of the Kyoto Protocol. The law clarifies the obligations of the government, local public organizations, businesses and citizens, obliges the government and local public organizations to draw up a plan (implementation plan) to reduce the greenhouse gases emission in line with carrying out their clerical work and operations, and to make public its implementation status, as well as to specify an entrustment system for ‘Global Warming Prevention Activities Advisors’ who provide advice and encouragement to local residents and a designation system for the ‘Prefectural Centers for Climate Change Action’ that is a foundation for encouraging and supporting the activities of private organizations.

In April 1999, the Cabinet decided its ‘Principles Concerning Global Warming Countermeasures’ following the adoption of the above law. It clarifies the basic activities for the government, local public organizations, businesses, and citizens, and also specifies implementation plan details for clerical work and the operation of local public organizations.

In June 1998, the Law Concerning the Rational Use of Energy was revised (enforced in April 1999) mainly from the viewpoint of reduction of CO₂ emission from energy sources, a major constituent of Greenhouse gas. The points of the revision were to strengthen efficiency standards for electrical appliances and automobiles using the top-runner approach, and to strengthen efficiency standards in factories and buildings. The top-runner approach is that products are trying to achieve the standards of energy efficiency that most efficient products supplied domestically on standard year have.

From 1998 to 1999, the basis in Japan for implementing measures to prevent global warming was established, but emissions continued to increase. In order to achieve the commitment stipulated in the Kyoto Protocol, further measures must be promoted, so global warming prevention measures have been reviewed by Central Environment Council and Advisory Committee for Natural Resources and Energy, etc. In March 2002, new “Guideline for Measures to Prevent Global Warming” was drawn up and officially approved by the “Global Warming Prevention Headquarters”. This new Guideline show an overview of the specific measures with details of how to achieve the 6% reduction commitment stipulated in the Kyoto Protocol, describe targets, measures, and their implementation schedule per greenhouse gas type and category, and also specify the total target amount in Japan for each measure, estimated emission reductions, and policies to promote these measures before concluding Kyoto Protocol.

As of May 2001, local public organizations included 47 prefectures and 3,224 municipalities (cities, towns, and villages) with local assemblies serving as their legislatures; their executive branches being headed by a governor in the case of prefectures and by a mayor in the case of municipalities. The size of the prefectures and municipalities varies.

Since measures to prevent global warming are intimately related to all socioeconomic activities, in addition to the policies of national government organs, the policies and measures implemented by regional and local governments and efforts to induce appropriate behavior on the part of local communities and individual citizens in their daily lives are also extremely important. Bearing in mind the key roles played by local public organizations in global warming countermeasures, since fiscal 1994 the Japanese government has been encouraging the drafting of regional plans for measures to address global warming. At present, 31 prefectures drew up the regional plan. Implementation plans for measures based on the law for promoting global warming countermeasures have been established in 40 prefectures: 412 cities, towns, and villages (as of April 2001), 1,453 members to global warming prevention activities advisors have been entrusted in twelve prefectures (as of April 2001), and 'Prefectural Centers for Climate Change Action' have been specified in nine prefectures (as of May 2001). In this manner, Japan's local public organizations are steadily increasing their efforts to address global warming and the continuing progress is expected.

1.12.2 Finances

Japan's national finances are administered as follows. Every fiscal year (April 1st to March 31st), the government prepares a budget, which must be approved by the Diet before it is implemented by the administrative organs. The national budget consists of three parts: the general account, special accounts, and government-related operating accounts.

The general account is the record of the national government's ordinary revenues and outlays. It is sourced from taxes and, when necessary, borrowing by the national government. This account covers the most fundamental national expenses, such as social welfare, education, and defense. In fiscal 2001, ordinary expenditure totaled 48.6589 trillion yen, 1.2 percent over the initial budget for the previous year. The general account totaled 82.6524 trillion yen, a decrease of 2.7 percent. Special accounts are specially established under the Finance Law independently of the general account in cases where the national government runs certain enterprises, invests certain funds, or allots certain revenues to particular expenditures. There are 38 such special accounts, including the Special Account for Government Enterprises, the Special Account for Food Control, and the Special Account for Insurance. Government-related operations are wholly state-owned financial institutions established via special legislation; National Life Finance Corporation, Japan Finance Corporation for Small Business, and Development Bank of Japan are among the six finance corporations, two banks, one enterprise, and one treasury set up in this way.

The global environmental protection-related component, either having global environmental protection as a direct goal or contributing especially significantly to global environmental protection, was allocated 645.3 billion yen in fiscal 2001 (669.9 billion yen in the initial budget for the previous year): the global warming countermeasures program accounted for 535.8 billion yen of this total (553.1 billion yen in the previous year). Thus, the fiscal 2001 budget allocations for global warming countermeasures account for 1.3 percent of total ordinary expenditures.

Table 1.4 General Account Budget by Major Expenditure Programs

(Units: hundred million yen, %)

	Fiscal 2001		
		Increase from Fiscal 2000 → 2001	Growth Rate (%)
Social Security	175,552	7,886	4.7
Education and Science	66,472	1,187	1.8
Government Employee Pensions and Others	13,562	△694	△4.9
National Defense	49,553	195	0.4
Public Works	94,352	12	0.0
Economic Assistance	9,562	△280	△2.8
(Reference:ODA)	10,152	△314	△3.0
Small- and Medium-sized Businesses	1,948	5	0.2
Energy Measures	6,139	△213	△3.4
Major Foodstuff Measures	6,952	99	1.5
Transfer to the Industrial Investment Special Account	1,537	△58	△3.6
Miscellaneous	54,460	△464	△0.8
Contingencies for Public Works	3,000	△2,000	△40.0
Contingencies	3,500	0	0.0
Total	486,589	5,675	1.2

Source: Ministry of Finance

Table 1.5 Global Environmental Conservation-Related Budget

(Unit: hundred million yen)

	Fiscal 1999	Fiscal 2000	Fiscal 2001
Global warming	5,19	5,53	5,358
	2	1	
Ozone layer depletion	39	44	10
Acid deposition	70	70	79
Marine pollution	33	41	25
Trans boundary movement of toxic waste	0.4	0.4	0.5
Tropical deforestation	17	16	44
Decline in number of species	18	19	10
Desertification	14	12	8
Environmental pollution in developing countries	56	48	49
Internationally valued environmental conservation	31	32	30
Unclassifiable	963	886	840
Total	6,43	6,69	6,453
	3	9	

Source: Ministry of the Environment

Chapter 2

Greenhouse Gas Inventory Information

2.1 Outline

On the basis of Article 4.1 (a) of the United Nations Framework Convention on Climate Change, all Parties to the Convention are required to submit national inventories of greenhouse gas emissions and removals to the Secretariat of the Convention. This chapter summarizes Japan's national inventory on emissions and removals of greenhouse gases and precursors from fiscal 1990 through 1999.

The calculation methods and the reporting format of the inventory are in accordance with the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, prepared by the IPCC (Inter-governmental Panel on Climate Change) (hereafter, 'Revised 1996 IPCC Guidelines')¹⁾. In general, this inventory was calculated and reported in accordance with these guidelines. In 2000, a 'Good Practice and Uncertainty Management' report²⁾ was drawn up in which was described calculation selection methods that take into consideration the different circumstances of each country and quantitative assessment methods for uncertainties. It states that each country should try to adopt this reporting procedure for their 2001 report inventory.

In general, this inventory was calculated and reported in accordance with the Revised 1996 IPCC Guidelines. However, some portions were calculated using methods that differ from the methods indicated in the Revised 1996 IPCC Guidelines in order to ensure that the results would reflect national circumstance of Japan. These differences are explained in detail in the relevant sections of this chapter. Application of the 'Good Practice and Uncertainty Management' report is being examined and has not yet been applied to the inventory.

Based on the Guidelines for the Preparation of the Second National Communications by Annex I Parties, as well as the conclusion of Subsidiary Body for Scientific and Technological Advice (SBSTA), emissions from international bunkers were calculated separately and were not included in total greenhouse gas emissions.

The target greenhouse gas source and sink categories and the uncertainties of the estimates are shown in Table 2.1.

The Revised 1996 IPCC Guidelines suggest applying a three-tiered ranking system [H (High), M (Medium), and L (Low)] to evaluate the quality of estimates for each source and sink category. However, these levels are not specifically defined. And, uncertainty assessment methods are indicated in the 'Good Practice and Uncertainty Management' report. However, in Japan, it is being examined. Therefore, evaluation for this report was made using the same standard used in the previous report. In other words, the compilers of this inventory have provided the three-tiered ranking based on the criteria shown in Table 2.2 in the same way as the second national report.

This chapter presents a comprehensive inventory table of the different target gases treated in each section, based on data dating from 1990 up to the most recent data available. A summary is given concerning emissions and removals of each gas, and an explanation is given concerning estimation methods of major gas emissions. The tables used in this chapter contain minor alterations to the standard forms indicated in the Revised 1996 IPCC Guidelines. For detailed information concerning the calculation and compilation of the inventory on greenhouse gases and the emission and removal categories used, consult the Revised 1996 IPCC Guidelines.

Table 2.1 Greenhouse Gas Source and Sink Categories, and Estimate Quality

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO ₂		CH ₄		N ₂ O		HFCs		PFCs		SF ₆		NO _x		CO		NMVOC		SO ₂	
	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality	Estimate	Quality
Total National Emissions and Removals		H		L		L		H		H		H		H		M		M		H
1 Energy	ALL	H	ALL	L	PART	L							ALL	H	ALL	M	ALL	L	PART	H
A. Fuel Combustion Activities																				
Reference Approach	ALL	H																		
Sectoral Approach	ALL	H	ALL	L	PART	L							ALL	M	ALL	M	ALL	L	PART	H
1. Energy Industries	ALL	H	ALL	M	ALL	L							ALL	H	ALL	M	ALL	L	ALL	H
2. Manufacturing Industries and Construction	ALL	H	ALL	L	ALL	L							ALL	H	ALL	M	ALL	L	ALL	H
3. Transport	ALL	H	ALL	L	PART	M							ALL	M	ALL	M	ALL	L	PART	H
4. Other Sectors	ALL	H	ALL	L	ALL	L							ALL	M	ALL	M	ALL	L	ALL	H
5. Other	ALL	H	NO	-	NO	-							NO	-	NO	-	NO	-	NO	-
B. Fugitive Emissions from Fuels	NO	-	ALL	L	NO	-							NO	-	NO	-	ALL	L	NO	-
1. Solid Fuels	NO	-	ALL	L	NO	-														
2. Oil and Natural Gas	NO	-	ALL	L	NO	-							NO	-	NO	-	ALL	L	NO	-
2 Industrial Processes	PART	H	PART	L	PART	H	PART	H	PART	H	PART	H	PART	H	NE	-	PART	L	PART	H
A. Mineral Products	PART	H	NO	-	NO	-							PART	H	NE	-	NO	-	PART	H
B. Chemical Industry	PART	H	PART	L	PART	H	NE	-	NE	-			PART	H	NE	-	NO	-	PART	H
C. Metal Production	NE, IE	-	NO, NE	-	NO	-			NE	-	NE	-	PART	H	NE	-	NO	-	PART	H
D. Other Production	NE	-											PART	H	NO, NE	-	NO	-	PART	H
E. Production of Halocarbons and SF ₆							PART	H	PART	H	PART	H								
F. Consumption of Halocarbons and SF ₆																				
Potential ⁽²⁾							PART	H	PART	H	PART	H								
Actual ⁽³⁾							PART	H	PART	H	PART	H								
G. Other	NO	-	NO	-	NO	-	NO	-	NO	-	NO	-	NO	-	NO	-	NO	-	NO	-
3 Solvent and Other Product Use	NO	-			ALL	H							NO	-	NO	-	PART	M	NO	-
4 Agriculture	NO	-	PART	L	PART	L							NE	-	PART	L	NE	-	NO	-
A. Enteric Fermentation			ALL	M																
B. Manure Management			ALL	L	ALL	L											NE	-		
C. Rice Cultivation			ALL	L													NE	-		
D. Agricultural Soils	NO	-	NE	-	ALL	L											NE	-		
E. Prescribed Burning of Savannas			NO	-	NO	-							NO	-	NO	-	NO	-	NA	-
F. Field Burning of Agricultural Residues			PART	L	PART	L							NE	-	PART	L	NE	-	NA	-
G. Other			NO	-	NO	-							NO	-	NO	-	NO	-	NO	-
5 Land-Use Change and Forestry	PART	M	PART	L	PART	L							PART	L	PART	L	NE	-	NE	-
A. Changes in Forest and Other Woody Biomass Stocks	PART	M																		
B. Forest and Grassland Conversion	PART	M	PART	L	PART	L							PART	L	PART	L	NE	-		
C. Abandonment of Managed Lands	NE	-																		
D. CO ₂ Emissions and Removals from Soil	NE	-																		
E. Other	NO	-	NO	-	NO	-							NO	-	NO	-	NO	-	NO	-
6 Waste	PART	H	PART	M	PART	L							PART	H	ALL	L	ALL	L	ALL	H
A. Solid Waste Disposal on Land	IE	-	ALL	M											NO	-	NO	-		
B. Wastewater Handling			PART	M	NE	-							NE	-	NO	-	NO	-		
C. Waste Incineration	ALL	H	ALL	L	ALL	L							ALL	H	ALL	L	ALL	L	ALL	H
D. Other	NO	-	NO	-	NO	-							NO	-	NO	-	NO	-	NO	-
7 Other (please specify)	NE	-	NE	-	NE	-	NE	-	NE	-	NE	-	NE	-	ALL	M	NE	-	NE	-
International Bunkers	ALL	H	ALL	L	PART	L							ALL	L	ALL	L	ALL	L	NE	-

Table 2.2 Evaluation Criteria for Greenhouse Gas Source and Sink Categories, and Estimate Qualities

Estimate		Quality	
Codes	Meaning		Meaning
PART	Part of targets are estimated	H	a) Cases in which there are sufficient measured or documented values for emission factor, and it is clear that their variations (standard deviation, mean value) are 30 percent or less.
ALL	All targets are estimated		b) Cases in which it is theoretically clear that the variable range of the emission factor is small.
NE	Not estimated		c) Cases in which, despite individual differences in emission factors, the actual emission amounts are ascertained through continuous data from statistics, survey reports, etc. based on actual measurements of the majority of emission sources.
IE	Included in other sections	M	Cases other than H and L
NO	Not occurring	L	a) Cases in which it is either theoretically impossible to estimate the value of the emission factor and their variations, or where there are no or only singular values for survey/document data for emission factors applicable to Japan.
NA	Not applicable (theoretically never possible)		b) Cases in which even though there are a number of survey/document data for emission factors, the factors differ by three times or more.
			c) Cases in which even though there are a number of survey/document data for emission factors and the factors differ by less than three times, it is estimated that the margin of error exceeds three times for the emission amount finally acquired.

2.2 Carbon Dioxide (CO₂)

2.2.1 Outline of Emissions and Removals

Carbon dioxide (CO₂) is the most plentiful greenhouse gas in Japan in terms of both emissions and removals and is therefore a top policy priority. As shown in Table 2.3, carbon dioxide is considered in the following emission and removal sectors: Energy (1); Industrial Processes (2); Land-Use Change & Forestry (5); and Waste (6). Table 2.3 indicates that emissions total more than 1 billion tons (full molecular weight basis, here and below) per year.

Table 2.3 shows that carbon dioxide emissions for fiscal years 1990 through 1999 have risen every year except for 1993, 1997, and 1998. Increases in the Other Sectors (1A4) and Manufacturing Industries and Construction (1A2) subsectors of the Fuel Combustion Activities (1A) sector are small, but the increase observed in the Transport (1A3) subsector is notable. A decrease occurred in the Industrial Processes (2) sector. On the other hand, an increase occurred in the Waste (6) sector.

Calculations for emission and removal amounts in the Land-Use Change & Forestry (5) sector from fiscal 1990 to 1995 were based on default methods established in the IPCC Guidelines. No estimates were made for fiscal 1996 or later as activity cannot be calculated due to statistical limitations. Calculation methods used in this sector are expected to change as greater understanding is acquired, however, total removals account for slightly less than 10% of total emissions.

In Table 2.4, in Fuel Combustion Activities (1A), emissions from electric power generation under the Energy Industries (1A1) are reallocated to subsectors (1A2 - 1A4) in accordance with electricity consumption. These values can be said to reflect the actual conditions and changes occurring in carbon dioxide emissions in these respective end-user sectors.

Figure 2.1 shows a breakdown of emissions by sector (fiscal 1999). The Fuel Combustion Activities (1A) sector is further broken down into subsectors. The subsector with the highest emissions is Energy Industries (1A1), which accounts for about 30% of the total. This is followed by Manufacturing Industries and Construction (1A2), Transport (1A3), and Other Sectors (1A4) in descending order. The Industrial

Processes (2) sector, which primarily uses limestone, accounts for 4% of the total, and the Waste (6) sector, which primarily focuses on the burning of waste derived from fossil fuels, accounts for 2%. The bottom of Figure 2.1 shows emissions from electric power generation distributed to the end-user sectors that ultimately use the generated electricity. The Manufacturing Industries and Construction (1A2) subsector emits the most, followed in descending order by Other Sectors (1A4) and Transport (1A3).

Figures 2.2 and 2.3 show changes in emission amounts in each sector from fiscal 1990 through fiscal 1999. With the exception of fiscal 1993, 1997, and 1998, when an unusually cool summer and economic depression resulted in reduced emissions, emission levels rose consistently from 1990.

Emission amounts per sector from fiscal 1990 in descending order are 'Transport (1A3)' (49 million tons [23.9%] increase), 'Energy Industries (1A1)', (32.53 million tons [9.6%] increase), and 'Manufacturing Industries and Construction (1A2)' (18.71 million tons [5.5%] increase).

CO₂ emissions in the transportation sector (1A3) from fiscal 1990 to 1995 showed a significant increase of 17% compared to fiscal 1990 levels due to the increased number of vehicles, increased amount of driving in private passenger vehicles, standard modification of mini-cars to improve safety, and the increased size (weight) of vehicles reflecting user preferences change. However, since fiscal 1995, such movement has been flat in fiscal 1999 except for CO₂ emissions from private passenger vehicles, which had increased by 11% compared to fiscal 1995. The increase rate across the entire transportation sector has fallen off with CO₂ emissions for fiscal 1999 showing an increase of just 5.6% over fiscal 1995.

As for Energy Industries (1A1) (energy conversion sector), the increase in carbon dioxide emissions from electric utilities, which are the largest at about 85% of total emissions, was 22.59 million tons [7.7%] compared to fiscal 1990. The main reason for that may be the increase in electrical energy output in fiscal 1990 (about 22%) on the increase in demand of residential and commercial sectors, and so on. However, it was controlled that the CO₂ emissions increased 7.7% in the same period, by the decline of CO₂ intensity in electric generation due to the expansion of nuclear share, and so on.

On the other hand, only the Industrial Processes (2) sector shows a decrease from fiscal 1990 (5.56 million ton [9.5%] decrease compared to fiscal 1990). The amounts of carbon dioxide emitted from all emission sources¹ of the 'Industrial Processes (2)' have declined. Reduction in carbon dioxide emissions from cement production is the largest – a 3.63 million ton [9.4%] decrease compared to fiscal 1990. Reduction in cement production by 7.4% compared to 1990 is likely to be main reason for that.

Emission figures for international bunkers have been separated as shown at the bottom of Table 2.3. This continues the practice adopted in the Second National Communication and is consistent with the Communication Guidelines. The amount of carbon dioxide emissions in fiscal 1999 increased by 5.32 million tons [17.4%] compared to fiscal 1990. Most of this increase has been caused by an increase in emissions from aircraft (5.34 million tons).

2.2.2 Methods of Estimating Emissions and Removals

Energy (1): Figures for the Fuel Combustion Activities (1A) sector were calculated by multiplying the total primary energy supply of each fuel³⁾ by carbon dioxide emission factors⁴⁾. This is called the 'supply-based top-down calculating method'. Figures for all other sectors were derived by multiplying the amounts of each type of fuel consumed in each sector³⁾ by their respective carbon dioxide emission factors⁴⁾. This is called the 'consumption-based top-down calculating method'. These two methods generate statistical errors that are allocated to the Other (1A5) subsector. Items that could not be classified into specific subsectors were also included in the Other (1A5) subsector.

Five percent of the carbons in 'coking coal' and 'petroleum coke' and 80% of the carbons in 'naphtha', 'lubricating oil', 'other petroleum products (asphalt, etc.)', and 'LPG' were assumed to be fixed in products. Carbon dioxide emissions from 'naphtha', 'LPG', 'natural gas', 'LNG', 'coal', and 'petroleum coke' for use in ammonia production are allocated to the Industrial Processes (2) sector.

Emissions from auto producers (power generated for their own use) were allocated not to the Energy Industries (1A1) subsector but rather divided among all relevant sectors according to how much electricity each sector produced and consumed. This approach is consistent with the

¹ Emissions of carbon dioxide in line with production of cement, quicklime, soda lime and steel.

Revised 1996 IPCC Guidelines. However, these figures do not reflect the different fuel mixes of each sector. Instead, the amount of carbon dioxide emitted per unit of electricity generated was calculated by using an average emission factor.

Industrial Processes (2): Carbon dioxide generated through thermal decomposition of limestone and other materials was calculated by multiplying the amounts of material consumed ⁵⁾ ⁶⁾ by their respective emission factors. Similarly, the amounts of materials used to make ammonia ⁷⁾ were multiplied by the emission factors ⁴⁾.

Land-Use Change & Forestry (5): Calculations were made for carbon removal amounts in forests, parks, and green land in accordance with the methods prescribed in the IPCC Guidelines. Necessary data concerning cut timber volumes, forested area, and amount of new growth were taken from the 'Statistical Handbook of Forestry' ⁸⁾. In terms of parks and green land, etc., Ministry of Land, Infrastructure and Transport survey data on parks and green land were used, as well as IPCC default values for new growth amounts. 'Not estimated' was recorded for some activity data that cannot be obtained due to statistical limitations for fiscal 1996 onwards.

Waste (6): Calculations were also made for Waste Incineration (6C). For municipal solid waste, the amount of waste burned was multiplied by the percentage of waste derived from fossil fuels ⁹⁾, with the result further multiplied by the emission factors. For industrial waste, emission amounts were calculated by multiplying the amounts of incinerated waste oil and waste plastic ¹⁰⁾ by the emission factors.

The same inventory calculation methods as used in the Second National Communication were adopted this time.

Table 2.3 Carbon Dioxide Emission and Removals (Fiscal 1990 – 1999)

(Unit : Gg)

Fiscal Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total National Emissions	1,124,350	1,147,789	1,162,218	1,143,968	1,214,078	1,217,764	1,236,191	1,233,525	1,186,964	1,224,980
Total Removals	-83,882	-83,843	-85,541	-90,057	-93,516	-96,676	NE	NE	NE	NE
1 Energy	1,052,782	1,072,706	1,085,118	1,064,565	1,133,429	1,138,556	1,153,570	1,150,775	1,109,504	1,147,945
1A Fuel Combustion Activities	1,052,782	1,072,706	1,085,118	1,064,565	1,133,429	1,138,556	1,153,570	1,150,775	1,109,504	1,147,945
1A1. Energy Industries	338,908	341,967	349,458	331,667	369,322	359,370	360,447	356,859	349,661	371,437
1A2. Manufacturing Industries and Construction	339,227	337,590	327,780	332,138	340,622	345,719	352,685	353,503	343,015	357,939
1A3. Transport	204,665	214,152	219,398	221,689	232,679	239,522	246,016	250,350	250,286	253,670
1A4. Other Sectors	158,233	164,502	169,778	168,984	167,049	177,029	173,326	171,614	167,056	165,624
1A5. Other	11,749	14,494	18,704	10,086	23,757	16,916	21,095	18,448	-513	-726
1B Fugitive Emissions from Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B2. Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2 Industrial Processes	58,795	60,382	60,999	60,333	61,303	61,237	61,079	59,501	53,956	53,233
3 Solvent and Other Product Use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4 Agriculture	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4A Enteric Fermentation										
4B Manure Management										
4C Rice Cultivation										
4D Agricultural Soils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4E Prescribed Burning of Savannas										
4F Field Burning of Agricultural Residues										
4G Other										
5 Land-Use Change and Forestry	-83,882	-83,843	-85,541	-90,057	-93,516	-96,676	NE	NE	NE	NE
5A Changes in Forest and Other Woody Biomass Stocks	-84,461	-84,751	-86,456	-90,979	-94,445	-97,618	NE	NE	NE	NE
5B Forest and Grassland Conversion	579	908	915	922	929	942	NE	NE	NE	NE
5C Abandonment of Managed Lands	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO
5D CO2 Emissions and Removals from Soil	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6 Waste	12,773	14,701	16,101	19,070	19,346	17,971	21,541	23,249	23,504	23,802
6A Solid Waste Disposal on Land	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
6B Wastewater Handling										
6C Waste Incineration	12,773	14,701	16,101	19,070	19,346	17,971	21,541	23,249	23,504	23,802
6D Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7 Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
International Bunkers	30,525	32,724	33,770	36,322	37,123	36,989	32,181	36,344	36,686	35,841

Note: If there are two notation keys in subsectors, the both (i.e. NE and NO) are shown.

Table 2.4 Carbon Dioxide Emissions (Fiscal 1990 – 1999)

(Unit : Gg)

Fiscal Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1A Fuel Combustion Activities	1,052,782	1,072,706	1,085,118	1,064,565	1,133,429	1,138,556	1,153,570	1,150,775	1,109,504	1,147,945
1A1. Energy Industries	77,307	78,555	79,604	78,880	82,790	82,845	81,698	83,443	83,797	86,350
1A2. Manufacturing Industries and Construction	455,422	452,708	441,904	435,922	454,792	454,577	462,303	460,407	442,080	463,387
1A3. Transport	211,386	220,907	226,244	228,197	239,646	246,241	252,619	256,689	256,386	259,911
1A4. Other Sectors	297,280	306,582	318,984	311,812	332,559	338,526	336,379	332,016	327,878	339,090
1A5. Other	11,387	13,953	18,382	9,753	23,642	16,367	20,571	18,221	-637	-792

Note: In 'Fuel Combustion Activities (1A)', emissions from electric power generation under the 'Energy Industries (1A1)' subsector are reallocated to subsectors (1A2 – 1A4) in accordance with electricity consumption.

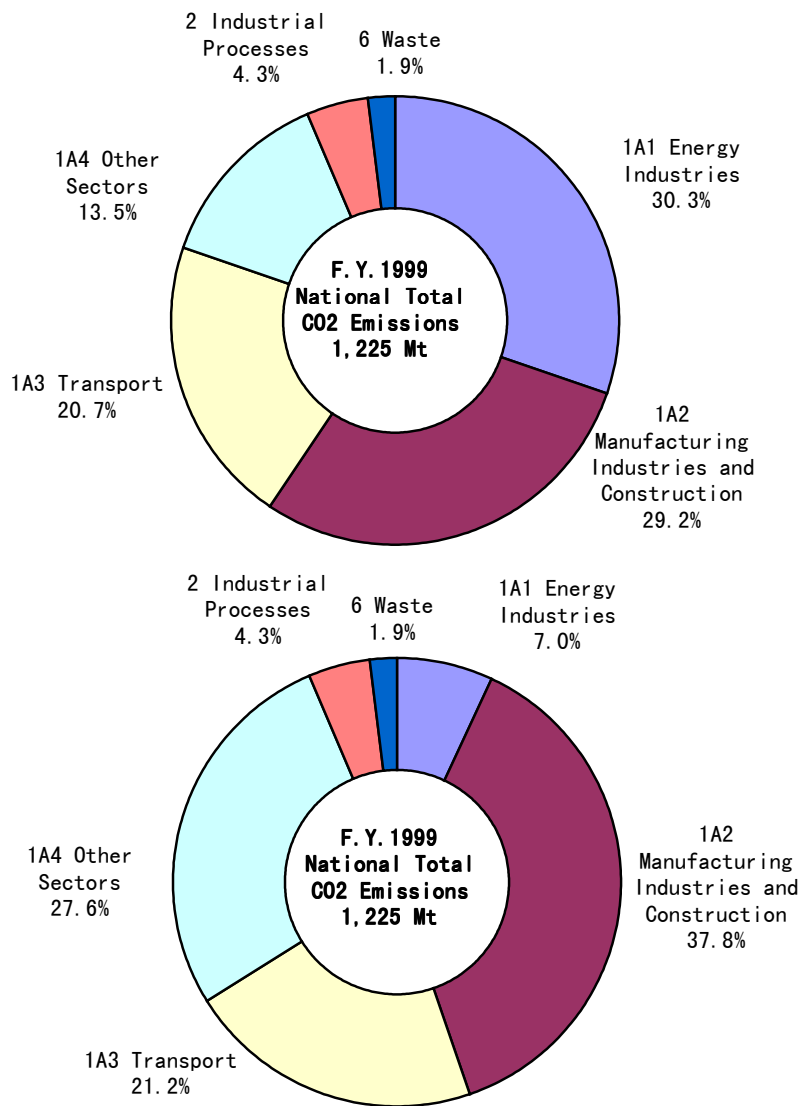


Figure 2.1 Breakdown of Carbon Dioxide Emissions

Note: The lower graph shows the breakdown in which emissions from electric power generation under the 'Energy Industries (1A1)' are reallocated to subsectors (1A2 – 1A4) in accordance with electricity consumption.

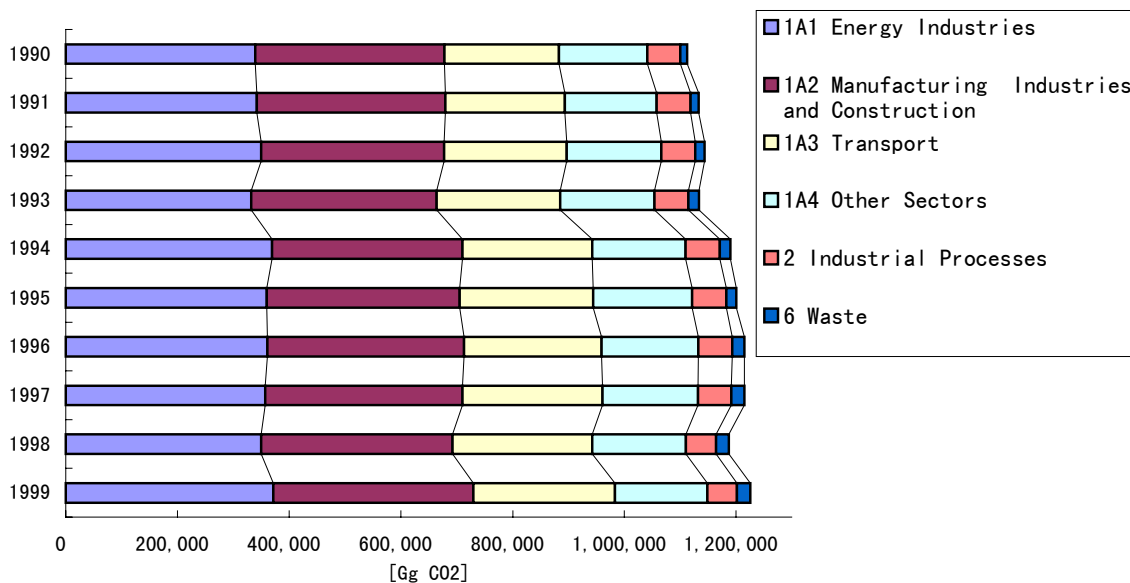


Figure 2.2 Breakdown of Carbon Dioxide Emissions by Sector (Fiscal 1990 – 1999)

Note: Emissions and removals from Land-Use Change & Forestry sector are not included.

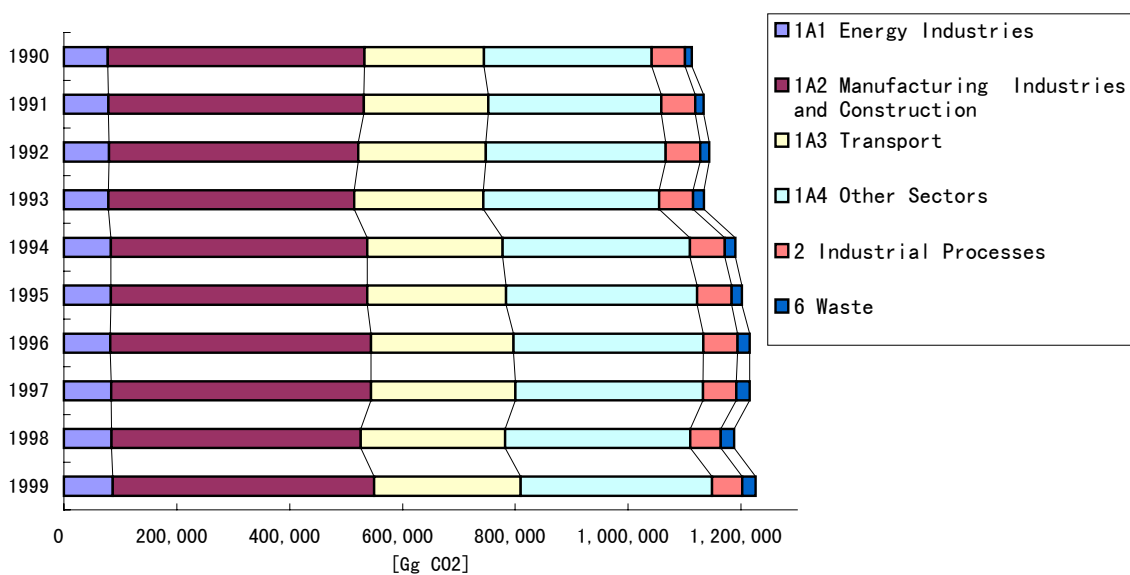


Figure 2.3 Breakdown of Carbon Dioxide Emissions by Sector (Fiscal 1990 – 1999)

Note: The breakdown in which emissions from electric power generation under the 'Energy Industries (1A1)' are reallocated to subsectors (1A2 – 1A4) in accordance with electricity consumption.

Emissions and removals from Land-Use Change & Forestry sector are not included.

2.3 Methane (CH₄)

2.3.1 Outline of Emissions

Japan emitted approximately 1.29 million tons of methane (actual weight) in fiscal 1999, primarily from activities in the Energy (1), Industrial Process (2), Agriculture (4), and Waste (6) sectors.

Table 2.5 shows changes in methane emissions in each sector from fiscal 1990. Total emissions have been reduced by 165,000 tons [11.4%] compared to fiscal 1990. From the view point of reduction amounts of

emissions per emission source from fiscal 1990, Solid Fuels (1B1) is the most important sector, which has declined by 58,000 tons [54.2%] mainly reflecting the decline in the amount of domestic coal mined by 53.8% compared to fiscal 1990. Rice Cultivation (4C) has declined by 50,000 tons [13.4%], mainly due to a 13.4% reduction in productive paddy field area compared to fiscal 1990.

Fuel Combustion Activities/Transport (1A3) has declined by 31,000 tons [41.3%] compared to fiscal 1990, mainly reflecting a decline of 34.4%¹¹⁾ in emission factors of mini-sized cargo vehicles, which account for nearly 60% of emissions from concerned emission sources, since fiscal 1990.

On the other hand, emissions from Oil and Natural Gas (1B2) have increased by 31,000 tons [58.7%] since fiscal 1990. It is thought that the main reason is a 71.3% increase in natural gas consumption since fiscal 1990.

Figure 2.4 shows the breakdown of emissions by sector. The most important sector is Agriculture (4), which accounts for about 52.8% of the total. Within this sector, the main subsectors are Enteric Fermentation (4A), Manure Management (4B), and Rice Cultivation (4C). Under Energy (1), Fuel Combustion Activities (1A) and Fugitive Emissions from Fuels (1B) account for 4.5% and 10.3% of the total, respectively. Under Waste (6), the main subsector is Solid Waste Disposal on Land (6A), which accounts for 28.1% of the total.

2.3.2 Methods of Estimating Emissions

Energy (1): For the Energy Industries (1A1), Manufacturing Industries and Construction (1A2), and part of the Other Sectors (1A4) under the Fuel Combustion Activities (1A) sector, emissions were calculated for each soot and smoke-emitting facility designated by the Air Pollution Control Law by multiplying the amounts of fuel consumed (broken down by type of furnace and type of fuel) by the emission factors¹²⁾. This is a “bottom-up” approach. The remainder of the Other Sectors (1A4) involves small boilers and fuel facilities, and emissions were calculated by multiplying the emission factors for different types of fuel and their applications by the amounts of fuel consumed. The figure shown in the Transport (1A3) subsector includes emissions from motor vehicles, ships, aircraft, and railways (diesel railcars). Emissions falling under the Solid Fuels (1B1) subsector of Fugitive Emissions from Fuels (1B) were calculated by multiplying the amount of coal mined¹³⁾ by the methane emission factor. For the Oil and Natural Gas (1B2) subsector, the amounts of each fuel produced and handled³⁾ were multiplied by the default emission factors of the Revised 1996 IPCC Guidelines.

Industrial Processes (2): The amounts of different chemical products manufactured were multiplied by their respective default emission factors from the Revised 1996 IPCC Guidelines.

Agriculture (4): For the Enteric Fermentation (4A) subsector, emissions were calculated by multiplying the numbers of each type of animal¹⁴⁾ by the emission factors. Emissions in the Manure Management (4B) subsector are calculated by using the method¹⁵⁾ that reflects the Japanese situation in this subsector. Methane emissions in the Rice Cultivation (4C) subsector were calculated by multiplying the areas of cultivated rice paddies¹⁶⁾ (broken down by soil type) by the appropriate emission factors.

Land-Use Change & Forestry (5): Consideration was given to the burning of biomass that accompanies the conversion of forest land to other uses, and calculations were made on the basis of default methods indicated in the Revised 1996 IPCC Guidelines.

Waste (6): For the Solid Waste Disposal on Land (6A) subsector, emissions were calculated using a model that gives consideration to the methane emission process as it occurs over the course of several years after the waste was buried in landfill¹⁷⁾. For the Waste Incineration (6C) subsector, the amounts of waste processed in the Waste Incinerator designated by the Air Pollution Control Law was multiplied by the emission factors¹²⁾.

Table 2.5 Methane Emissions (Fiscal 1990 – 1999)

(Unit : Gg)

Fiscal Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total	1,452	1,443	1,435	1,428	1,414	1,404	1,375	1,318	1,298	1,287
1 Energy	249	245	241	232	220	221	220	189	186	190
1A Fuel Combustion Activities	89	81	74	66	59	60	59	59	57	58
1A1. Energy Industries	-2	-2	-2	-2	-2	-2	-2	-2	-2	-2
1A2. Manufacturing Industries and Construction	7	7	7	7	6	6	6	6	6	6
1A3. Transport	76	67	59	52	46	46	44	45	45	44
1A4. Other Sectors	9	8	9	9	9	10	9	9	9	9
1A5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B Fugitive Emissions from Fuels	160	165	167	166	161	160	162	130	129	132
1B1. Solid Fuels	107	107	107	101	94	89	87	53	50	49
1B2. Oil and Natural Gas	52	57	61	65	67	71	74	78	79	83
2 Industrial Processes	49	48	46	45	48	49	50	50	47	48
3 Solvent and Other Product Use										
4 Agriculture	758	763	768	776	771	756	736	713	697	681
4A Enteric Fermentation	345	350	351	348	344	339	335	331	328	324
4B Manure Management	35	35	35	34	33	33	32	32	31	31
4C Rice Cultivation	373	374	378	388	389	379	364	345	333	323
4D Agricultural Soils	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4E Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4F Field Burning of Agricultural Residues	5	5	5	6	5	6	5	5	4	4
4G Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 Land-Use Change and Forestry	3	4	4	4	4	4	NE	NE	NE	NE
5A Changes in Forest and Other Woody Biomass Stocks										
5B Forest and Grassland Conversion	3	4	4	4	4	4	NE	NE	NE	NE
5C Abandonment of Managed Lands										
5D CO2 Emissions and Removals from Soil										
6 Waste	394	383	376	372	370	374	369	366	369	368
6A Solid Waste Disposal on Land	388	377	369	365	364	367	362	358	361	360
6B Wastewater Handling	6	6	6	7	6	6	7	7	8	7
6C Waste Incineration	0	0	0	0	0	0	0	0	0	0
6D Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7 Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
International Bunkers	2	2	2	2	3	2	2	2	2	2

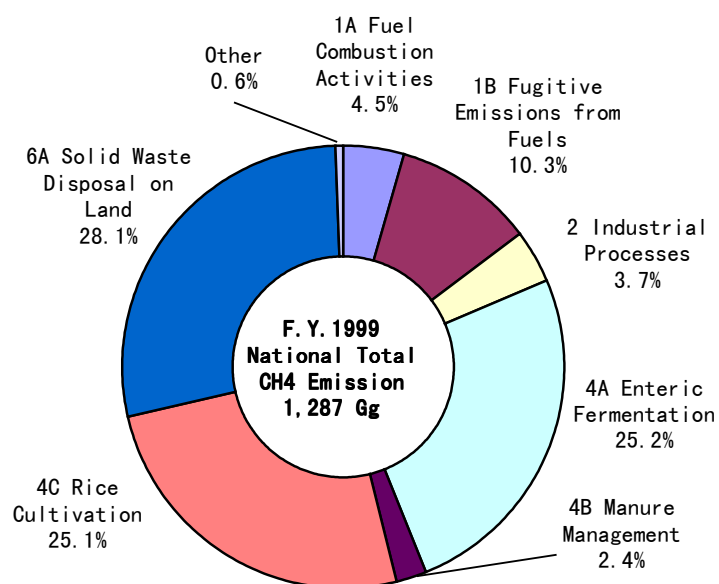


Figure 2.4 Breakdown of Methane Emissions (Fiscal 1999)

2.4 Nitrous Oxide (N₂O)

2.4.1 Outline of Emissions

Nitrous oxide (N₂O) emissions in fiscal 1999 in Japan totaled about 50,000 tons (actual weight of nitrous oxide).

Table 2.6 shows emissions in all sectors from fiscal 1990 through 1999. Total emissions increased until fiscal 1997, but significantly declined up to fiscal 1999. The significant reduction from fiscal 1998 to 1999 is mainly because of the introduction in March 1999 of a decomposition system for nitrous oxide emitted in the production of adipic acid and emissions from this emission source declined by 19,000 tons (88.1%) compared to fiscal 1990.

Figure 2.5 breaks down nitrous oxide emissions in fiscal 1999 according to sector. The Energy (1) sector accounted for 47.5% of all emissions, followed in descending order by Agriculture (4) [29.6%], Waste (6) [11.8%], and Industrial Processes (2) [8.9%].

2.4.2 Methods of Estimating Emissions

Energy (1): For the Energy Industries (1A1), Manufacturing and Construction (1A2), and part of the Other Sectors (1A4) under the Fuel Combustion (1A) sector, emissions were calculated for each soot and smoke-emitting facility designated by the Air Pollution Control Law by multiplying the amounts of fuel consumed (broken down by type of furnace and type of fuel) by the emission factors¹²⁾. This is a “bottom-up” approach. The remainder of the Other Sectors (1A4) subsector involves small boilers and fuel facilities, and emissions were calculated by multiplying the emission factors for different types of fuel and their applications by the amounts of fuel consumed. The figure shown in the Transport (1A3) subsector includes emissions from motor vehicles, ships, aircraft, and railways (diesel railcars).

Industrial Processes (2): Emissions from the manufacture of adipic acid¹⁸⁾ and nitric acid¹⁹⁾ were calculated by multiplying the respective amounts manufactured by the emission factors.

Solvent and Other Product Use (3): The amount of nitrous oxide shipped as medical gas (laughing gas)²⁰⁾ was considered equal to the amount of emissions.

Agriculture (4): For Manure Management (4B), emissions were calculated using the method reflecting Japanese circumstances ¹⁵⁾. For the Agricultural Soils (4D) subsector, emissions were calculated by multiplying the amount of nitrogen fertilizer ²¹⁾ used (other than in rice paddies) by the emission factor ²²⁾.

Land-Use Change & Forestry (5): Consideration was given to the burning of biomass that accompanies the conversion of forest land to other uses, and calculations were made on the basis of default methods indicated in the revised 1996 IPCC Guidelines.

Waste (6): For the Waste Incineration (6C) subsector, the amount of waste processed in the Waste Incinerator designated by the Air Pollution Control Law was multiplied by the emission factors¹²⁾. The emission from sewage sludge was estimated, taking account of incinerator type, etc. ²³⁾.

Table 2.6 Nitrous Oxide Emissions (Fiscal 1990 – 1999)

(Unit : Gg)

Fiscal Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total	67.0	65.4	65.8	65.3	69.2	70.3	73.6	75.9	72.0	53.3
1 Energy	19.3	20.2	20.7	20.9	21.9	23.6	24.0	24.7	24.5	25.3
1A Fuel Combustion Activities	19.3	20.2	20.7	20.9	21.9	23.6	24.0	24.7	24.5	25.3
1A1. Energy Industries	2.1	2.2	2.3	2.4	2.6	3.8	3.8	3.9	3.8	4.1
1A2. Manufacturing Industries and Construction	4.0	4.3	4.3	4.5	5.1	5.2	5.4	5.8	5.7	6.0
1A3. Transport	12.9	13.4	13.7	13.7	13.9	14.3	14.5	14.7	14.6	14.9
1A4. Other Sectors	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
1A5. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B Fugitive Emissions from Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B2. Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2 Industrial Processes	23.9	21.9	21.6	21.2	24.0	23.8	26.6	28.1	24.5	4.7
3 Solvent and Other Product Use	0.9	1.2	1.3	1.3	1.4	1.4	1.4	1.3	1.2	1.2
4 Agriculture	18.0	17.6	17.5	17.3	16.9	16.4	16.1	16.0	15.9	15.8
4A Enteric Fermentation										
4B Manure Management	13.5	13.3	13.2	12.9	12.6	12.4	12.2	12.1	12.0	11.9
4C Rice Cultivation										
4D Agricultural Soils	3.8	3.6	3.6	3.5	3.5	3.3	3.1	3.1	3.1	3.1
4E Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4F Field Burning of Agricultural Residues	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.7
4G Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 Land-Use Change and Forestry	0.0	0.0	0.0	0.0	0.0	0.0	NE	NE	NE	NE
5A Changes in Forest and Other Woody Biomass Stocks										
5B Forest and Grassland Conversion	0.0	0.0	0.0	0.0	0.0	0.0	NE	NE	NE	NE
5C Abandonment of Managed Lands										
5D CO2 Emissions and Removals from Soil										
6 Waste	4.9	4.6	4.6	4.6	4.9	5.1	5.5	5.8	6.0	6.3
6A Solid Waste Disposal on Land										
6B Wastewater Handling	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6C Waste Incineration	4.9	4.6	4.6	4.6	4.9	5.1	5.5	5.8	6.0	6.3
6D Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7 Other										
International Bunkers	0.5	0.5	0.5	0.6	0.6	0.5	0.4	0.5	0.5	0.5

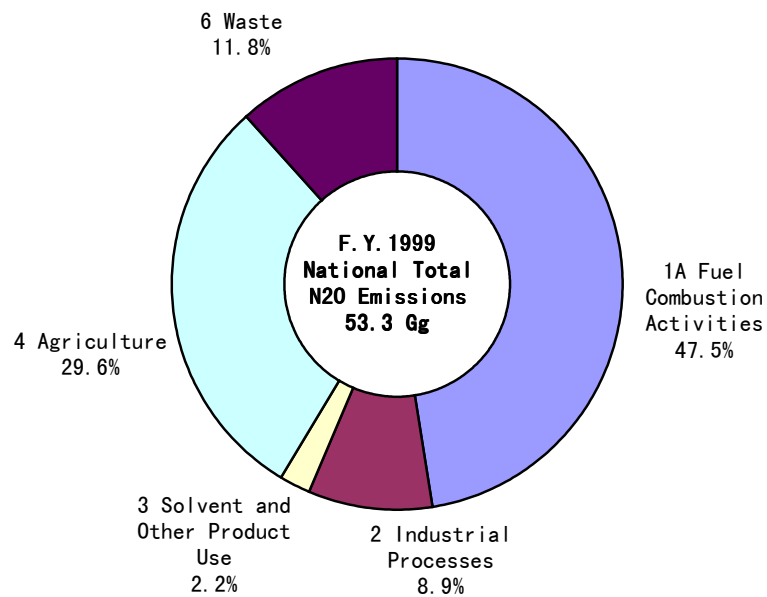


Figure 2.5 Breakdown of Nitrous Oxide Emissions (Fiscal 1999)

2.5 Hydrofluorocarbons (HFCs)

2.5.1 Outline of Emissions

Hydrofluorocarbons (HFCs) have been used in refrigerants, aerosols, and other goods in recent years. The amount of HFC emissions in Japan was about 19.5 million tons of carbon dioxide equivalents in fiscal 1999, with a potential emissions amount of about 38.72 million tons of carbon dioxide equivalents.

Table 2.7 outlines the HFCs emissions since fiscal 1995. From fiscal 1995 to 1999, the emission amount has declined. A reduction in HFC production is the main reason behind that.

Figure 2.6 shows a breakdown of HFCs emissions in each sector in fiscal 1999. The main sectors, in descending order, are by-products during HCFC-22 production (72.3%), aerosols, MDI (metered-dose inhaler) (14.3%), refrigerators and air conditioners (9.7%), and foaming agents (2.1%).

2.5.2 Methods of Estimating Emissions

Emission amounts at each stage from production to disposal were estimated using industry statistics in business circles and suchlike.

Table 2.7 Actual Emissions of Hydrofluorocarbons (Fiscal 1995 – 1999)

	unit	1995	1996	1997	1998	1999
Total Actual Emissions	[Gg CO2eq.]	20,044	19,662	19,584	19,027	19,497
E. Production of Halocarbons and SF6	[Gg CO2eq.]	17,398	16,007	15,032	13,995	14,203
1. By-product Emissions (HCFC-22)	[Gg CO2eq.]	16,965	15,596	14,695	13,783	14,102
2. Fugitive Emissions	[Gg CO2eq.]	433	411	337	212	101
F(a). Consumption of Halocarbons and SF6 (actual emissions - Tier 2)	[Gg CO2eq.]	2,646	3,655	4,552	5,032	5,294
1. Refrigeration and Air Conditioning Equipment	[Gg CO2eq.]	706	1,025	1,311	1,657	1,889
2. Foam Blowing	[Gg CO2eq.]	455	415	412	406	403
3. Fire Extinguishers	[Gg CO2eq.]	IE	IE	IE	IE	IE
4. Aerosols/Metered Dose Inhalers	[Gg CO2eq.]	1,365	2,084	2,646	2,795	2,792
6. Semiconductor Manufacture	[Gg CO2eq.]	120	113	150	139	144
8. Other	[Gg CO2eq.]	1	18	33	35	66

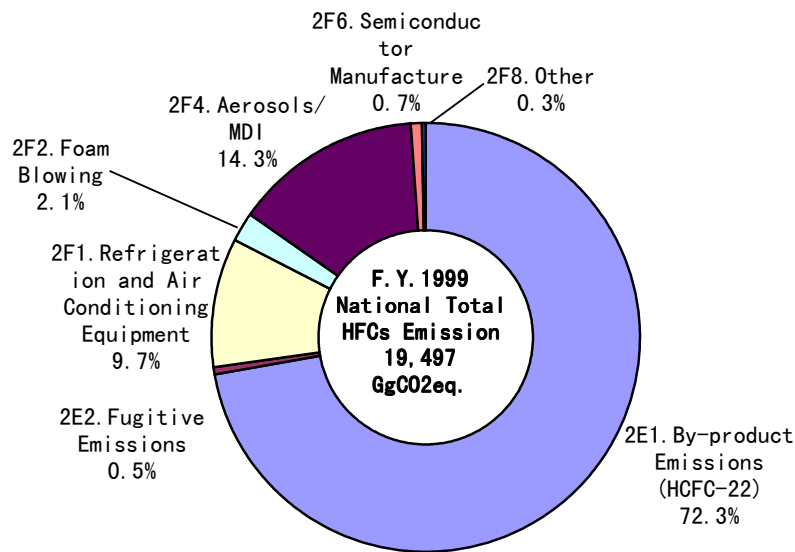


Figure 2.6 Breakdown of Hydrofluorocarbons Emissions (Fiscal 1999)

Table 2.8 Potential Hydrofluorocarbon Emissions (Fiscal 1990 – 1999)

	unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
F(p). Total Potential Emissions	[Gg CO2eq.]	17,930	18,070	19,750	21,310	28,840	31,160	31,628	34,890	31,554	38,722
HFC-23 (CHF3, GWP=11700)	[t]	1,500	1,500	1,500	1,300	1,500	1,500	1,459	1,555	1,547	1,544
Production	[t]	1,500	1,500	1,500	1,300	1,500	1,500	1,459	1,555	1,547	1,544
Import	[t]	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Export	[t]	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Destroyed Amount	[t]	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
HFC-134a (C2H2F4, GWP=1300)	[t]	0	400	1,400	4,400	8,100	9,300	9,886	11,674	9,615	14,153
Production	[t]	0	200	2,500	11,100	18,400	22,000	24,949	23,728	20,502	25,693
Import	[t]	0	200	300	200	0	0	0	846	310	0
Export	[t]	0	0	1,400	6,900	10,300	12,700	15,063	12,900	11,197	11,540
Destroyed Amount	[t]	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Other HFCs※	[Gg CO2eq.]	380	0	380	380	760	1,520	1,706	1,520	954	2,258
Production	[Gg CO2eq.]	0	0	0	380	760	1,140	1,398	1,140	977	1,538
Import	[Gg CO2eq.]	380	0	380	0	0	380	308	380	649	1,770
Export	[Gg CO2eq.]	0	0	0	0	0	0	0	0	671	1,049
Destroyed Amount	[Gg CO2eq.]	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

*) Other HFCs include HFC-32 (CH₂F₂, GWP: 650), HFC-125 (C₂H₅F, GWP: 2800), HFC-152a (C₂H₄F₂, GWP: 140), and HFC-143a (C₂H₃F₃, GWP: 3800). 3800 is adopted as GWP of other HFCs as a breakdown of such HFCs between 1990 and 1997 cannot be clearly specified.

2.6 Perfluorocarbons (PFCs)

2.6.1 Outline of Emissions

Perfluorocarbons (PFCs) are used as semiconductor etching gases and cleaning solvents for electronic parts. The PFC emissions amount in Japan was about 11.04 million tons of carbon dioxide equivalents in fiscal 1999, with a potential emissions amount of about 17.4 million tons of carbon dioxide equivalents. Table 2.9 outlines PFC emissions since fiscal 1995. From fiscal 1995 to 1999, the emission amount has declined. Reduction in emissions amount in the sector of cleaning solvents of electronic parts and so on is the main reason for that.

Figure 2.7 shows a breakdown of PFC emissions in each sector in fiscal 1999. The main sectors are solvents (45.9%), semiconductor production (42.6%), and fugitive emissions (11.5%) in descending order.

2.6.2 Methods of Estimating Emissions

Emission amounts at each stage of production to disposal were estimated using the industry statistics in business circles and suchlike.

Table 2.9 Actual Emissions of Perfluorocarbons (Fiscal 1995 – 1999)

	unit	1995	1996	1997	1998	1999
Total Actual Emissions	[Gg CO2eq.]	11,433	11,201	13,953	12,390	11,043
E. Production of Halocarbons and SF6	[Gg CO2eq.]	762	1,008	1,417	1,390	1,273
2. Fugitive Emissions	[Gg CO2eq.]	762	1,008	1,417	1,390	1,273
F(a). Consumption of Halocarbons and SF6 (actual emissions – Tier 2)	[Gg CO2eq.]	10,671	10,193	12,536	11,000	9,770
5. Solvents	[Gg CO2eq.]	7,014	6,729	8,207	6,671	5,068
6. Semiconductor Manufacture	[Gg CO2eq.]	3,658	3,465	4,329	4,329	4,702

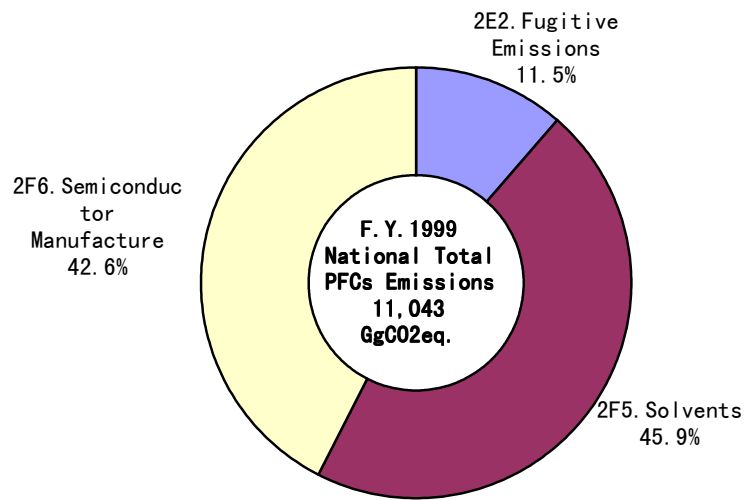


Figure 2.7 Breakdown of Actual Perfluorocarbon Emissions (Fiscal 1999)

Table 2.10 Potential Perfluorocarbon Emissions (Fiscal 1990 – 1999)

	unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
F(p). Total Potential Emissions	[Gg CO2eq.]	5,670	6,370	6,370	8,860	12,274	16,601	18,622	19,650	17,786	17,397
PFC-14 (CF ₄ , GWP=6500)	[t]	300	300	300	360	500	650	740	700	198	417
Production	[t]	400	400	400	460	600	750	840	800	908	860
Import	[t]	0	0	0	0	0	0	0	0	0	0
Export	[t]	100	100	100	100	100	100	100	100	710	443
Destroyed Amount	[t]	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Other PFCs※	[Gg CO2eq.]	3,720	4,420	4,420	6,520	9,024	12,376	13,812	15,100	16,499	14,686
Production	[Gg CO2eq.]	920	920	920	920	1,380	3,276	5,080	6,000	7,935	8,941
Import	[Gg CO2eq.]	2,800	3,500	3,500	5,600	7,644	10,020	10,812	11,640	11,409	8,011
Export	[Gg CO2eq.]	0	0	0	0	0	920	2,080	2,540	2,846	2,266
Destroyed Amount	[Gg CO2eq.]	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

*) Other PFCs include PFC-116 (C₂F₆, GWP: 9200), PFC-218 (C₃F₈, GWP: 7000), PFC-c318 (c-C₄F₈, GWP: 8700), and PFC-41-12 (C₃F₁₂, GWP: 7500). 7000 is adopted as GWP of other PFCs as breakdown of such PFCs between 1990 and 1997 cannot be clearly specified.

2.7 Sulfur Hexafluoride (SF₆)

2.7.1 Outline of Emissions

Sulfur hexafluoride (SF₆) has been used as an electric power insulation gas. It has also been used in recent years as a semiconductor etching gas. The actual SF₆ emission amount in Japan was about 8.35 million tons of carbon dioxide equivalents in fiscal 1999, with a potential emission amount of about 34.06 million tons of carbon dioxide equivalents.

Figure 2.8 shows a breakdown of SF₆ emissions in each sector in fiscal 1999. The main sectors are electrical equipment (59.5%), semiconductor production (22.2%), and fugitive emissions (18.3%) in descending order.

2.7.2 Methods of Estimating Emissions

Emission amount at each stage of production to disposal were estimated using industry statistics in business circles and suchlike.

Table 2.11 Actual Emissions of Sulfur Hexafluoride (Fiscal 1995 – 1999)

	unit	1995	1996	1997	1998	1999
Total Actual Emissions	[Gg CO2eq.]	16,730	17,181	14,435	12,824	8,351
E. Production of Halocarbons and SF ₆	[Gg CO2eq.]	4,708	4,183	2,581	2,103	1,527
2. Fugitive Emissions	[t]	197	175	108	88	64
F(a). Consumption of Halocarbons and SF ₆ (actual emissions - Tier 2)	[Gg CO2eq.]	12,022	12,998	11,854	10,721	6,824
6. Semiconductor Manufacture	[t]	43	51	65	68	77
7. Electrical Equipment	[t]	460	493	431	380	208

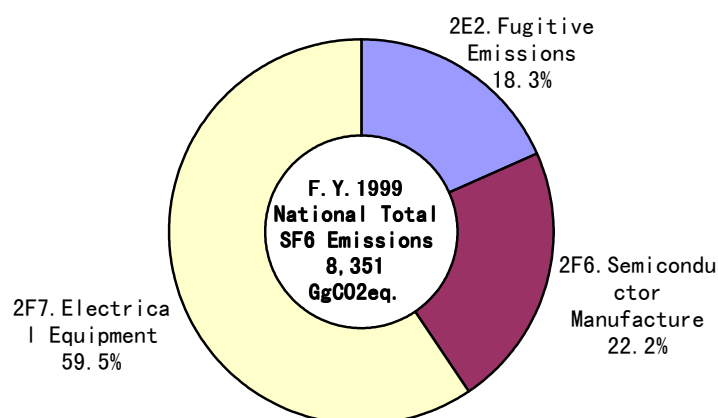


Figure 2.8 Breakdown of Actual Sulfur Hexafluoride Emissions (Fiscal 1999)

Table 2.12 Potential Sulfur Hexafluoride Emissions (Fiscal 1990 – 1999)

	unit	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
F(p). Total Potential Emissions	[Gg CO2eq.]	38,240	43,498	47,800	45,410	45,410	52,580	50,190	49,712	49,999	34,058
SF6 (GWP=23900)	[t]	1,600	1,820	2,000	1,900	1,900	2,200	2,100	2,080	2,092	1,425
Production	[t]	1,900	2,060	2,300	2,200	2,200	2,400	2,400	2,540	2,440	1,838
Import	[t]	0	80	0	0	0	0	0	0	0	0
Export	[t]	300	320	300	300	300	200	300	460	348	413
Destroyed Amount	[t]	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

2.8 Nitrogen Oxide (NO_x)

2.8.1 Outline of Emissions

Japan emitted approximately 2 million tons of nitrogen oxides (NO_x) in fiscal 1999, primarily from activities in the Energy (1), Industrial Processes (2), and Waste (6) sectors. NO_x emissions are calculated as NO₂ equivalent weights.

Table 2.13 shows emissions from fiscal 1990 through fiscal 1999. Although there have been fluctuations, the overall amount of emissions has remained essentially stable. Increases have occurred in the following sectors: Fuel Combustion Activities (1A) excluding the Energy Industry (1A1) subsector and Waste Incineration (6C). These rises reflect increases in fuel consumption and greater amounts of incinerated waste.

Figure 2.9 breaks down nitrogen oxide emissions in fiscal 1999 according to sector. The Fuel Combustion Activities (1A) sector accounted for 93% of all emissions, broken down in descending order into the following subsectors: Transport (1A3), Manufacturing Industries and Construction (1A2), Energy Industries (1A1), and Other Sectors (1A4). The Industrial Processes (2) sector accounted for 4.2% of the total, and the Waste (6) sector accounted for 3.3%.

2.8.2 Method of Estimating Emissions

Energy (1): For the Energy Industries (1A1), Manufacturing Industries and Construction (1A2), and part of

the Other Sectors (1A4) under the Fuel Combustion Activities (1A) sector, emissions were calculated for each soot and smoke-emitting facility designated by the Air Pollution Control Law by multiplying the amounts of fuel consumed (broken down by type of furnace and type of fuel) by the emission factors¹²⁾. This is a “bottom-up” approach. The remainder of the Other Sectors (1A4) subsector involves small boilers and fuel facilities, and emissions were calculated by multiplying the emission factors for different types of fuel and their applications by the amounts of fuel consumed. The figure shown in the Transport (1A3) subsector includes emissions from motor vehicles, ships, aircraft, and railways (diesel railcars). Emissions for motor vehicles were calculated by determining the total distance traveled by each type of vehicle and multiplying by the emission factors²⁴⁾. In all others, the default emission factors of the Revised 1996 IPCC Guidelines were used.

Industrial Processes (2): Estimates were made for nitrogen oxide emissions from soot and smoke-emitting facilities designated by the Air Pollution Control Law¹²⁾.

Land-Use Change & Forestry (5): Consideration was given to the burning of biomass that accompanies the conversion of forest land to other uses, and calculations were made on the basis of default methods indicated in the Revised 1996 IPCC Guidelines.

Waste (6): For the Waste Incineration (6C) subsector, the amounts of waste processed in Waste Incinerators designated by the Air Pollution Control Law were multiplied by the emission factors¹²⁾.

Table 2.13 Nitrogen Oxide Emissions (Fiscal 1990 – 1999)

(Unit : Gg)

Fiscal Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total	1,867.2	1,910.4	1,896.1	1,887.1	1,917.7	2,007.7	2,017.4	2,047.3	1,964.7	1,996.0
1 Energy	1,722.4	1,751.6	1,742.8	1,737.2	1,766.0	1,854.4	1,867.7	1,894.3	1,815.6	1,847.7
1A Fuel Combustion Activities	1,722.4	1,751.6	1,742.8	1,737.2	1,766.0	1,854.4	1,867.7	1,894.3	1,815.6	1,847.7
1A1. Energy Industries	265.4	267.5	264.6	253.4	264.4	251.4	246.9	243.5	236.9	251.0
1A2. Manufacturing Industries and Construction	451.8	438.7	433.2	450.5	467.8	508.9	499.7	504.8	483.1	494.0
1A3. Transport	915.9	959.2	951.1	926.6	931.9	963.3	993.7	1,020.2	973.2	979.5
1A4. Other Sectors	89.2	86.2	93.9	106.7	101.9	130.8	127.4	125.9	122.5	123.2
1A5. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
1B Fugitive Emissions from Fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1B1. Solid Fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1B2. Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2 Industrial Processes	92.2	102.5	96.8	92.4	91.9	90.6	88.3	90.3	84.1	83.3
3 Solvent and Other Product Use										
4 Agriculture	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4A Enteric Fermentation										
4B Manure Management										
4C Rice Cultivation										
4D Agricultural Soils										
4E Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4F Field Burning of Agricultural Residues	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4G Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 Land-Use Change and Forestry	0.6	1.0	1.0	1.0	1.0	1.0	NE	NE	NE	NE
5A Changes in Forest and Other Woody Biomass Stocks										
5B Forest and Grassland Conversion	0.6	1.0	1.0	1.0	1.0	1.0	NE	NE	NE	NE
5C Abandonment of Managed Lands										
5D CO2 Emissions and Removals from Soil										
6 Waste	52.1	55.3	55.4	56.6	58.8	61.6	61.4	62.8	64.9	64.9
6A Solid Waste Disposal on Land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6B Wastewater Handling	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6C Waste Incineration	52.1	55.3	55.4	56.6	58.8	61.6	61.4	62.8	64.9	64.9
6D Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7 Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
International Bunkers	475.5	515.4	535.5	595.2	601.2	558.6	415.1	497.2	521.4	496.6

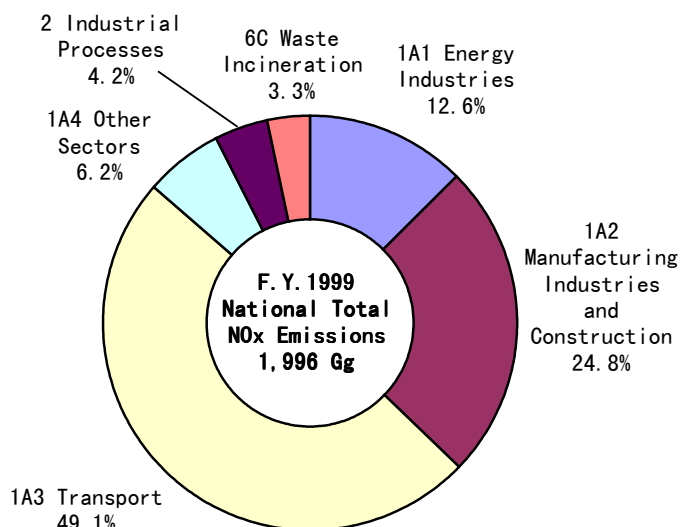


Figure 2.9 Breakdown of Nitrogen Oxide Emissions (Fiscal 1999)

2.9 Carbon Monoxide (CO)

2.9.1 Outline of Emissions

Japan emitted approximately 3.67 million tons of carbon monoxide (CO) in fiscal 1999, almost all of which came from the Fuel Combustion Activities (1A) sector.

Table 2.14 shows emissions from fiscal 1990 through fiscal 1999. The overall amount of emissions has declined slightly. About 55% is emitted from the Transport (1A3) sector, of which 97% is generated by motor vehicles. Increases have been observed in the Waste Incineration (6C) subsector. Declines have occurred in the following subsectors: Energy Industries (1A1) and Manufacturing Industries and Construction (1A2).

Figure 2.10 breaks down carbon monoxide emissions in fiscal 1999 according to sector. The Fuel Combustion Activities (1A) sector under Energy (1) accounted for about 95% of all emissions, broken down in descending order into the following subsectors: Transport (1A3), Manufacturing Industries and Construction (1A2), Energy Industries (1A1), and Other Sectors (1A4). Nearly all of the emissions in the Transport (1A3) sector were from motor vehicles (1.95 million tons as of fiscal 1999, which accounted for 53% of total emissions). The emissions amount from Burning of Agricultural Residues (4F) is considered for Agriculture (4), which accounted for 3.7% of total emissions. The Waste (6) sector accounted for 1.1% of total emissions, taking into account emissions generated in the Waste Incineration (6C) subsector.

2.9.2 Methods of Estimating Emissions

Energy (1): For the Energy Industries (1A1), Manufacturing Industries and Construction (1A2), and part of the Other Sectors (1A4) under the Fuel Combustion Activities (1A) sector, emissions were calculated for each soot and smoke-emitting facility designated by the Air Pollution Control Law by multiplying the amounts of fuel consumed (broken down by type of furnace and type of fuel) by the emission factors¹²⁾. This is a “bottom-up” approach. The remainder of the Other Sectors (1A4) subsector involves small boilers and fuel facilities, and emissions were calculated by multiplying the emission factors for different types of fuel and their applications by the amounts of fuel consumed. The figure shown in the Transport (1A3) subsector includes emissions from motor vehicles, ships, aircraft, and railways (diesel railcars). Emissions for automotive vehicles were calculated by determining the total distance traveled by each type of vehicle and multiplying by the emission factors²⁴⁾. In all others, the default emission factors from the

Revised 1996 IPCC Guidelines were used.

Agriculture (4): Carbon monoxide emissions generated in the Field Burning of Agricultural Residues (4F) subsector were taken into account.

Land-Use Change & Forestry (5): Consideration was given to the burning of biomass that accompanies the conversion of forest land to other uses, and calculations were made on the basis of default methods indicated in the Revised 1996 IPCC Guidelines.

Waste (6): For the Waste Incineration (6C) subsector, the amounts of waste processed in Waste Incinerators designated by the Air Pollution Control Law were multiplied by the emission factors¹²⁾.

Other (7): Carbon monoxide emissions from tobacco smoke were calculated by multiplying the amount of carbon monoxide generated by each smoked item²⁵⁾ by the total number of items smoked²⁶⁾.

Table 2.14 Carbon Monoxide Emissions (Fiscal 1990 – 1999)

(Unit : Gg)

Fiscal Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total	3,871.6	3,904.6	3,879.1	3,825.5	3,917.6	3,803.1	3,750.5	3,793.5	3,666.7	3,673.9
1 Energy	3,639.2	3,655.1	3,633.4	3,564.9	3,652.5	3,540.9	3,531.0	3,586.6	3,469.1	3,480.8
1A Fuel Combustion Activities	3,639.2	3,655.1	3,633.4	3,564.9	3,652.5	3,540.9	3,531.0	3,586.6	3,469.1	3,480.8
1A1. Energy Industries	57.7	58.1	57.1	56.4	56.5	58.8	54.6	54.8	53.3	56.3
1A2. Manufacturing Industries and Construction	1,509.7	1,468.6	1,461.9	1,454.5	1,602.8	1,437.2	1,451.1	1,487.9	1,396.5	1,387.9
1A3. Transport	2,043.8	2,099.8	2,084.5	2,022.2	1,963.0	2,010.5	1,990.6	2,009.4	1,985.8	2,002.3
1A4. Other Sectors	27.9	28.7	29.9	31.8	30.2	34.4	34.7	34.5	33.5	34.4
1A5. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
1B Fugitive Emissions from Fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1B1. Solid Fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1B2. Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2 Industrial Processes	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
3 Solvent and Other Product Use										
4 Agriculture	162.1	165.2	160.9	174.5	172.2	174.0	163.1	150.2	139.4	135.1
4A Enteric Fermentation										
4B Manure Management										
4C Rice Cultivation										
4D Agricultural Soils										
4E Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4F Field Burning of Agricultural Residues	162.1	165.2	160.9	174.5	172.2	174.0	163.1	150.2	139.4	135.1
4G Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 Land-Use Change and Forestry	22.1	34.7	34.9	35.2	35.5	36.0	NE	NE	NE	NE
5A Changes in Forest and Other Woody Biomass Stocks										
5B Forest and Grassland Conversion	22.1	34.7	34.9	35.2	35.5	36.0	NE	NE	NE	NE
5C Abandonment of Managed Lands										
5D CO2 Emissions and Removals from Soil										
6 Waste	30.5	31.6	31.7	32.7	39.1	33.8	37.2	38.6	39.7	39.7
6A Solid Waste Disposal on Land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6B Wastewater Handling	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6C Waste Incineration	30.5	31.6	31.7	32.7	39.1	33.8	37.2	38.6	39.7	39.7
6D Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7 Other	17.7	18.1	18.1	18.3	18.4	18.4	19.2	18.0	18.5	18.3
International Bunkers	64.5	69.4	71.7	77.8	79.3	77.5	64.9	74.3	75.7	73.5

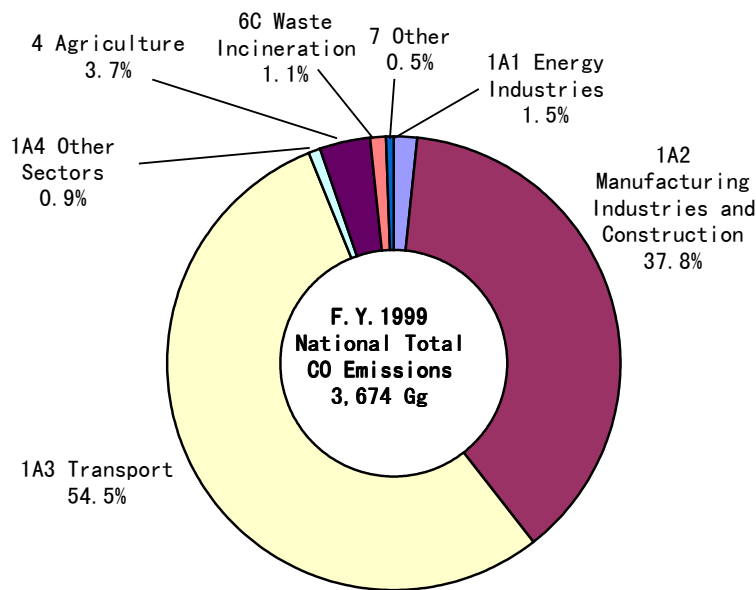


Figure 2.10 Breakdown of Carbon Monoxide Emissions (Fiscal 1999)

2.10 Non-Methane Volatile Organic Compounds (NMVOC)

2.10.1 Outline of Emissions

Japan generated approximately 1.85 million tons of non-methane volatile organic compounds (NMVOC) emissions in fiscal 1999, generated primarily in the Energy (1), Industrial Processes (2), and Solvent and Other Product Use (3) sectors.

Table 2.15 shows emissions from fiscal 1990, broken down by each sector. Overall emissions have declined slightly, reflecting a decline in the Solvent and Other Product Use (3) sector, which is the most main source of emissions. A slight decline also occurred in the Fuel Combustion Activities (1A) subsector, while an increase occurred in the Fugitive Emissions from Fuels (1B) subsector.

Figure 2.11 breaks down non-methane volatile organic compound emissions in fiscal 1999 according to sector. Emissions were the greatest in the Solvent and Other Product Use (3) sector, followed in descending order by the Energy (1) and Industrial Processes (2) sectors. The Solvent and Other Product Use (3) sector accounts for 70.2% of the total and includes emissions generated through the use of paints, oil removers and dry cleaning, as well as chemical products. The subsectors Fuel Combustion Activities (1A) and Fugitive Emissions from Fuels (1B) of the Energy (1) sector account for 12.4% and 12.8% of the total, respectively.

2.10.2 Methods of Estimating Emissions

Energy (1): For the Energy Industries (1A1), Manufacturing Industries and Construction (1A2), and part of the Other Sectors (1A4) under the Fuel Combustion Activities (1A) sector, emissions were calculated for each soot and smoke-emitting facility designated by the Air Pollution Control Law by multiplying the amounts of fuel consumed (broken down by type of furnace and type of fuel) by the emission factors¹²⁾. This is a “bottom-up” approach. The remainder of the Other Sectors (1A4) subsector involves small boilers and fuel facilities, and emissions were calculated by multiplying the emission factors for different types of fuel and their applications by the amounts of fuel consumed. The figure shown in the Transport (1A3) subsector includes emissions from motor vehicles, ships, aircraft, and railways (diesel railcars). Emissions for motor vehicles were calculated by determining the total distance traveled by each type of vehicle and multiplying by

the emission factors ²⁴⁾. In all others, the default emission factors of the revised 1996 IPCC Guidelines were used. Values shown in the Fugitive Emissions from Fuels (1B) subsector represent emissions from evaporation occurring during the handling of crude oil and petroleum products. The activity data for this subsector included the amounts handled or the amounts shipped ¹³⁾, which were multiplied by the emission factors in accordance with how the materials were handled ²⁷⁾.

Industrial Processes (2): The amounts emitted through the manufacture of petroleum products (primarily in the petrochemical industry) were estimated. The amounts of such products produced ²⁸⁾ were multiplied by the emission factors ²⁹⁾.

Solvent and Other Product Use (3): The amounts of products produced or consumed in each application ²⁸⁾ were multiplied by the emission factors ²⁷⁾.

Waste (6): For the Waste Incineration (6C) subsector, the amounts of waste processed in the Waste Incinerator designated by the Air Pollution Control Law were multiplied by the emission factors ¹²⁾.

Table 2.15 Non-Methane Volatile Organic Compounds Emissions (Fiscal 1990 – 1999)

(Unit : Gg)

Fiscal Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total	1,911.0	1,888.7	1,855.6	1,808.2	1,851.9	1,874.7	1,906.6	1,921.0	1,814.5	1,849.9
1 Energy	442.2	443.3	443.0	434.9	439.6	449.0	456.1	459.3	458.9	465.6
1A Fuel Combustion Activities	243.0	240.0	236.5	226.5	222.3	228.7	231.3	231.6	227.4	229.7
1A1. Energy Industries	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1A2. Manufacturing Industries and Construction	1.6	1.8	3.0	1.8	2.0	1.8	1.9	1.9	1.8	1.8
1A3. Transport	241.3	238.1	233.3	224.5	220.1	226.6	229.1	229.4	225.3	227.6
1A4. Other Sectors	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3
1A5. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
1B Fugitive Emissions from Fuels	199.3	203.4	206.5	208.4	217.3	220.3	224.8	227.7	231.6	235.9
1B1. Solid Fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1B2. Oil and Natural Gas	199.3	203.4	206.5	208.4	217.3	220.3	224.8	227.7	231.6	235.9
2 Industrial Processes	80.9	81.1	79.8	76.3	79.4	83.3	85.3	86.9	82.7	86.0
3 Solvent and Other Product Use	1,387.8	1,364.3	1,332.8	1,297.0	1,332.9	1,342.3	1,365.1	1,374.8	1,272.8	1,298.2
4 Agriculture	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4A Enteric Fermentation										
4B Manure Management	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4C Rice Cultivation	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4D Agricultural Soils	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4E Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4F Field Burning of Agricultural Residues	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4G Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 Land-Use Change and Forestry										
5A Changes in Forest and Other Woody Biomass Stocks										
5B Forest and Grassland Conversion										
5C Abandonment of Managed Lands										
5D CO ₂ Emissions and Removals from Soil										
6 Waste	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6A Solid Waste Disposal on Land	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6B Wastewater Handling	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6C Waste Incineration	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6D Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7 Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
International Bunkers	15.5	16.8	17.4	19.1	19.4	18.4	14.5	17.0	17.6	16.9

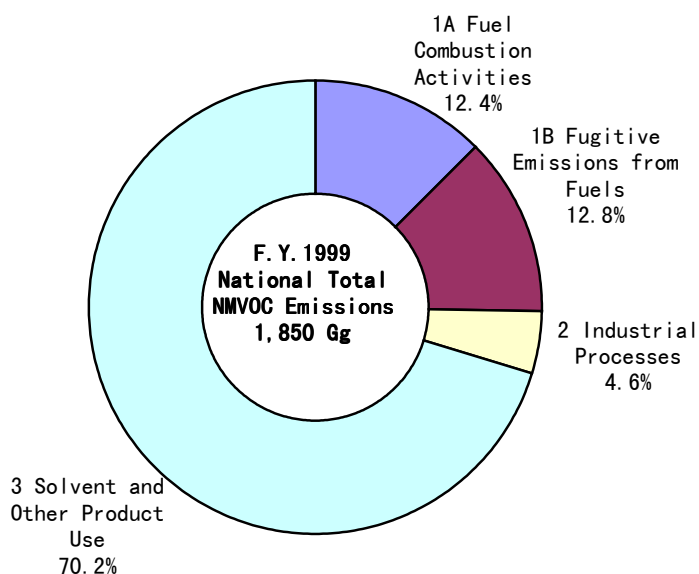


Figure 2.11 Breakdown of Non-Methane Volatile Organic Compounds Emissions (Fiscal 1999)

2.11 Sulfur Dioxide (SO₂)

2.11.1 Outline of Emissions

Japan emitted approximately 870,000 tons of sulfur dioxide in fiscal 1999.

Table 2.16 shows emissions from fiscal 1990 through 1999, broken down by sector. Overall emissions have declined. A significant decline was seen in the Transport (1A3) sector in fiscal 1993, reflecting declines in the sulfur amounts in fuel³⁰⁾. Emissions have also declined in Manufacturing Industries and Construction (1A2), and Industrial Processes (2). The Energy Industries (1A1) sector has fluctuated, while the Waste Incineration (6C) subsector has shown an increase even though the amount of emissions has fluctuated.

Figure 2.12 shows a breakdown of sulfur dioxide emissions in fiscal 1999 according to sector. Emissions were the greatest in the Manufacturing Industries and Construction (1A2) subsector, accounting for 41% of the total. The Energy Industries (1A1) subsector accounted for 26%. The Industrial Processes (2) sector includes emissions generated when sulfide minerals are smelted, accounting for 5% of the total.

2.11.2 Methods of Estimating Emissions

Energy (1): For the Energy Industries (1A1), Manufacturing Industries and Construction (1A2), and part of the Other Sectors (1A4) under the Fuel Combustion Activities (1A) sector, emissions were calculated for each soot and smoke-emitting facility designated by the Air Pollution Control Law by multiplying the amounts of fuel consumed (broken down by type of furnace and type of fuel) by the emission factors¹²⁾. This is a “bottom-up” approach. The remainder of the Other Sectors (1A4) subsector involves small boilers and fuel facilities, and emissions were calculated by multiplying the emission factors for different types of fuel and their applications by the amounts of fuel consumed. The figure shown in the Transport (1A3) subsector includes emissions from motor vehicles, ships, aircraft, and railways (diesel railcars).

Industrial Processes (2): Estimates were made for sulfur dioxide emissions from soot and smoke-emitting facilities designated by the Air Pollution Control Law¹²⁾.

Waste (6): For the Waste Incineration (6C) subsector, the amounts of waste processed in Waste Incinerators designated by the Air Pollution Control Law were multiplied by the emission factors

12).

Table 2.16 Sulfur Dioxide Emissions (Fiscal 1990-1999)

(Unit : Gg)

Fiscal Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total	972.0	966.2	923.0	882.6	937.7	905.6	869.8	868.3	848.4	870.1
1 Energy	890.9	881.1	843.7	791.8	843.4	807.5	790.7	787.3	768.6	790.1
1A Fuel Combustion Activities	890.9	881.1	843.7	791.8	843.4	807.5	790.7	787.3	768.6	790.1
1A1. Energy Industries	238.6	236.0	248.7	230.0	250.9	225.9	217.5	214.9	209.1	221.6
1A2. Manufacturing Industries and Construction	379.7	359.1	356.8	367.8	382.3	362.3	357.2	357.5	344.7	353.7
1A3. Transport	185.8	202.0	149.6	88.4	91.0	95.4	99.0	98.8	96.7	97.0
1A4. Other Sectors	86.8	84.0	88.6	105.6	119.3	123.9	117.0	116.1	118.2	117.9
1A5. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
1B Fugitive Emissions from Fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1B1. Solid Fuels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1B2. Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2 Industrial Processes	48.1	53.3	41.7	50.8	52.1	53.0	43.6	44.9	42.3	42.5
3 Solvent and Other Product Use										
4 Agriculture										
4A Enteric Fermentation										
4B Manure Management										
4C Rice Cultivation										
4D Agricultural Soils										
4E Prescribed Burning of Savannas										
4F Field Burning of Agricultural Residues										
4G Other										
5 Land-Use Change and Forestry										
5A Changes in Forest and Other Woody Biomass Stocks										
5B Forest and Grassland Conversion										
5C Abandonment of Managed Lands										
5D CO2 Emissions and Removals from Soil										
6 Waste	32.9	31.8	37.6	40.0	42.2	45.1	35.4	36.2	37.6	37.5
6A Solid Waste Disposal on Land										
6B Wastewater Handling										
6C Waste Incineration	32.9	31.8	37.6	40.0	42.2	45.1	35.4	36.2	37.6	37.5
6D Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
7 Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
International Bunkers	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO	NE, NO

Note: If there are two notation keys in subsectors, the both (i.e. NE and NO) are shown.

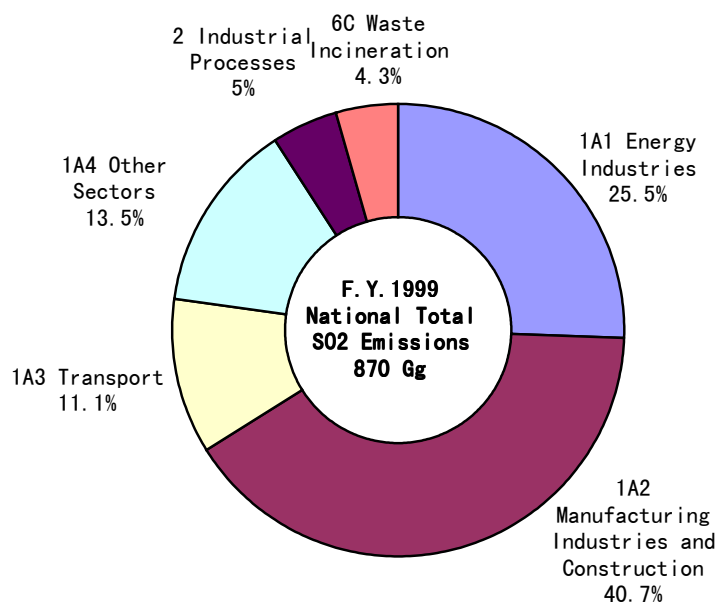


Figure 2.12 Breakdown of Sulfur Dioxide Emissions (Fiscal 1999)

References

(A publication data was omitted for the statistics that was referred for several years.)

- 1) IPCC (1997): Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories
- 2) IPCC (2000): Good Practice and Uncertainty Management in National Greenhouse Gas Inventories
- 3) Agency of Natural Resources and Energy: "General Energy Statistics"
- 4) Environment Agency: "The Estimation of CO₂ Emission in Japan (1992)"
- 5) Ministry of Economy, Trade and Industry (METI): "Yearbook of Minerals and Non-ferrous Metals Statistics"
- 6) METI: "Statistical Yearbook for the Ceramics and Building Materials Industries"
- 7) METI: "Current Survey of Energy Consumption in Commerce, Mining and Manufacturing"
- 8) Forestry Agency: "Statistical Handbook of Forestry"
- 9) Japan Environmental Sanitation Center (Incorporated Foundation): "Municipal Waste Composition Analysis"
- 10) Ministry of the Environment: "Industrial Waste Administration Research"
- 11) Environment Agency: "Research into Units and Total Vehicular Exhaust (1997)"
- 12) Ministry of the Environment: "Research of Air Pollutant Emissions from Stationary Sources"
- 13) METI: "Statistical Yearbook on Energy Supply and Demand"
- 14) Ministry of Agriculture, Forestry and Fisheries (MAFF): "Report of Livestock"
- 15) Japan Livestock Technology Association: "Control of Emissions of Greenhouse Gases from Livestock Farming (4th Ed.) (1999)."
- 16) MAFF: "Crop Statistics"
- 17) Y. Matsuzawa et al (1993): "Estimate of the Methane Emissions from Final Disposal Landfill Site," from the proceedings of the 4th Annual Conference of the Japan Society of Waste Management Experts.
- 18) Production amounts and fiscal 1999 emission factors were determined through manufacturer hearings; emission factors from fiscal 1990-98 were derived from a study conducted by Miyazaki Prefecture and the Environment Agency (1995) entitled: "Study of Greenhouse Gas Emission Factors from Stationary Sources."
- 19) Production amounts from METI: "Statistical Yearbook on the Chemical Industry". Emission factors were determined through manufacturer hearings.
- 20) Ministry of Health, Labour and Welfare (MHLW): "Statistics of Production by Pharmaceutical Industry."
- 21) Amounts of fertilizer used determined through the MAFF: "Pocket Handbook of Fertilizers".
- 22) Average value of NO_x discharge ratio out of the nitrogen amounts in fertilizer used, acquired through research carried out by 45 prefectural agricultural test centers nationwide.
- 23) The amount of incinerated sewage sludge was determined through studies by the Japan Sewage Works Association. Emissions factors were determined by the Public Works Research Institute of the Ministry of Construction (1994): "Technical Memorandum of PWRI."
- 24) Distances traveled were based on data from the Ministry of Transport: "Statistical Yearbook of Motor Vehicle Transport." Emissions factors were based on Environment Agency materials.
- 25) Data from manufacturer hearings.
- 26) Tobacco Institute of Japan: "Total Domestic Cigarette Consumption."
- 27) Environment Agency materials.
- 28) METI: mostly from the "Statistical Yearbook on the Chemical Industry"
- 29) Researched by the Petroleum Association of Japan

Chapter 3

Policies and Measures

In Japan, the Global Warming Prevention Headquarters was established in December 1997 by order of the Cabinet to implement specific and effective countermeasures against global warming in reaction to the Third Session of the Conference of the Parties to the UNFCCC (COP3, also known as the “Kyoto Conference on Global Warming Prevention”). The “Guideline for Measures to Prevent Global Warming” was drawn up in June 1998 by these headquarters.

Subsequently, new “Guideline for Measures to Prevent Global Warming” was concluded on 19th March 2002, as additional measures need to be promoted to achieve the commitment stipulated in the Kyoto Protocol as emissions continue to increase.

This chapter is based on Chapters 1 through 4 of this new Guideline.*

3.1 Background and Significance of Review of Guideline for Measures to Prevent Global Warming

3.1.1 Basic understanding of global warming

The global warming issue refers to the adverse effect on both human being and the natural ecosystem, from the increase in global surface and atmospheric temperature due to the increase of greenhouse gases concentrations by human activities. It is certainly the most important environmental issue for human life in terms of the scale and severity of its estimated impact. According to the Intergovernmental Panel on Climate Change (IPCC), global mean surface temperature has increased by 0.6 ± 0.2 °C between 1861 and the present, and global mean sea level has risen by 10 to 20 centimeters within the 20th century. It also mentions that regional climate changes have impacted on a variety of physical and biological systems in many areas of the world, as evidenced by the recession of mountain glaciers and the melting of permafrost. Furthermore, it describes new and more reliable evidence that most of warming observed over the last 50 years has been caused mainly by the human activities. In terms of future projection, the global mean surface temperature is projected to increase by 1.4 to 5.8°C over the period 1990-2100, with global mean sea level rising by between 9 and 88 centimeters due mainly to the thermal expansion of sea water. It is reckoned that the impact on human society will include increases in the number of flood victims and infectious diseases such as malaria, further damage to the ecosystem, as well as the increase of extreme weather events. It also mentions that while any increase in temperature will cause net economic losses in developing countries, temperature increases of more than a few degrees centigrade will incur net economic losses in developed countries, thus widening the gap between the north and south will be further exacerbated.

3.1.2 Measures for international society

(1) Adoption and implementation of the Framework Convention on Climate Change

The “United Nations Framework Convention on Climate Change” was adopted in May 1992 by international society to resolve global warming-related issues. Japan signed the “Framework Convention on Climate Change” at the UN Conference on Environment and Development in June 1992, and accepted it in May 1993. The “Framework Convention on Climate Change” came into effect in March 1994. The ultimate objective of the “Framework Convention on Climate Change” is to achieve

* In the Greenhouse Gas Emission/Removal Inventory submitted in 2001 and Chapter 2, total greenhouse gas emissions in the base year (1990 levels for CO₂, CH₄ and N₂O; 1995 levels for HFC, PFC and SF₆) and total emissions in 1999 were 1,223.8 million tons and 1,300.7 million tons respectively, but revised statistics are used here as it was discovered in the latest emission studies that the amounts of waste incineration and cement production were under-calculated, thus leading to new Guideline.

stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climatic system. The “Framework Convention on Climate Change” states that such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner. The “Framework Convention on Climate Change” also stipulates that, based on a concept of “common but differentiated responsibilities” of the Parties, it is recognized that the return by the end of the decade 1990-1999 to earlier levels of emissions of greenhouse gases would contribute to the modification of long-term trends in emissions, and that the developed country Parties shall communicate detailed information on its policies and measures to limit its emissions of greenhouse gases and to protect and enhance its greenhouse gas sinks, and reservoirs as well as on its resulting projected greenhouse gas emissions and removals for the decade with the aim of returning these emissions to their 1990 level. The “Framework Convention on Climate Change” thus makes it clear that the developed country Parties should take the lead in combating climate change ahead of developing countries. On the other hand, it stipulates the basic responsibilities of developing country Parties, such as estimation of the emission amounts in each country and its reporting to the Convention secretariat, while also clarifying the obligation of developed country Parties to support their implementation.

(2) Measures for the implementation of the Kyoto Protocol in 2002

As a first step towards long-term and continued reductions in emissions, the Kyoto Protocol – which provide a legally binding commitment to reduce greenhouse gas emissions by developed countries – was adopted at the Third Conference of the Parties (COP3) for the “Framework Convention on Climate Change” held in Kyoto in December 1997.

Under the Kyoto Protocol, the greenhouse gases subject to the quantified emission limitation and reduction commitments are carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). A legally binding quantified commitment has been established for each country with a view to reducing the developed countries’ overall emissions of these greenhouse gases by at least 5 per cent below 1990 levels in the first commitment period from 2008 to 2012. The quantified commitment for Japan is a 6% reduction, while those for the USA and EU are 7% and 8% respectively. The Kyoto Protocol introduces the so-called ‘Kyoto mechanisms’ (a mechanism stipulated in Article 6 of the Kyoto Protocol (so-called, and hereafter, referred to as, ‘Joint Implementation (JI)’), a clean development mechanism (CDM) under Article 12, and emission trading under Article 17) as an international system to promote cost-effective measures to achieve such commitments.

Since then, international negotiations have been pursued to decide the operational details for the implementation of the Kyoto Protocol, and the decisions elaborating these details (so-called “the Marrakesh Accords”) were adopted at COP7 held in Marrakech in October and November 2001. While the USA, which is the largest greenhouse gas emitter of the world, has made clear its position not to become a party to the Kyoto Protocol, the EU and other developed countries have already begun preparations towards the conclusion of the Kyoto Protocol following the decision reached at COP7, so as to enable its entry into force in 2002.

Japan, which chaired COP3 (The Kyoto Conference) at which the Kyoto Protocol was adopted, convened a Global Warming Prevention Headquarters meeting on February 13th 2002, and decided to make every effort to obtain the Diet’s approval for its conclusion of the Kyoto Protocol and to complete legislative process for the adoption of the necessary domestic laws, taking into account the holding of the World Summit on Sustainable Development (The Johannesburg Summit) from late August into September. It was also decided at the meeting to review the ‘Guideline of Measures to Prevent Global Warming’ (Global Warming Prevention Headquarters decision, June 1998: hereafter referred to as the ‘old Guideline’) and establish a new Guideline. At the same time, Japan continues to make every effort to establish common rules in which all countries participate.

3.1.3 Measures to date, and the challenge of achieving the 6% reduction commitment stipulated in the Kyoto Protocol

Japan established an “Action Program to Arrest Global Warming” at the “Council of Ministers for Global Environmental Conservation” in October 1990, and took various measures to reduce and stabilize CO₂ emissions at 1990 levels from 2000 onward. This target value was also mentioned in the Framework Convention on Climate Change as well, but it is thought that this target was not achieved in 2000.

Taking into account the adoption of the Kyoto Protocol in December 1997, the Global Warming Prevention Headquarters drew up its “Guideline of Measures to Prevent Global Warming” in June 1998, covering those measures against global warming needing to be urgently promoted with the target year 2010 in view.

Furthermore, Japan has fixed a basic framework to promote measures to prevent global warming in Japan by establishing the “Law Concerning the Promotion of the Measures to Cope with Global Warming” (1998 law No. 117; hereafter ‘Law to Promote Global Warming Countermeasures’), and established basic policies based on it. Japan has also implemented various domestic measures, such as revision of the “Law Concerning the Rational Use of Energy” (1979 law No. 49; hereafter ‘Law for Energy Conservation’).

However, greenhouse gas emissions are still increasing. Emissions of greenhouse gases from Japan increased by around 6.9% in fiscal 1999 compared to the base year (1990 for CO₂, CH₄, and N₂O, while 1995 for HFCs, PFCs, and SF₆. Thereafter same). It has been estimated that greenhouse gas emissions will increase in 2010 by around 7% compared to the base year assuming existing measures and policies, so further measures are required to achieve the Kyoto Protocol commitment.

Japan plans to conclude the Kyoto Protocol as soon as the requisite approval is granted by the Diet. However, it will not be easy for Japan to achieve the 6% reduction commitment stipulated for it in the Kyoto Protocol (hereafter ‘6% reduction commitment’) since its energy efficiency is already of the highest standard in the world, and accordingly close cooperation of the government, local authorities, businesses and citizens will be required to meet the challenge of achieving the commitment. On the basis of the above, the revised “Guideline of Measures to Prevent Global Warming” which the Government of Japan elaborated prior to its conclusion of the Kyoto Protocol provides an overview of the specific measures to achieve the 6% reduction commitment which strongly promote combined efforts of the government, local authorities, businesses and citizens. Additionally, targets and measures to address each of the greenhouse gases and other categories, as well as the schedule for implementation of such measures are described, indicating for each measure the target amount of its introduction in the whole country, its resulting emission reduction estimated and policies to promote it.

3.2 Basic Policies for Measures to Prevent Global Warming

3.2.1 Direction for global warming prevention to aim in

As a measure to prevent global warming from now on, firstly, we must try to reverse the trend for ever-increasing total amounts of greenhouse gas emissions to a reducing basis at an early stage, and link such reductions to the achievement of the 6% reduction commitment stipulated in the Kyoto Protocol, leading also to a longer term and continued emission reduction.

(1) Achievement of the 6% reduction commitment stipulated under the Kyoto Protocol

Japan positively promotes measures to prevent global warming as required to achieve the 6% reduction commitment stipulated in the Kyoto Protocol, namely the commitment to reduce its overall emissions of greenhouse gases by 6% below 1990 levels in the first commitment period from 2008 to 2012. If measures are introduced later, larger reductions will be required in a shorter period to achieve the 6% reduction commitment, so we are immediately implementing such measures as can be carried out now to prevent global warming, will reverse the rising trend to a falling trend at the earliest possible stage, and thus achieve the 6% reduction commitment.

(2) Long-term and continued reductions in greenhouse gas emissions

We plan to achieve the 6% reduction commitment stipulated in the Kyoto Protocol and head towards longer-term and continued emission reductions. In order to do so, we are implementing each measure

very carefully, and at the same time, striving to build a society in which a system to reduce greenhouse gas emissions is incorporated while trying to maintain consistency between each area of the overall policy and with due consideration for Japanese socioeconomic trends in the 21st century.

3.2.2 Basic concept for establishment and implementation of measures to prevent global warming

(1) Preparation and establishment of a system for contribution to both the environment and economy

We are endeavoring to prepare and establish a mechanism to ensure contribution to both the environment and economy by make the best use of technological innovation and innovative ideas in economic circles to link the various measures aimed at achieving the 6% reduction commitment called for in the Kyoto Protocol and to create labor opportunities by stimulating the economy in Japan.

(2) Step-by-step approach

We have segmented the term from 2002 to the end of the first commitment period, and define the term from 2002 to 2004 as the '1st step', from 2005 to 2007 as the '2nd step', with the first commitment period (2008 ~ 2012) as the '3rd step'. We will steadily quantify how to achieve the 6% reduction commitment stipulated in the Kyoto Protocol in the first commitment period, evaluate the progress of such measures, policies and emission statuses before the 2nd and 3rd steps, and adopt a step-by-step approach by implementing any additional requisite measures and policies. In carrying out the above, we shall include in this guideline any targets for each of greenhouse gases and other segments, Japan's overall implementation target amount for each measure, the estimated emission reduction amount, and policies to promote such measures to evaluate and review based on objective factors.

(3) Promotion of measures through cooperation between government, local authorities, businesses, and citizens

In order to promote measures to prevent global warming, cooperation between all parties is indispensable, by having the government, local authorities, businesses, and citizens each playing their roles. Also, local authorities shall establish comprehensive and considered policies to control greenhouse gas emissions in accordance with the natural and social conditions in each area while bearing in mind the basic concept of the above (1) and (2).

(4) Ensuring international cooperation for measures to prevent global warming

As the causes and effects of global warming are worldwide, it is necessary for all countries to work hard to reduce greenhouse gases in order to ensure the effectiveness of action against global warming, while, in addition to the efforts of each country, further efforts under international cooperation is indispensable. Thus, Japan continues its maximum efforts for the establishment of a common rule in which all countries including the USA and developing countries participate.

It is estimated that CO₂ emissions will increase rapidly in line with an increased global population and economic growth, so Japan intends to play a leading role drawing up global measures through international cooperation using its preeminent technological strengths and accumulated environmental conservation experience.

3.3 Policies Aimed at Achieving the Commitment to a 6% Reduction

3.3.1 Current status and future prospects of greenhouse gas emissions

Japanese aggregate anthropogenic carbon dioxide equivalent emissions of greenhouse gases listed in Annex A of Kyoto Protocol (hereafter, 'total greenhouse gas emissions') is 1,314 million tons of CO₂ in 1999. When the old Guideline was established, it was estimated that greenhouse gas emissions would increase significantly if no special measures were taken. As a result of promoting various measures based on the old Guideline, total greenhouse gas emissions in 2010 (assuming existing measures) is estimated at about 1,320 million tons of CO₂, and it is expected to be reduced to about a 7% increase compared to the base year. On the other hand, our total greenhouse gas emissions in the base year is 1,229 million tons of CO₂. In order to achieve the 6% reduction commitment for Japan stipulated in the Kyoto Protocol, a reduction to 1,155 million tons of CO₂ (6% off the above value) is required. Thus, in order to achieve the 6% reduction commitment, we must also strive to reduce emissions by about 13% (approximately 165 million tons of CO₂) over and above existing measures.

3.3.2 Targets for each of greenhouse gases and other segments

We shall try to achieve the 6% reduction commitment stipulated in the Kyoto Protocol based on the following targets for the time being.

Even if adequate progress is expected for targets ①-⑤ within the first commitment period, further emission reductions shall be promoted as well as continuously and steadily promoting earlier measures without allowing any complacency.

Furthermore, Japan shall study the utilization of the Kyoto mechanisms while taking account of international situation and bearing in mind the commitment achievement responsibility and the general rule that Kyoto mechanisms stipulated in the Kyoto Protocol are supplementary to domestic measures.

- 1 We shall try to reduce carbon dioxide emissions from energy sources to the same level as fiscal 1990 within the first commitment period.
- 2 We shall try to reduce carbon dioxide emissions from non-energy sources, methane, and nitrous oxide by 0.5% compared to the total greenhouse gas emissions in the base year from the fiscal 1990 level within the first commitment period.
- 3 We shall try to achieve a 2% reduction compared to the total greenhouse gas emissions in the base year from the fiscal 1990 level within the first commitment period by innovative technological development and promotion of further activities to prevent global warming involving various sectors and layers of the public.
- 4 In terms of emissions of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆), we shall try to contain the impact to within about +2% compared to the total greenhouse gas emissions in the base year from 1995 within the first commitment period.
- 5 For general targeted forests stipulated in Article 3.3 and 3.4 of the Kyoto Protocol, we shall try to ensure removals of about 13 million tons of carbon (47.67 million tons of CO₂; about 3.9% compared to the total greenhouse gas emissions in the base year) as agreed at COP7 through sink activities in Japan.

3.3.3 Targets for each measure

In order to show an overview of the measures with specific evidence to achieve the 6% reduction commitment stipulated in the Kyoto Protocol, this Guideline stipulates implementation target amounts, and estimated emission reduction amounts for each measure in order to achieve the target for each of greenhouse gases and other segments, and policies to promote such measures. Details are shown in the tables per field (see Tables 3.1-3.11) in the following section 3.4. We shall also make the utmost effort for steady implementation towards further reduction of emissions for measures whose setup of target amounts and estimated emission reduction amounts is difficult.

Implementation target amounts and estimated amounts for emission reduction for the whole of Japan shall be decided as an expected standard for introduction and practice from the technological and economic viewpoint in order to achieve the target for each of greenhouse gases and other segments.

3.4 Promotion of Measures to Prevent Global Warming for Achievement of 6% Reduction Commitment

3.4.1 Comprehensive and systematic promotion of measures to prevent global warming

We are making enormous effort to conclude a “Bill for revising a part of the Law Concerning the Promotion of Measures to Cope with Global Warming” stipulating the establishment of a Kyoto Protocol target achievement plan, legal stipulation of the Global Warming Prevention Headquarters, and strengthening measures carried out by citizens. At the same time, we shall quickly establish a Kyoto Protocol Target Achievement Plan in accordance with the law based on this Guideline, and promote comprehensive and systematic measures to achieve the 6% reduction commitment stipulated in the Kyoto Protocol. We shall also consider the opinions of the members at the Joint Meeting of Councils Relating to Domestic Measures to Arrest Global Warming Issue (held on August 22nd 1997 in line with the Prime Minister’s decision) for the establishment of the Kyoto Protocol Target Achievement Plan.

We have just established this Guideline bearing in mind public comments and the deliberation results of the Relevant Advisory Councils. In order to establish the Kyoto Protocol Target Achievement Plan based on this Guideline, we shall listen to the various opinions from various sectors and layers of the public.

3.4.2 Promotion of a reduction in Carbon Dioxide Emissions focused on measures related to energy supply and demand

Approximately 90% of greenhouse gas emissions in Japan are generated from energy sources, such as from using oil, coal, and natural gas. Following the experience of the last two oil crises, energy conservation has progressed on the demand side thanks to various energy policies and efforts made at every level by the general public. In terms of the supply side, the ratios of nuclear power and natural gas-derived energy have steadily been increasing as substitutes for oil. As a result, energy consumption in relation to GDP and carbon dioxide emissions are generally lower than both Europe and America, and Japan has been one of the most noteworthy countries in terms of measures to prevent global warming and energy conservation.

On the other hand, energy is indispensable for public life and economic activity. Despite the tough economic situation we faced in the nineties, energy consumption has continued to increase. As a result, carbon dioxide emissions from energy sources in fiscal 2000 increased by around 10% (preliminary values) compared to fiscal 1990. In order to achieve the 6% reduction commitment stipulated in the Kyoto Protocol, Japan is trying to reduce carbon dioxide emissions from energy sources to the fiscal 1990 level by fiscal 2010.

<Reduction in Carbon Dioxide Emissions from Energy Sources>

In the Guideline of Measures to Prevent Global Warming (the old Guideline) of 1998, it has been estimated that carbon dioxide emissions from energy sources in fiscal 2010 will represent a 20% increase on fiscal 1990 levels if the measures mentioned in the old Guideline were not implemented. Since 1998, we have been actively promoting measures related to energy supply and demand based on the old Guideline, but even though the framework of the existing policies will be maintained, it is estimated that carbon dioxide emissions from energy sources in fiscal 2010 will be approximately 1,126 million tons of CO₂, which is approximately 73 million tons more than fiscal 1990 (about 1,053 million tons of CO₂). The reason on the demand side is that energy demand mainly in the residential/commercial and transportation (passenger vehicle) sectors have increased significantly compared to fiscal 1990. The reason on the supply side is that the introduction of non-fossil energy such as nuclear power has not progressed as much as anticipated when the old Guideline was established, and use of coal – which relatively cheap – is expected to increase significantly.

Thus, Japan implements further energy conservation measures, new energy-related measures and other new measures such as fuel switching, as well as continuing to implement the measures stated in the old Guideline to reduce carbon dioxide emissions from energy sources in fiscal 2010 to the fiscal 1990 level. Japan also continues to promote its nuclear policy with giving priority to safety. Through such additional measures, the emission reduction amount for fiscal 2010 will be approximately 22 million tons of CO₂ through emission control measures at the demand side (energy conservation measure), approximately 34 million tons of CO₂ through new energy measures, and approximately 18 million tons of CO₂ through fuel switching. Estimated emissions for fiscal 2010 per sector when these measures will be implemented will be 462 million tons of CO₂ (-7%) from the industrial sector, 260 million tons of CO₂ from the residential and commercial sector (-2%), and 250 million tons of CO₂ from the transportation sector (+17%). (Percentages in parentheses show the reduction ratios from fiscal 1990 emissions per sector.) The reduction amount through each additional measure and emission reduction per sector are defined as the target for achieving the commitment stipulated in the Kyoto Protocol in this Guideline. Emission reduction target amount per sector shall be set up as achievable standards when expected effects are made through measures implemented by the energy supply side, such as promotion of nuclear power with giving priority to safety is ensured, introduction of new energy, and fuel switching, and also through measures implemented by each sector on the energy demand side, while our economy grows at its potential growth ratio.

Global warming issues are closely related to energy issues, and accordingly, Japan is going to further strengthen various measures for both energy supply and demand sides to achieve the 6% reduction commitment stipulated in the Kyoto Protocol while striving for contribution to both the environment and economy, and construct an environment-conscious energy supply and demand structure. Utilization of the Kyoto mechanisms for businesses is an effective way of ensuring a reduction in carbon dioxide emissions from energy sources. In terms of reducing carbon dioxide emissions at the energy supply and demand side, values are estimated as the effects of the measures concerned resulting from the effects of all supply and demand side measures included in this Guideline, rather than achieving this emission reduction only by implementing the relevant measures. From this viewpoint, it is appropriate to evaluate measures with a certain degree of flexibility from an overall viewpoint for the energy supply and demand structure while adopting the reduction and implementation target amounts.

<Promotion of energy demand side measures to reduce Carbon Dioxide Emissions (energy conservation measure)>

Striving for maximum energy conservation with minimum detriment to the national economy is one of the most effective ways of preventing global warming. There are various parties who need energy, so effective handling to reduce carbon dioxide emissions cannot be achieved without their own action, such as generation of ideas by each energy consumer. Based on the above, Japan implements energy demand side measures focused on independent action carried out by the industrial sector, promotion of technological development and implementation of energy conservation type equipment and systems in the residential and commercial sector, as well as preparation of the environment required for them. Through such actions, new economic growth can be expected through the development of advanced energy-saving equipment and investment in energy-saving facilities, while maintaining the current economic welfare standards for the general public's lifestyle, and aiming for contribution to both the environment and economy is considered possible.

Especially in the residential/commercial and transportation (passenger vehicle) sectors whose energy consumption has significantly increased compared to fiscal 1990 despite the economic depression in the nineties, minimizing increase in carbon dioxide emissions from these sectors is an urgent task.

Energy demand for the residential and commercial sector has steadily increased even after the oil crisis. Within this sector, in the residential sub-sector, the reasons for the increase in demand are the increased amount of equipment retained and modification of use duration and conditions in accordance with the popularization of new equipment and the demands of citizens that requests an ever more comfortable lifestyle. In terms of the commercial sub-sector, the main reason of its increase is greater floor space in office buildings and commercial facilities in line with changes in the industrial structure. Thus, Japan shall strengthen measures by increasing equipment efficiency, carrying out thorough energy

management, and improving the energy-saving performance of housing and buildings in the residential and commercial sector.

In terms of the transportation sector, from fiscal 1990 to 1995, carbon dioxide emission increased significantly in line with energy consumption to 17% more than that in fiscal 1990. Since 1995, carbon dioxide emissions have been stable except emissions from passenger vehicles, which were 11% more in fiscal 1999 than those in fiscal 1995. Total carbon dioxide emissions from the transport sector in fiscal 1999 were 5.6% more than those in fiscal 1995. However, carbon dioxide emissions from the transportation sector are still higher than those in fiscal 1990, so the government shall continue to implement various measures, such as traffic measures, improving logistical efficiency and modal shift, and promoting increased use of public transport.

Through implementation of such demand side measures, in terms of the expected effect for fiscal 2010, about 50 million kiloliters reduction is expected through existing measures, with a further 7 million kiloliters reduction through additional measures in crude oil equivalent. In terms of the reduction in carbon dioxide emissions, about 22 million tons of CO₂ is expected to be cut through such additional measures.

(1) Steady implementation of voluntary action plans and follow-up

The Keidanren Voluntary Action Plan on the Environment developed by the Japan Federation of Economic Organizations (Keidanren) was established by industry as subjective measures for global warming issues, action has been taken on that basis, and significant results have been achieved so far. The voluntary action plan is one of the core components of this Guideline with the aim of achieving contribution to both the environment and economy whereby optimal methods can be selected through the subjective and wide ranging participation of individual entities and the use of their own ideas, while flexible and quick action is possible in response to any change in status. In particular, the expected amount of energy savings through such voluntary action plans and so on account for about a third of the energy conservation measures stated in this Guideline, and it is a core plan for future energy conservation measures as well. The further establishment of volunteer action plans and their steady implementation is expected in both the residential and commercial sector and the transportation sector, which expect to see a continued and significant increase in energy consumption in the future. Japan is also trying to enhance follow-up measures for them.

[Current measures]

The Keidanren Voluntary Action Plan on the Environment was established in June 1997, with the expressed intent of reducing carbon dioxide emissions for 2010 to no more than those of 1990. Voluntary action plans have also been established by various other industries as well as the Keidanren Voluntary Action Plan on the Environment. We are checking the progress of the action plans that have already been established by industry for energy conservation and reduction of carbon dioxide emissions, and ensure their effectiveness through the Relevant Advisory Councils. We also encourage industries that have not established such action plans to quickly do so with numeric targets.

[Additional measures]

Keidanren is currently studying how to implement a third-party authentication and registration system. The government will provide the required support and promote its smooth implementation to engender transparency and reliability of the voluntary action plan that has been established by Keidanren and so on.

Furthermore, we will follow up the progress of the energy conservation measures through voluntary action plans based on the mid- and long-term plans and periodical reports submitted annually to the government in accordance with the Law Concerning the Rational Use of Energy. In terms of the implementation of comprehensive checks per business type that began this fiscal year, we shall continuously try to increase the effectiveness of such voluntary measures while utilizing their advantages by carrying out priority checks with industries that have not established voluntary action plans and industries whose progress in terms of energy conservation measures lags behind the targets set in the voluntary action plan in the event that such action plans are established.

At the same time, we shall provide priority support for measures in accordance with the voluntary action plans and so on per company and industry for assistance systems to implement corporate energy conservation facilities.

(2) Comprehensive energy management

Appropriate management is important to promote energy conservation wherever energy is consumed. Thus, we strive for on-site energy management by promoting appropriate energy management at private residences and office buildings through the utilization of IT, as well as establishing a system for energy management at factories and business sites by focusing on measures based on the Law Concerning the Rational Use of Energy.

[Current measures]

① Measures for factories and business sites based on the Law Concerning the Rational Use of Energy

In terms of energy conservation for factories and business sites, we are implementing measures to establish energy management systems assuming implementation of voluntary measures by companies, such as the establishment of energy manager systems / energy management staff systems and energy conservation plans in factories and business sites that consume large amounts of energy, in line with the Law Concerning the Rational Use of Energy.

[Additional measures]

① Implementation of comprehensive factory checkups

Since fiscal 2001, we have been implementing a new comprehensive checkup scheme concerning the compliance status using standards based on the Law Concerning the Rational Use of Energy for factories that consume large amounts of energy. As a result, we have actuated measures based on the Law Concerning the Rational Use of Energy such as instructing the creation of a rationalization plan for factories that have not implemented sufficient measures for rationalization of energy use, with the threat of publication if they do not adhere to such instructions.

In terms of comprehensive checkups, we will try to increase the effectiveness of the voluntary action plan by following up on the progress status of the energy conservation measures stated in the voluntary action plan based on the mid- and long-term plans and periodical reports submitted annually to the government in accordance with the Law Concerning the Rational Use of Energy, and intensify our comprehensive factory checkups for any businesses whose progress in terms of energy conservation measures significantly lags behind the targets stated in the voluntary action plan, or for businesses that have not established such voluntary action plans.

② Promotion of energy demand side management for commercial sector

In order to strengthen energy demand side management measures at large business sites with large energy consumption, we propose a revision of the Law Concerning the Rational Use of Energy, and are trying to establish a system that conforms to those energy management measures that have already been implemented for large-scale factories while bearing in mind actual commercial demand.

We also promote energy management by establishing support measures such as assistance systems for Building Energy Management System (BEMS) to enable smooth and appropriate energy management at commercial buildings through the utilization of the latest IT.

Furthermore, we are trying to create an environment that promotes the active use of Energy Service Company (ESCO) businesses that comprehensively promotes energy conservation for businesses as an agent for parties who established the facility.

③ Development and distribution of the Home Energy Management System (HEMS)

In order to manage energy at home smoothly and appropriately, we are trying to develop and popularize the Home Energy Management System (HEMS) that can increase public awareness of the cost of energy and provide optimal control of the major domestic appliances by displaying energy usage in cost terms and displaying the data visually in real-time through the utilization of IT.

(3) Further improving appliance efficiency

Measures to improve appliance efficiency are reliable ways to promote energy conservation with minimal adverse effects for countless consumers.

Based on the above, we are utilizing a labeling system and so on for vehicles, household electrical products and office appliances, etc., for which an energy conservation standard has been specified based on the Top Runner Approach as introduced in the Revised Law Concerning the Rational Use of Energy in 1998. Also, we continue to extend the range of targets for energy conservation standards based on the Top Runner Approach concept as well as trying to promote the introduction of products that have achieved the relevant standard on the market.

Furthermore, we support the smooth introduction of efficient water supply systems to the water supply field where improvements in terms of energy efficiency have not progressed sufficiently.

In terms of transportation equipment, improvement of energy efficiency of railways, ships, and aircraft, as well as motor vehicles should be pursued.

[Current measures]

① Introduction of Top Runner Approach in line with the Law Concerning the Rational Use of Energy

We have just adopted the 'Top Runner Approach' concept with the aim of raising the standards for maximum energy conservation performance or higher concerning fuel efficiency standards of motor vehicles and energy conservation standards for household electrical products and office appliances, etc., from among applicable commercial products through revision of the Law Concerning the Rational Use of Energy in 1998. The smooth introduction of products to the market that have achieved the relevant standards by accelerating the development and dissemination of such products, including the government's procurement of low-emission vehicles as official cars.

② Promoting the use of hybrid and natural gas vehicles

The government should promote the smooth introduction of hybrid vehicles and natural gas trucks and buses, which have high energy conservation performance, in to the market with supportive measures including subsidies and tax concessions, bearing in mind their cost differences.

③ Improving the energy efficiency of railways, ships, and aircraft

The introduction of trains, ships and aircraft with better energy efficiency characteristics.

[Additional measures]

① Expansion of appliances targeted for Top Runner standard application

Gas and oil consuming appliances, vending machines, and transformers that have not been targeted under regulations in the Law Concerning the Rational Use of Energy are to be targeted for energy conservation standards based on the concept of the Top Runner Approach.

② Accelerated introduction of vehicles that meet Top Runner standards

Based on the Top Runner Approach concept stipulated under the Law Concerning the Rational Use of Energy, the Top Runner standards on vehicles should be achieved precedently through industry's voluntary measures by reducing Automobile Acquisition Tax and the green automobile taxation for vehicles whose fuel efficiency standards are provided to be achieved by fiscal 2010.

③ Development and distribution of revolutionary domestic vessels (Super Eco-Ships)

The development and distribution of Super Eco-Ships should be promoted that are expected to reduce the impact on the environment through increased transport efficiency with the high efficiency propulsion system and improved ship shape.

④ Promoting the spread of high efficacy water heater

In order to promote energy conservation in the water supply field, where the energy demand ratio is large, within the residential and commercial sector, we are establishing support measures such as assistance systems for equipment with superior energy conservation performance compared to the

existing system, i.e., carbon dioxide refrigerant heat pump water heater, and high efficiency water heater with latent heat exchanger.

⑤ Reduction of standby power consumption

We are trying to reduce the amount of electricity consumed while domestic electrical appliances and suchlike are on standby, which wastes electricity as they are not actually being used. In order to do so, we have created an environment in which the industries concerned can strive for reductions with major domestic electrical appliances through voluntary measures to achieve a target of 1W or less for equipment requiring energy consumption when on standby, such as for timer functions, or to reduce it as close to zero as possible in all other cases.

⑥ Promotion of the number of vehicular models of hybrid vehicles

Supportive measures should be conducted such as subsidies to introduce and popularize low emission vehicles such as hybrid vehicles.

⑦ Promoting the introduction of high performance industrial furnaces

As a result of field tests that were carried out after completion of technological development, considerable energy saving results were seen. We implement support measures such as assistance systems to introduce energy saving facilities to companies to promote the introduction of high performance industrial furnaces from which greater energy saving is expected.

(4) Increased energy conservation performance in housing and buildings

The energy conservation performance of housing and building has long had a large effect on energy consumption within the residential and commercial sector, so the implementation of reliable measures is required.

Thus, we publicize judgment criteria for construction parties in line with the Law Concerning the Rational Use of Energy, and implement reliable energy conservation measures through assistance, construction instruction, and providing information to consumers.

We also try to take the lead in implementing energy conservation measures in public housing and buildings.

[Current measures]

① Promoting the spread of housing and buildings with superior energy conservation performance

We are trying to promote the spread of housing and buildings with superior energy conservation performance by providing incentives such as through the Housing Loan Corporation, instruction in line with the Law Concerning the Rational Use of Energy, adoption of energy conservation-related performance display system, development of engineers, and the promotion of voluntary measures carried out by the industries concerned.

② Measures for public housing and buildings

We implement energy conservation measures for public housing and promote the establishment of environment-friendly government building facilities (Green Government Buildings).

[Additional measures]

① Strengthening incentives for housing

We try to provide incentives for environment-friendly housing by strengthening standards concerning energy conservation performance for the Housing Loan Corporation.

② Strengthening energy conservation measures for buildings

We propose a revision to the Law Concerning the Rational Use of Energy, and obligate the notification of energy conservation measures at the time of construction or expansion of office

buildings and commercial facilities. We also try to promote green assessment and renovation of existing government building facilities.

(5) Vehicle traffic measure

Regarding measures on the road transportation, which are the mainstay in the transportation sector, it is important to give further environmental consideration on business vehicles, as well as developing and distributing low emission vehicles and highly fuel-efficient vehicles including clean energy vehicles aiming at improved efficiency as mentioned above.

Furthermore, measures to control traffic flow and manage traffic demand should be continued.

In order to facilitate smooth traffic flow, the trunk route network should be extended by developing circular roads and preparing crossings and flyovers.

[Current measures]

Measures should be implemented to promote alternatives to transportation by utilizing information communications techniques such as tele-working while existing measures such as management of vehicular traffic demand, promotion of the Intelligent Transport Systems (ITS), implementation of measures to prevent illegal parking, reduction of engineering work on roads, and the establishment of traffic safety facilities are to be implemented.

[Additional measures]

Great emphasis should be put on business vehicles' driving style with regard to the environment by promoting eco-driving through distribution of idling prevention systems on buses and trucks, and controlling the maximum speed of large trucks by obliging the installation of speed limiting device.

Measures for environment-friendly traffic management should be conducted such as utilization of results of Traffic Demand Management (TDM) proof tests, and developing a comprehensive urban traffic management project that controls traffic signals and provides information based on environmental data. In addition, further studies on traffic regulations and around crossings.

(6) Construction of a traffic system with minimal environmental impact

In the transportation sector, it is necessary to implement measures to ensure a transportation system with little carbon dioxide emissions and low environmental impact for passenger and freight transportation, in addition to measures on road transportation.

To this end, it is important to implement deliberate and steady measures to shift transportation modes towards alternative ones with better energy consumption and improved efficiency of freight transportation.

A shift from private passenger vehicles to public transportation or passenger transportation should be continued through development of public transportation and improvements in their services and convenience.

[Current measures]

Measures to promote domestic sea freight transportation by ship and rail and to improve efficiency of freight transportation should be conducted to curb emissions of carbon dioxide.

Promotion of the use of public transportation should be carried out by constructing new railways and modified personal rapid transit system in urban areas, and improving existing services and convenience.

[Additional measures]

Transportation modes should be shifted towards marine transport and the competitiveness of domestic sea transport should be strengthened by introducing new technologies, such as the development of Super Eco-Ships that increased energy consumption efficiency, reviewing regulations, and developing a marine highway network. At the same time, a modal shift to rail transport should be promoted by

improving the convenience of railways such as by increasing their capacity. Furthermore, measures to further improve logistical efficiency should be strengthened by reviewing regulations, improving convenience, and developing transportation structure such as a multipurpose international. Measures to promote the use of public transportation services should be strengthened as well.

(7) Development and diffusion of new energy-saving technologies

It is important to continuously promote the development and distribution of new energy-saving technologies, as significant improvements in energy efficiency are highly likely through such breakthroughs. Thus, we promote the introduction of highly efficient boilers and lasers whose effects are expected by 2010, and highly efficient lighting using light emitting diodes at this stage. In the transportation sector, the development and distribution of next generation low-emission vehicles including clean energy vehicles as well as next-generation energy-saving transportation.

Table 3.1 Demand Side Measures for the Industrial Sector

Current measures and their reduction amounts	Additional measures and their reduction amounts	Measures of the government and so on; (Current○, Additional◎)
<p>○Steady implementation and follow-up of the voluntary action plan (Target of the Keidanren Voluntary Action Plan on the Environment is to reduce CO₂ emissions for 2010 to no more than 1990 levels.)</p> <p>○Factory measures based on the Law Concerning the Rational Use of Energy <Target amount> Energy conservation effects: Approx. 20.1 million kl Approx. 60.5 million t-CO₂</p>	<p>○Promoting the introduction of high performance industrial furnaces <Target amount> Energy conservation effects: Approx. 400,000 kl Approx. 1.1 million t-CO₂</p> <p>○Technological development and diffusion of its results • Highly efficient boilers • Highly efficient lasers <Target amount> Energy conservation effects: Approx. 500,000 kl Approx. 1.5 million t-CO₂</p>	<p>○Since fiscal 2001, a new comprehensive check scheme has been implemented to assess standard compliance based on the Law Concerning the Rational Use of Energy. Legal action will be initiated based on the Law Concerning the Rational Use of Energy as required. The government also follows up the progress of the energy conservation measures through the voluntary action plan based on reports submitted to the government in accordance with the Law Concerning the Rational Use of Energy, and implements priority checks based on the same law for industries that have not established voluntary action plans or whose progress towards such energy conservation measures lags far behind the target.</p> <p>◎Extensive support is provided for such measures in line with the voluntary action plans and so on of companies and industries with regard to assistance systems for companies to introduce energy saving facilities.</p> <p>◎Until fiscal 2001, support has been provided for the technological development of highly efficient lasers and so on.</p>

- Additional measures refer to extra measures established as of this Guideline review, or measures whose details have been completely reviewed and strengthened, while current measures cover all other existing measures.
- Reduction amount indicates approximate estimated amount contributing to CO₂ emissions as of 2010 when the relevant measures are implemented.
- The unit of Energy conservation effects, "kl" means kiloliter of crude oil equivalent.
- The same definitions apply for descriptions in all tables below.

Table 3.2 Demand Side Measures for the Residential and Commercial Sector

Current measures and their reduction amount	Additional measures and their reduction amount	Measures of the government and so on; (Current○, Additional◎)
●Measures to improve efficiency of equipment		
○Strengthening to improve efficiency of equipment		○Through revision of the Law Concerning the Rational Use of Energy

<p><Target amount> Energy conservation effects: Approx. 5.4 million kl (Assumed to achieve standard value of all targeted manufacturers as of the target year per equipment)</p> <ul style="list-style-type: none"> ■ Air conditioners <ul style="list-style-type: none"> ▪ Target year 2007 refrigeration year (partially 2004 refrigeration year) ▪ Energy conservation effects*: Approx. 63% (for both coolers and heaters) ▪ Energy conservation effects*: Approx. 14% (only coolers) ■ TVs <ul style="list-style-type: none"> ▪ Target year: Fiscal 2003 ▪ Energy conservation effects: Approx. 16% ■ VTRs <ul style="list-style-type: none"> ▪ Target year: Fiscal 2003 ▪ Energy conservation effect*s: Approx. 59% ■ Fluorescent lights <ul style="list-style-type: none"> ▪ Target year: Fiscal 2005 ▪ Energy conservation effects*: Approx. 17% ■ Copiers <ul style="list-style-type: none"> ▪ Target year: Fiscal 2006 ▪ Energy conservation effects*: Approx. 30% ■ Computers <ul style="list-style-type: none"> ▪ Target year: Fiscal 2005 ▪ Energy conservation effects*: Approx. 83% ■ Hard disc drive <ul style="list-style-type: none"> ▪ Target year: Fiscal 2005 ▪ Energy conservation effects*: Approx. 78% ■ Refrigerators/freezers <ul style="list-style-type: none"> ▪ Target year: Fiscal 2004 ▪ Energy conservation effects*: Approx. 30% <p>(* About 20% more energy conservation effects overall are anticipated by adopting the top-runner approach compared to the original estimates set up under the old Guideline) Approx. 30.4 million t-CO₂</p>	<p>○Expansion of equipment to which Top Runner Approach applies <Target amount> Energy conservation effects: Approx. 1.2 million kl Approx. 2.9 million t-CO₂</p> <p>○Promotion of distribution of high efficiency water heater <Target amount> Energy conservation effects: Approx. 500,000 kl (Expected to distribute about 4 million units by fiscal 2010) Approx. 1.1 million t-CO₂</p> <p>○Reduction of standby power consumption <Target amount> Energy conservation effects: Approx. 400,000 kl Approx. 1.1 million t-CO₂</p> <p>○Technological development and result distribution <ul style="list-style-type: none"> ▪ High efficiency lighting <Target amount></p>	<p>in 1998, the Top Runner Approach has been adopted for domestic electric appliances and OA equipment (i.e. air conditioners, TVs, VTRs, fluorescent lights, copiers, computers, hard disc drive, refrigerators, freezers).</p> <p>◎Gas/oil equipment, and commercial equipment, etc. that were not previously targeted are added based on the Top Runner Approach.</p> <p>◎Assistance system to promote its spread has been established.</p> <p>◎A system enabling consumers to identify products with minimal electricity consumption during standby will be established in the near future.</p> <p>◎Support is provided for technological development of highly efficient lighting, etc.</p>
--	---	--

	Energy conservation effects: Approx. 500,000 kl Approx. 1.8 million t-CO ₂	
●Increasing energy conservation efficiency for housing and buildings		
<p>○Increasing energy conservation efficiency for housing and buildings <Target amount> Energy conservation effects: Approx. 8.6 million kl</p> <p>■New housing ▪ Target year: Fiscal 2008 : 50% achieve current standards</p> <p>■New buildings (non- residence, 2,000m² or more) ▪ Target year: Fiscal 2006 : 80% achieve current standards Approx. 35.6 million t-CO₂</p>		<p>[Increasing energy conservation efficiency for housing]</p> <p>○Under the Law Concerning the Rational Use of Energy, responsibility for such efforts lies with the parties requesting construction. “Design and Construction Guidelines on the Rationalization of Energy Use for Houses” have been drawn up and published as detailed specifications and standards to assist parties requesting construction to make decisions (revised and strengthened in March 1999).</p> <p>◎Strengthening standards for energy saving housing by providing incentives through financing by the Housing Loan Corporation</p> <p>○Implementing energy conservation measures in public housing and assistance for housing in towns that comply with energy conservation standards</p> <p>○Promoting the distribution of systems showing clear housing efficiencies including energy conservation efficiency (Housing Performance Indication System)</p> <p>[Increasing energy conservation efficiency for buildings (non-residential)]</p> <p>○Responsibility for efforts on parties requesting construction based on the Law Concerning the Rational Use of Energy. Decision standards for parties requesting construction are drawn up and published. (Revised and strengthened in March 1999)</p> <p>◎Responsibility for notifying energy conservation measures when building special new buildings and their refurbishment or addition (Revision of the Law Concerning the Rational Use of Energy)</p> <p>○Providing incentives through financing and tax system of the Development Bank of Japan</p> <p>○Promoting the establishment of environment-friendly government</p>

		<p>building facilities (Green Government Buildings)</p> <p>◎Endeavors to promote green assessment and renovation of existing government building facilities</p> <p>[Improving energy conservation efficiency for both housing and buildings]</p> <p>○Development of engineers to handle design and construction through training courses</p> <p>○Promotion of voluntary measures for the relevant industries involved in housing and buildings</p>
--	--	--

●Strengthening energy demand side management

	<p>○Promoting distribution of the Home Energy Management System (HEMS) <Target amount> Energy conservation effects: Approx. 900,000kl (Expected distribution to about 30% of total households by fiscal 2010) Approx. 2.9 million t-CO₂</p> <p>○Promotion of energy demand side management for commercial sector <Target amount> [BEMS] Energy conservation effects: Approx. 1.6 million kl (Expected distribution to about 30% of total commercial floor space by fiscal 2010) Approx. 7.7 million t-CO₂</p>	<p>◎Implementation of support for field tests</p> <p>◎Energy management system that applies to large-scale factories is adopted for large-scale office buildings through revision of the Law Concerning the Rational Use of Energy.</p> <p>◎Assistance system for promoting distribution of the Building Energy Management System (BEMS) is established.</p> <p>◎Support measures such as assistance systems and low interest loan systems will be established for further utilization of Energy Service Company (ESCO).</p>
--	---	--

Table3.3 Demand-side Measures in the Transportation Sector

Current measures and their reduction amount	Additional measures and their reduction amount	Measures of the government and so on; (Current○, Additional◎)
■Measures on road transportation		
●Development/ dissemination of low emission vehicles including clean energy vehicles and highly fuel efficient vehicles, and environmental considerations of the driving style of business vehicles		
▪ Development and distribution of low emission vehicles including clean energy vehicles and highly fuel efficient vehicles		
○Strengthening measures to improve motor vehicle fuel efficiency (Estimated emission reduction)	○Rapid introduction of vehicles that meet Top Runner Approach, the green automobile taxation and automobile acquisition tax reduction, and accelerating the	○Following revision of the Law Concerning the Rational Use of Energy in 1998, the Top Runner Approach has been applied to motor vehicles. ◎Introduction of green automobile

<p>Approx. 13.9 million t-CO₂ <Target amount> Energy conservation effects: Approx. 5.4 million kl (Expect to achieve standard values for all targeted manufacturers by the target year per gasoline vehicle and diesel vehicle))</p> <ul style="list-style-type: none"> ■ Passenger vehicle (gasoline) <ul style="list-style-type: none"> ▪ Target year: Fiscal 2010 ▪ Energy conservation effects*: Approx. 23% ■ Passenger vehicle (diesel) <ul style="list-style-type: none"> ▪ Target year: Fiscal 2005 ▪ Energy conservation effects*: Approx. 15% ■ Freight vehicle (gasoline) <ul style="list-style-type: none"> ▪ Target year: Fiscal 2010 ▪ Energy conservation effects*: Approx. 13% ■ Freight vehicle (diesel) <ul style="list-style-type: none"> ▪ Target year: Fiscal 2005 ▪ Energy conservation effects*: Approx. 7% <p>(* Overall energy conservation of about 20% is anticipated by adopting the Top Runner Approach compared to the original estimates set up in the old Guideline)</p> <p>○ Promoting dissemination of clean energy vehicles (Estimated emission reduction) Approx. 2.2 million t-CO₂ <Target amount> Energy conservation effects: Approx. 800,000 kl</p>	<p>development and distribution of low emission vehicles through the procurement of low emission official vehicles by the government. (Estimated emission reduction) Approx. 2.6 million t-CO₂ <Target amount> Energy conservation effects: Approx. 1.0 million kl</p> <p>(Note) In the case that the Guideline is, the measures shall be revised so that the latest progress, such as the green automobile taxation established in April 2001 and reducing automobile acquisition tax, and the procurement of low emission official vehicles by the government is well reflected.</p>	<p>taxation</p> <ul style="list-style-type: none"> ◎ Extension of reduction of automobile acquisition tax ◎ Establishment of fuel measuring methods to consider fuel efficiency standards of freight vehicles 2.5t or more of GVW ◎ Promotion of measures to replace general low emission official vehicles within about three years following fiscal 2002 ◎ Promotion of technological development and practical proof testing for the earliest possible use of fuel-cell vehicles ◎ Promoting development of next generation low emission vehicles (including clean energy vehicles) ◎ Development of an IT network to promote widespread the distribution of low emission vehicles, including clean energy vehicles ◎ Provision of assistance for low emission vehicles, including clean energy vehicles ○ Support for practical use of electric vehicle joint-use system ◎ Promotion of assistance to establish an enhanced fuel supply infrastructure (eco stations) ◎ Measures on motor vehicle fuel quality to ensure sufficient functioning of the emission post-processing system (Reduction of sulfur content from 500 ppm to 50 ppm by the end of 2004 for diesel fuel. Further improvements such as reducing sulfur from gasoline should be pursued.)
<ul style="list-style-type: none"> ▪ Environmental consideration of the driving style of business vehicles 		

	<p>○Review and promotion of existing measures to promote eco drive of buses and trucks, etc.</p> <p>○Promotion of measures to reduce impact on the environment through consideration of driving style of business vehicles, etc.</p> <ul style="list-style-type: none"> ▪ Distribution of vehicles featuring idling prevention systems (Estimated emission reduction) Approx. 1.1 million t-CO₂ <Target amount> Energy conservation effects: Approx. 400,000 kl (Expected installation on about 30% of replaced buses and trucks) ▪ Installation of speed limiting device on large trucks (Estimated emission reduction) Approx. 800,000 t-CO₂ <Target amount> Energy conservation effects: Approx. 300,000 kl 	<p>◎Promotion of green management by motor vehicle transportation companies from fiscal 2002</p> <p>◎Mandatory installation of speed limiting device on large trucks (Production vehicles: September 2003 onward; Vehicles in use: Step by step from September 2003 onward)</p>
<p>●Measures on the traffic flow</p>		
<p>○Car traffic demand management (Estimated emission reduction) Approx. 700,000 t-CO₂ <Target amount> Energy conservation effects: Approx. 200,000 kl</p> <p>○Promotion of Intelligent Transport Systems (ITS) (Estimated emission reduction) Approx. 3.7 million t-CO₂ <Target amount> Energy conservation effects: Approx. 1.4 million kl</p>	<p>○Review and steady promotion of existing measures</p>	<p>○Promotion of Traffic Demand Management (TDM)</p> <p>◎Utilization of Traffic Demand Management (TDM) proof tests established in fiscal 2001 to establish comprehensive plans for smooth urban transportation</p> <p>○Promoting the preparation of a bicycle-friendly environment by improving cycle routes and parking areas.</p> <p>○Implementation of social tests to contribute to promoting the use of bicycles</p> <p>○Preparing the Electric Toll Collection (ETC) System, and improving services by increasing the number of toll gates to 900 nationwide by the end of fiscal 2002.</p> <p>○Improving traffic information collection services through preparation of infrared beacons, etc.</p> <p>○Promotion of VICS (Vehicle Information and Communications System) (Service to be launched nationwide within fiscal 2002)</p> <p>○Improving the central processing system and traffic control center system by introducing a new signal controlling system(MODERATO)</p> <p>○Promotion of the Environment</p>

<p>○Measures to prevent illegal parking and stopping on roads</p>	<p>○Promotion of road traffic information provision business</p>	<p>Protection Management Systems (EPMS), and suchlike</p> <ul style="list-style-type: none"> ○Preparation of the Mobile Operation Control System (MOCS) for business vehicles ◎Promotion of environment-friendly traffic management project ◎Development and standardization of Internet ITS and probe information system ○Development of a safety support system and comfortable driving by providing information and warnings to drivers ○Positively promoting the introduction and distribution of ETC-enabled vehicles and triple-media VICS-enabled vehicles based on the Green Purchasing Law by the government, etc. ○Centralized signal control <Preparation of about 40,000 signals is expected between 1995 and 2010> ◎Promoting the provision of accurate and appropriate road traffic information by road traffic data providers through revision of the Road traffic law in 2001 ◎Appropriate operation of the traffic information verification system ◎Promoting the preparation of a database on traffic regulation information ○Implementation of appropriate car parking regulations ○Establishment of a system to minimize illegal car parking and a car parking indication system, etc. ○Promoting patrols to counter illegal car park
---	--	---

<p>○Reduction in amount of engineering work on roads (Estimated emission reduction) Approx. 400,000 t-CO₂ <Target amount> Energy conservation effects: Approx. 100,000 kl</p> <p>○Preparation of traffic safety facilities (Estimated emission reduction) Approx. 700,000 t-CO₂ <Target amount> Energy conservation effects: Approx. 200,000 kl</p> <p>○Promotion of commuting alternatives using data communications such as teleworking (Estimated emission reduction) Approx. 3.4 million t-CO₂ <Target amount> Energy conservation effects: Approx. 1.3 million kl (assuming that the number of tele-workers in 2010 represent about a quarter of all workers (16.3 million people))</p>		<p>○Improvement of public drains, promotion of intensive engineering work and joint implementation, appropriate operation of road use permission</p> <p>○Establishment, systemization, and improvement in signal induction <Increasing efficiency of about 20,000 signals is expected between 1995 and 2010></p> <p>○Increasing efficiency of traffic control</p> <p>○Promoting measures to counter bottlenecks by preparing traffic indications and rail crossing signals</p> <p>○Promoting the change of signal lights to LEDs</p> <p>○Improving data communication environment in companies, tax-related measures and financial support to contribute to introducing teleworking and support for SOHO.</p> <p>◎Providing information and diffusion promotion to promote teleworking and SOHO.</p>
<p>■ Establishment of a transportation system with minimum impact on the environment</p>		
<p>● Modal shift and improving freight efficiency</p>		
<p>○Promotion of domestic sea freight and rail freight (Estimated emission reduction) Approx. 1.5 million t-CO₂ <Target amount> Energy conservation effects: Approx. 500,000 kl</p>	<p>○Review and steady promotion of current measures.</p> <p>○Studying institutional arrangements to promote a distribution system with reduced impacts on the environment</p>	<p>◎Studying institutional arrangements including legislation to support improved efficiency of trunk line distribution</p> <p>◎Promotion of Traffic Demand Management (TDM) proof tests contributing to improved efficiency of urban freight services</p> <p>◎Conducting proof tests to reduce environmental impact of trunk line from fiscal 2002</p>

○Promotion of modal shift to shipping by reviewing regulations, strengthening competitiveness through introduction of new technologies, and improving transport efficiency

(Estimated emission reduction)

Approx. 2.6 million t-CO₂

<Target amount>

Energy conservation effects:

Approx. 1.0 million kl

(assuming an increase in the share of domestic shipping to 44%)

○Increased rail convenience by strengthening transport capacity

(Estimated emission reduction)

Approx. 300,000 t-CO₂

<Target amount>

Energy conservation effects:

Approx. 100,000 kl

(assuming an increase in rail container traffic of 3.6%)

◎Submission of proposal to the ordinary session of the Diet in 2002 to revise the law on freight transportation business to relax regulations on participation and pricing

◎Increasing the share of domestic shipping to 44% or more by strengthening its competitiveness by:

- Developing a plan for next-generation domestic shipping by the end of fiscal 2001

- Reviewing regulations, such as relaxing regulations on participation

- Reviewing social regulations such as those on crew rotation

- Completing proof testing of Super Eco-Ships by fiscal 2005, aiming at practical use from fiscal 2006

◎Development of a marine highway network by establishing domestic trade terminals required for consistent integrated transport, non-stop coastal shipping service to reduce coastal shipping operations

- Completion of the Tokyo Bay passage preparation project by 2007

- Strengthening shipping control and support functions based on the Vessel Traffic Advisory Service Center utilizing Automatic Identification System (AIS) in the Tokyo Bay by fiscal 2006

○Increasing rail freight transportation capacity

◎Submitting a proposal to the ordinary session of the Diet in 2002 to revise the Law for Railway Business Enterprise to relax fare and participation regulations

◎Preparation of a cold chain system of foods by rail

<p>○Improving efficiency of freight services (Estimated emission reduction) Approx. 4.7 million t-CO₂ <Target amount> Energy conservation effects: Approx. 1.8 million kl</p>	<p>○Reviewing current measures and effects and promoting measures as follows. ▪ Improving efficiency of transportation by truck (Estimated emission reduction) Approx. 2.9 million t-CO₂ <Target amount> Energy conservation effects: Approx. 1.1 million kl (assuming an increase in the ownership of trailers by about 15,000, and the ownership of 25-ton category vehicles by about 70,000 from fiscal 1996 and 2010) ▪ Reduction in overland transportation of international freight (Estimated emission reduction) Approx. 1.8 million t-CO₂ <Target amount> Energy conservation effects: Approx. 700,000 kl (assuming a reduction in overland transportation by about 9,300 million ton-km)</p>	<p>◎Submitting proposal to the ordinary session of the Diet in 2002 to revise the law for freight vehicle transportation business to activate freight services through deregulation ○Promoting the use of large vehicles and trailers ○Strengthening bridges in line with the increase in the vehicle size ○Development of international marine container terminals in main and core international harbors ◎Development of multipurpose international terminals ◎Preparation of joint delivery facilities of fresh foods, etc. ○Establishing, upgrading, and central control of signals</p>
<p>●Promoting use of public transportation</p>		
<p>○Promoting use of public transportation (Estimated emission reduction amount) Approx. 5.2 million t-CO₂ <Target amount> Energy conservation effects: Approx. 2 million kl (assuming a reduction in passenger vehicle about 80 million vehicles-km)</p>	<p>○Review and steady promotion of current measures ○Steady promotion of new railways and modified personal rapid transit system preparation in urban areas ○Promoting the use of public transport by further improving services and convenience</p>	<p>○Promoting the establishment of new railways in urban areas (new services of about 310km are planned to start between 1995 and 2010) ○Promoting the preparation of the modified personal rapid transit system such as new traffic system in urban area (new services of about 100km planned to start between 1995 and 2010) ○Construction of Authorized Shinkansen lines ○Promoting the use of public transport by improving services and convenience such as introduction of IC cards and improvements in connections ◎Utilization of Traffic Demand Management (TDM) proof text established in fiscal 2001 to develop comprehensive plans for smooth urban transportation ◎Promoting the use of public transportation through national campaigns ○Development of traffic junctions such as squares in front of stations ○Implementation of social experiments that contribute to the</p>

		<p>promotion of public transportation</p> <p>○Promoting the preparation of Public Transportation Priority Systems (PTPS) by establishing dedicated/priority bus lanes, and priority bus signal controls</p>
<p>●Increasing energy consumption efficiency for other transport</p> <p>* Except effects through “improvements in shipping energy consumption efficiency”</p>		
<p>○Increasing energy consumption efficiency of railway transportation (Estimated emission reduction) Approx. 400,000 t-CO₂</p> <p><Target amount> Energy conservation effects: Approx. 100,000 kl (assuming improved energy consumption of around 7%)</p> <p>○Increasing aeronautical energy consumption efficiency (Estimated emission reduction) Approx. 1.1 million t-CO₂</p> <p><Target amount> Energy conservation effects: Approx. 400,000 kl (assuming improved energy consumption of around 7%)</p>	<p>○Promoting the development of new technologies</p>	<p>○Promoting the introduction of new rail carriages and aircraft materials</p> <ul style="list-style-type: none"> ▪ Measures carried out by companies to introduce energy-saving carriages and aircraft materials ▪ Updating carriages and aircraft materials through supportive measures to introduce new carriages and aircraft materials <p>◎Supporting the development of new technologies such as Super Eco-Ships</p> <p>◎Research and development of new-generation energy-saving transportation</p>

〈Promotion of energy supply side Carbon Dioxide Emission reduction〉

Our energy supply has been diversified by increasing the ratio derived from nuclear power and natural gas under the oil alternative energy policy following the experience of the last two oil crises. On the other hand, dependence on cheap coal fuel has increased following recent deregulation in the energy sector and the request for further efficiency increases, and it cannot be denied that this has been one of the causes behind the increased carbon dioxide emissions.

Under the circumstances in which carbon dioxide emissions from energy sources account for about 90% of total emissions, promoting the further introduction of non-fossil energy such as nuclear power and new energies will be required to ensure a steady supply and harmony with global warming countermeasures. We continue to promote a shift in fuels between fossil energies that represent the core of our energy supply, and will strive to establish an energy supply structure in harmony with the environment while still satisfying demand for improved efficiency.

(1) New energy measures

The adoption of new energy sources is one way to maintain steady supplies, and also enables rationalization of fossil energy use while reducing the environmental impact and minimizing additional carbon dioxide emissions from energy generating process. As a result, it contributes to ways to prevent global warming by reducing carbon dioxide emissions, so it needs to be introduced positively.

Currently, the ratio of new energy on the supply side out of the total primary energy supply is less than 2%. If we consider the possibility of future technological progress and expectations of an improved economical efficiency, we must adopt new energy enthusiastically to play a major role as energy sources in Japan for the long term. New energy sources will also contribute significantly to creating labor opportunities and stimulating the economy through creation of new markets and development of new technologies.

We will actively promote the following policies concerning new energy measures.

- 1) Support at the introduction stage
- 2) Support at the stages of technological development and demonstration
- 3) Preparation of environment and awareness campaign, etc.
- 4) Introduction of measures to expand new markets for the electricity sector (proposing the establishment of the Bill Concerning the Use of New Energy by Electric Utilities)

As the usage formats for new energy are dispersed-types, measures must be implemented while considering important actions carried out by local authorities and businesses such as introducing wind power generation, waste power generation, and biomass energy, etc. while actions in terms of housing carried out by individuals are important in such as introducing photovoltaic power generation and solar thermal utilization.

As waste power generation effectively uses surplus energy from the waste that must be burned, it shall be promoted while keeping consistency with the philosophy of the "The Basic Law for Establishing a Recycling-Based Society" and the "National targets in waste management policy" stated in the "Waste Management and Public Cleansing Law".

By actively implementing these measures, we shall try to produce 19.1 million kl worth of new energy by fiscal 2010 as a new energy on the supply side measure. Through this, we expect a reduction of approximately 34 million tons of CO₂ through additional measures. In terms of new energy on the demand side measures, by fiscal 2010, the introduction of new energy with 3.48 million clean-energy vehicles, 4.64 million kW natural gas co-generation systems, and 2.2 million kW fuel cells* is expected.

*) These energy conservation effects are handled on the energy demand side.

(Current measures)

- ① Support at the introduction stage
 - Promotion of introduction support for local authorities and businesses, etc.
 - Promotion of introduction support for photovoltaic power generation, etc.
 - Support with regard to taxation or financing

- ② Support at the stages of technological development and demonstration
 - Promotion of technological developments and demonstration tests for fuel cells and photovoltaic power generation
- ③ Preparation of environment and awareness campaign, etc.
 - Preparation of regulations and systems
 - Promotion of awareness campaign, etc.

(Additional measures)

- ① Support at the introduction stage
 - Placement biomass energy and snow ice cryogenic energy in the Law Concerning Promotion of the Use of New Energy
 - Promotion of introduction support for local authorities and companies, etc.
 - Promotion of introduction support for photovoltaic power generation, and solar thermal utilization, etc.
 - Promotion of green purchases and procurement
- ② Support at the stages of technological development and demonstration
 - Strengthening the support for technological developments and demonstration tests, etc. concerning fuel cells, photovoltaic power generation, and biomass energy, etc.
- ③ Preparation of environment and awareness campaign, etc.
 - Studying grid-connection system measures
 - Strengthening awareness campaign, etc.
- ④ Measure to expand new markets in the electricity sector
 - Proposal to establish the Bill Concerning the Use of New Energy by Electric Utilities

Table 3.4 New Energy Measures

Current measures and their reduction amount	Additional measures and their reduction amount	Measures of the government and so on; (Current○, Additional◎)
<p>○Current new energy measures New energy measure completed in 1998 aimed at introducing 19.1 million kl worth of new energy by fiscal 2010</p> <p><estimated introduction amount in fiscal 2010: 8.78 million kl></p>		<p>【Support at introduction stage】</p> <p>○Promotion of introduction support for local authorities and businesses, etc.</p> <p>○Promotion of introduction support for photovoltaic power generation, etc.</p> <p>○Support with regard to taxation or financing</p> <p>【Support at the stages of technological development and demonstration】</p> <p>○Promotion of technological developments and demonstration tests for fuel cells and photovoltaic power generation</p> <p>【Preparation of environment and awareness campaign, etc.】</p> <p>○Preparation of regulations and systems</p> <p>○Promotion of awareness campaign, etc.</p>
	<p>○Additional new energy measures Additional new energy measure completed in 2001 aimed at introducing 19.1 million kl worth of new energy by fiscal 2010 (Estimated emission reduction) Approx. 34 million t-CO₂</p> <p>[targeted introduction amount in fiscal 2010: 19.1 million kl]</p>	<p>【Support at the introduction stage】</p> <p>◎Placement biomass energy and snow ice cryogenic energy in the Law Concerning Promotion of the Use of New Energy</p> <p>◎Promotion of introduction support for local authorities and companies, etc.</p> <p>◎Promotion of introduction support for photovoltaic power generation, and</p>

	<p>(Breakdown is as follows.)</p> <p>Photovoltaic power generation: 4.82 million kW (including photovoltaic power generation for housing: estimated approx. 1 million units)</p> <p>Wind power generation: 3 million kW</p> <p>Waste power generation: 4.17 million kW</p> <p>Biomass power generation: 330,000 kW</p> <p>Solar thermal utilization: 4.39 million kl (including solar thermal utilization for housing: Estimated approx. 9 million units)</p> <p>Unutilized energy: 580,000 kl</p> <p>Thermal utilization of waste: 140,000 kl</p> <p>Thermal utilization of biomass: 670,000 kl</p> <p>Black liquor, refused wood, etc.: 4.94 million kl</p>	<p>solar thermal utilization, etc.</p> <p>◎Promotion of green purchases and procurement 【Support at the stages of technological development and demonstration】</p> <p>◎Strengthening the support for technological developments and demonstration tests, etc. concerning fuel cells, photovoltaic power generation, and biomass energy, etc.</p> <p>◎Promotion of technological development and so on bearing in mind regional characteristics 【Preparation of environment and awareness campaign, etc.】</p> <p>◎Studying grid-connection system measures</p> <p>◎Promoting the establishment of a software infrastructure for practical use of fuel cells</p> <p>◎Strengthening awareness campaign, etc.</p> <p>【Measures to expand new markets in the electricity sector】</p> <p>◎Proposal to establish the Bill Concerning the Use of New Energy by Electric Utilities</p>
--	---	---

(2) Fuel switching, etc.

Currently, it is estimated that fossil fuels which account for about 83% of the total primary energy supply will continue to be the main energy supply in 2010 and later. Thus, converting the fossil fuel supply structure to a more environmentally friendly type with minimum carbon dioxide emissions while maintaining a steady supply is a very important issue from the viewpoint of handling global warming issues over the long term as well. Even with the implementation of the above energy conservation and new energy measures through fiscal 2010, a further reduction of approximately 18 million tons of carbon dioxide emissions from energy sources is required to bring back to the same level as fiscal 1990.

Thus, the implementation of fuel switching is required with a focus on the power generation field, in which increased use of such fuel as coal is expected. Specifically, we are promoting the conversion of industrial coal-fired boilers to natural gas as well as promoting the conversion of the now old coal-fired power generations that have long been used to highly efficient natural gas combined cycle power generation. We also promote improvements in the pipeline infrastructure through a low-interest financing system, and seek to expand the introduction of natural gas. Through the comprehensive implementation of the above measures, a reduction of approximately 18 million tons of CO₂ emissions is expected.

We continue to promote measures of load-leveling in power demand to reduce carbon dioxide emissions by promoting the distribution of heat storage systems.

(Additional measures)

① Support of promoting Fuel switching

- Subsidies to offset the costs of converting old coal-fired thermal power generations to natural gas, and for converting facilities that consume large amounts of energy to natural gas

② Environment preparation

- Preparation of safety standards for natural gas pipelines

- Low interest financing for domestic natural gas development projects (developing wells and linked pipelines, etc.)

Table 3.5 Fuel switching, etc.

Current measures and their reduction amount	Additional measures and their reduction amount	Measures of the government and so on; (Current○, Additional◎)
	○Additional measures for fuel switching, etc. such as electricity (Estimated emission reduction) Approx. 18 million t-CO ₂	◎Subsidization towards part of the cost of converting old coal fired power generations to natural gas power generations ◎Subsidization towards part of the cost of fuel switching such as industrial boilers expected to downsize or cut CO ₂ emissions ◎Preparation of safety standards for natural gas pipelines ○Low interest financing for domestic natural gas development projects (developing wells and linked pipelines, etc.)

(3) Promotion of nuclear power

Nuclear power generation which was introduced with the intention of assuring a steady energy supply in Japan does not emit carbon dioxide during the power generation process, so can be considered an important source of electricity in view of measures against global warming perspective as well. The effective reduction in carbon dioxide emissions per 1.35 million kW class nuclear power plant as an alternative to coal-derived power is significant and equivalent to about 0.7% of the total carbon dioxide emissions from energy sources in fiscal 1990. In order to achieve our reduction target while satisfying the ever-increasing demand for energy, the establishment of new nuclear power plants is indispensable. Thus, promoting nuclear power generation with giving priority to safety has been defined as an important issue from a standpoint for measures against global warming as well as from the energy policy perspective, and thus the construction of new nuclear power plants is required with the aim of increasing nuclear-generated electricity by around 30% by fiscal 2010 compared to fiscal 2000.

In order to promote nuclear use, measures must be taken to secure nationwide agreement, including in places where electricity is consumed as well as in the vicinity of nuclear facilities with giving priority to safety. Also, an environment needs to be prepared to promote the provision of education to enable each citizen to deepen their understanding, consider by themselves, and can decide of energy issues, including the use of nuclear power. Various regional promotion activities concerning the siting of nuclear power plants and the like have been taken in accordance with the “Three Electric Power-Source Siting Laws” and “Law on Special Measures concerning Promotion of the Development of Nuclear Power Site Regions” with full consideration for disaster prevention factors. We continue to push for steady and further promotion of these activities, and implement cooperative measures by the central government with cooperation from the various government offices concerned in order to promote the siting of nuclear facilities.

We also steadily promote nuclear fuel cycle, including research and development in Japan to ensure the continued long-term operational reliability of nuclear power plants, as well as to make effective use of our limited uranium resources. Furthermore, we continue to work for the siting of final disposal facilities for high-level radioactive waste, which is an important issue in terms of nuclear power generation.

(Current measures)

- ① Implementing measures to gain nationwide agreement including in electricity consumption areas as well as in the vicinity of nuclear facilities with giving priority to safety
- ② Steady promotion of measures in accordance with the “Three Electric Power-Source Siting Laws” and “Law on Special Measures concerning Promotion of the Development of Nuclear PowerSite Regions”
- ③ Measures to establish nuclear fuel cycle in Japan such as research and development of nuclear fuel cycles, appropriate technological transfer of their results, and steady promotion of the MOX utilization in LWRs.

(Additional measures)

- ① Promotion of the Power Sited Regions Promotion Measures related to location of nuclear fuel cycle facilities (addition of MOX fuel fabrication facilities and final disposal facilities for high-level radioactive waste and the like as facilities subject to grant initial measure subsidies such as locating power plants)
- ② Drastic strengthening of “public hearings and PR activities” to acquire nationwide agreement concerning the nuclear power policy
- ③ Creation of environment to promote education related to energy and nuclear power

Matrix Table (Refer to the attachment)

3.4.3 Promoting measures for reducing emissions of Carbon Dioxide from non-energy sources , Methane, and Nitrous Oxide

As measures for limitation of carbon dioxide emission from non-energy sources, reduction of waste incineration volume by promoting reducing, reusing and recycling waste, and effective use of recyclable wood that can limit the amount of fossil fuels used as raw materials or as a biomass energy source. As a means of reducing methane (CH₄) emissions, we have been conducting technological studies concerning reduction in direct landfill disposal of waste, improvement of farmland management, and livestock management. We have also been promoting the reduction of nitrous oxide (N₂O) emissions during the industrial process, and increasing incineration temperatures at incineration plants for municipal solid waste and wastewater sludge.

Carbon dioxide emitted in industrial processes through the processing of limestone, production of ammonia, and so on for fiscal 1999 (54 million tons of CO₂) was reduced by 12.8% compared to the emissions in fiscal 1990. The primary reason is a 12.4% reduction in cement production for fiscal 1999 compared to fiscal 1990. Carbon dioxide emissions through incineration of waste originating from fossil fuels (waste oil and waste plastics, etc.) only accounts for about 2% of total carbon dioxide emissions, but a comparison of fiscal 1999 emissions (23 million tons of CO₂) against the emissions for fiscal 1990 shows an increase of about 1.5 times.

On the other hand, both methane and nitrous oxide emissions in fiscal 1999 (25 million tons of CO₂ and 18 million tons of CO₂ respectively) fell by 12.4% and 21.1% respectively compared to fiscal 1990. The primary reason for the cut in methane is the reduction in the agricultural sector resulting from the decrease in paddy field area, while the main reason for the reduction in nitrous oxide is the introduction of a decomposition equipment during the manufacture of synthetic fiber materials.

It is expected that emissions of carbon dioxide from non-energy sources, methane, and nitrous oxide emissions in these fields will be reduced by 2.8% in 2010 compared to 1990 (0.29% compared to total greenhouse gas emissions in the base year) through current actions and measures, and will be reduced by 4.8% compared to 1990 (0.5% compared to total greenhouse gas emissions in the base year) with the implementation of additional measures.

Table 3.6 Promotion of Measures to Reduce Emissions of Carbon Dioxide from Non-Energy Sources, Methane, and Nitrous Oxide

	Current measures and their reduction amount	Additional measures and their reduction amount	Measures of the government and so on; (Current○,Additional◎)
CO ₂ emissions	<ul style="list-style-type: none"> ○ Measures to reduce CO₂ emissions from industrial processes <ul style="list-style-type: none"> ▪ Increased use of mixed cement with less CO₂ emissions during the production process 		<ul style="list-style-type: none"> ○ Promotion of Law for Promotion of Procurement of Recycled Products by the National Organizations and Local Authorities on its own Initiative
	<ul style="list-style-type: none"> ○ Promotion of measures to reduce CO₂ emissions caused by waste incineration (approx. 3 million t-CO₂) <ul style="list-style-type: none"> ▪ Reducing waste generation and restricting waste generation, and increasing recycling ratio through appropriate sorting of waste, implementation of separated collection and reusing, and establishment of relevant facilities [municipal solid waste: approx. 24%, industrial waste: approx. 47%] ▪ Promoting the use of recycled resources and products by promoting green purchasing 	<ul style="list-style-type: none"> ○ A reduction of approximately 3 million tons of CO₂ is steadily being implemented by setting up reduction targets based on the Basic Guideline for the Promotion of Measures against Dioxins_(September 1999), constitution of The Basic Law for Establishing a Recycling-Based Society, revision of the Waste Management and Public Cleansing Law, establishment of related individual recycling regulations (June 2000), and the setting up National targets in waste management policy (May 2001) in line with the Waste Management and Public Cleansing Law. 	<ul style="list-style-type: none"> ○ Setting up National targets in waste management policy based on the Waste Management and Public Cleansing Law, and implementation of measures based on related individual recycling laws for containers and packaging, and construction and demolition waste, etc.
		<ul style="list-style-type: none"> ○ Substitution of fossil fuel origin products <ul style="list-style-type: none"> ▪ Promoting the development and introduction of biomass technology 	<ul style="list-style-type: none"> ○ Development of biomass technology such as biodegradable materials, and supporting their introduction to business
	<ul style="list-style-type: none"> ○ Promoting the effective use of timber resources <ul style="list-style-type: none"> ▪ Current status of supply and utilization of forest products through the Basic Plan on Forest and Forestry <p>[Wood supply and use] 20 million m³</p>	<ul style="list-style-type: none"> ○Expansion of the utilization of timber and wood materials <ul style="list-style-type: none"> ▪ Target for pertaining to the supply and utilization of forest products stated in the Basic Plan on Forest and Forestry <p>[Wood supply and use] 25 million m³</p>	<ul style="list-style-type: none"> ○ Improvement of technologies of timber and wood materials processing, expansion of wood demand, and awareness campaigns for its long-term use, etc. ○Expansion of demand for wood in housing, for which the ratio of wood demand is large, and promotion of its long-term use

			<ul style="list-style-type: none"> ○ Expanding wood demand through public awareness campaigns, and extending its use such as in public facilities, and promotion of its long-term and multi-stage use.
		<ul style="list-style-type: none"> ○ Promoting a reduction in emissions of CO₂ from farmland (including pastures) soil <ul style="list-style-type: none"> ▪ Reduction of CO₂ emissions from farmland soil by appropriately supplying organic substances through compost deoxidization and green manure cultivation in farmland [140,000 ha (estimated area for farmland where organic substances will newly be supplied appropriately)] (approx. 420,000 t-CO₂) 	<ul style="list-style-type: none"> ◎ Promotion of compost deoxidization and green manure cultivation in farmland ○ Promoting the preparation and preservation management of grassland
CH ₄	<p>(Measures to reduce CH₄ emissions)</p> <ul style="list-style-type: none"> ○ Promoting a reduction in waste generation and recycling waste, and trying to halve the volume of waste disposed of in landfills by only incinerating waste that cannot be reduced through other measures <p>[Municipal solid waste: 6.4 million tons, industrial waste: 30 million tons] (Approx. 1.2 million t-CO₂)</p>		<ul style="list-style-type: none"> ○ Widespread use of suitable strategies in the production and cooking processes based on Food Recycling Law, and promoting a reduction in the generation of food waste by improving distributional efficiency ○ Establishment of recycling facilities to prepare compost and feed
	<ul style="list-style-type: none"> ○ Improvement of farmland management 	<ul style="list-style-type: none"> ○ Development of technologies to reduce emission of greenhouse gases from agricultural sector 	<ul style="list-style-type: none"> ○ Improvements in farmland management ○ Development of technologies to reduce greenhouse gas emissions from the agricultural sector
	<ul style="list-style-type: none"> ○ Establishment of emission reduction technologies such as livestock feeding management skills 		
N ₂ O	<p>(Measures to reduce N₂O emission)</p> <ul style="list-style-type: none"> ○ Establishment of N₂O emission suppressing equipment in adipic acid production process <p>(Approx. 8.74 million t-CO₂)</p>		<ul style="list-style-type: none"> ○ It has been already implemented voluntarily in the plant

<ul style="list-style-type: none"> ○ Sophistication of combustion in incineration facilities for wastewater sludge (Approx. 1.4 million t-CO₂) ○ Sophistication of combustion in incineration facilities for municipal solid waste (Approx. 50,000 t-CO₂) 		<ul style="list-style-type: none"> ○ Thorough awareness of the “Guideline to establish global warming prevention plans for sewerage” ◎ Introduction of high-temperature combustion in all Fluidized bed incinerators of the sludge with polyelectrolyte flocculant, by clarifying the appropriate incineration temperature management stated in the “sewerage facility plan and design guideline” ○ Setting up maintenance management standards and structure standards for waste incineration facilities
<ul style="list-style-type: none"> ○ Improving drainage treatment in line with wider use of sewage and combined household treatment systems (johkasou), etc. (approx. 700,000 t-CO₂) 		<ul style="list-style-type: none"> ○ Promoting the preparation of sewage and combined household treatment systems (johkasou)
	<ul style="list-style-type: none"> ○ Development of technologies to reduce greenhouse gas emissions from the agricultural sector 	<ul style="list-style-type: none"> ○ Promoting the provision of appropriate manuring ○ Development of technologies to reduce greenhouse gas emissions from the agricultural sector
<p>Emission reduction through current measures: total approx. 15.09 million t-CO₂ (about ▲1.23% compared to total greenhouse gas emissions in the base year)</p>	<p>Emission reduction through additional measures: approx. 3.02 million t-CO₂ (about ▲0.25% compared to total greenhouse gas emissions in the base year)</p>	

Note 1) A total reduction of about 2.6 million tons of carbon dioxide or more shall be achieved through measures not showing reduced amounts such as the increased use of mixed cement.

Note 2) Emission of carbon dioxide from farmland will be included in the inventory of emissions and removals in line with the Marrakesh Accords, and efforts to reduce emissions will be made.

<p>Emission outlook for 2010</p> <p style="text-align: right;">Approx. 122 million t-CO₂ (about ▲0.5% compared to total greenhouse gas emissions in the base year)</p>

3.4.4 Promoting measures to Containment of emissions of Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulfur Hexafluoride (SF₆)

(1) Existing measures

The ratio of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆) emissions out of total greenhouse gas emissions is only about 3% (fiscal 1999 carbon dioxide equivalent basis), but how to limit their increase is the issue as they are main alternatives to ozone depleting substances, whose production and consumption are being phased out in accordance with the Montreal Protocol. Thus, the following have been implemented as current measures to reduce approximately 34 million tons of CO₂ from a business as usual basis.

① Promotion of implementation of voluntary action plans of industries

The industrial sectors established voluntary action plans in April 1998 based on the “Guidelines for measures to limit emissions of HFCs, PFCs, and SF₆ by industry” (issued by the Ministry of the Economy, Trade and Industry) in February 1998. Since then, the Industrial Structure Council has annually followed up progress of the industry action plans. (Currently, 19 business organizations in 10 sectors have adopted the action plan.) Measures to support those organizations’ emission limitation actions have also been implemented.

② Development of alternative substances

Research and development of new alternative substances, and development of technologies to recover and destroy HFCs have been implemented.

As a result of these measures, actual emissions in 2000 has been reduced by 26.2% compared to 1995, and satisfactory results are seen.

(2) Future measures and policies

It is estimated that such emissions will increase in line with a full-scale conversion from ozone depleting substances. We are trying to ensure a reduction of about 34 million tons of CO₂ by implementing additional measures in conjunction with effective and specific measures, as well as continuing to promote the current measures.

① Promotion of implementation of voluntary action plans of industries

The Industrial Structure Council continuously follows up on the progress of the industry action plans, and also tries to improve the transparency and accountability of the action plans, as well as to improve the effectiveness to achieve the target. Furthermore, industrial associations those which have not yet established voluntary action plans will continue to be encouraged to establish ones, and support measures for emission limitation actions of companies shall be implemented.

② Research and Development of alternative substances, alternative technologies, and recovery and destruction technologies

Research and development of new alternatives to hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆), their alternative technologies, and recovery/destruction technologies should be carried out. More specifically, new substitutes for refrigerants, cleaners, and foaming agents should be developed; substitute gases and systems and substitute processes for etching gas (PFCs) used in the production process for electronic devices should continue to be developed; and research should continue into cleaning process systems for electronic device production using substitutes for PFCs and sulfur hexafluoride (SF₆). In addition, energy-saving synthetic technologies for new fluorocarbon substitutes should be developed; inexpensive and compact fluorocarbon recycling and destruction technologies should be developed; and technologies for highly efficient insulating construction materials should be developed without using fluorocarbons.

③ Promoting the use of products using substitute substances

With all due consideration for safety, economy, and energy efficiency, information provision and awareness campaigns for products using substitute substances or products using hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆) with less impact on global warming should be promoted.

④ Recovery of HFCs refrigerants from equipment as required by law

In order to recover and destroy HFCs, a recovery and destruction system has been prepared through voluntary measures by industries as well as local communities. Since April 2001, the “Law for Recycling of Specified Kinds of Home Appliances (Home Appliance Recycling Law)” has been enforced. In 2002, the “Law for ensuring the Implementation of Recovery and Destruction of Fluorocarbons concerning Specified Products (the Fluorocarbon Recovery and Destruction Law) is enforced from April for commercial air-conditioners, refrigerators and chillers, and later, other

provision of this law for mobile air conditioners will come into effect. Recovery and destruction of HFCs used as refrigerants shall be ensured through the appropriate enforcement of these laws.

Table 3.7 Implementation of Measures to Limit Emissions of Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), and Sulfur Hexafluoride (SF₆)

Current measures and their reduction amounts	Additional measures and their reduction amounts	Measures of the government and so on; (Current○, Additional◎)
<p>○Promotion of implementation of voluntary action plans of industries 19 business organizations in 10 sectors have established action plans to limit emissions, and have steadily been implementing them. The Industrial Structure Council has been following up on the action plans annually.</p> <p>○Research and development of substitutes, etc. Research and development of new alternative substances, alternative technologies, and recovery/destruction technologies</p> <ul style="list-style-type: none"> ▪ Development of new alternative substances ▪ Development of substitute gases systems, and substitute processes for etching gas (PFC) used in production of electronic devices ▪ Research into production and cleaning process system for electronic device production using substitutes for SF₆ and PFCs ▪ Development of technologies to destroy HFC 23 generated as a by-product of the industrial process 	<p>○Research and development of substitutes, etc.</p> <p>○Promoting use of products using alternative substances</p> <p>○Recovery of HFC refrigerants from equipment as required by law</p>	<p>○The Industrial Structure Council continuously follows up progress of the action plans of the industries.</p> <p>◎Efforts to improve transparency and accountability of the action plans, and to increase effectiveness to achieve the target. Furthermore, those business associations that have not yet established their own, shall be encouraged to do so.</p> <p>○Current research and development of alternative substances, alternative technologies, and so on should continue.</p> <p>◎New technological development should be carried out as follows.</p> <ul style="list-style-type: none"> ▪ Development of energy-saving synthetic technologies for fluorocarbon substitutes ▪ Development of inexpensive and compact fluorocarbon recycling and destruction technologies ▪ Development of technologies for highly efficient insulating construction materials without using fluorocarbons <p>◎With all due consideration for safety, economy, and energy efficiency, information provision and awareness campaigns for products using substitute substances or products using HFCs, PFCs, SF₆ with less impact on global warming should be promoted</p> <p>◎Appropriate enforcement of Home Appliance Recycling Law and Fluorocarbon Recovery and Destruction Law</p>

Reduction of approx. 34 million t-CO ₂	Increasing prospects for reduction of approx. 34 million t-CO ₂	
---	--	--

Emission outlook for 2010

Approx. 73 million t-CO₂ (*)

(About +2% compared to total greenhouse gas emissions in the base year)

※ Increase amount will be controlled to +2% of total GHG emissions in the base year, from +5% of total GHG emissions in the base year on business as usual case

(Total amounts of emissions on business as usual case: approx. 107 million tons of CO₂)

3.4.5 Strengthening research and development of advanced and innovative energy- and environment-related technologies

Global warming is an issue that must be addressed throughout the 21st century. In order to tackle this issue, breakthroughs are required by promoting technological innovations that reach beyond existing assumptions as well as implementing measures by applying actions that can be undertaken at this stage.

In terms of innovative technological development, we aim for a 2% emission reduction compared to total greenhouse gas emissions in the base year, as well as further promoting activities to prevent global warming through efforts made by various sectors and layers of the public within the first commitment period. Thus far, we have been strongly promoting innovative technological development beyond the current technological standards such as ultra-efficient photovoltaic power generation, energy conservation-related technology in the energy use sector such as technologies using supercritical fluids as innovative environmental energy technology for 2010. We have also been deliberately implementing research and development of ultra-steels and super heat-resistant materials to improve energy use efficiency, development of technologies for carbon dioxide storage and fixation, and innovative hydrogen production techniques that are expected to prevent global warming, all of which are to strongly promote measures for an ultimate solution to global warming issues.

An effective reduction in greenhouse gases is expected in the future through innovative environmental and energy technology, but it is still only at the research and development stage, so such technology must be established at the earliest point.

Thus, in order to ensure maximum effectiveness as we head towards 2010, we are strongly promoting the establishment of technologies with good prospects at the earliest stage. More specifically, we are trying to strengthen technological developments further concerning technology aimed at innovative energy conversion, basic technology significantly increasing energy efficiency during product use, and innovative processes and system technology aimed at significant energy savings in the production process, etc. In addition, we are comprehensively implementing measures to introduce and distribute active publication of the technological development results as well.

On the other hand, measures to prevent global warming must be implemented by strategically combining short- and long-term technological development with a long-term view. Therefore, we are working hard on technologies even if their technological development results will be long in coming if they appear to have good prospects.

In order to promote development of these innovative energy- and environment-related technologies, we are conducting research and development concerning technologies for global warming prevention measures in accordance with the “Science and Technology Basic Plan” (decided by the Government of Japan in March 2001), and are also seeking comprehensive promotion under the global warming research initiative of the Council for Science and Technology Policy.

Table 3.8 Strengthening Research and Development of Advanced and Innovative Energy- and Environment-Related Technologies

Current measures and their reduction amount	Additional measures and their reduction amount	Measures of the government and so on; (Current○, Additional◎)
---	--	---

<ul style="list-style-type: none"> ○ Promoting development of innovative technologies beyond current technological standards <ul style="list-style-type: none"> ▪ Development of energy conservation-related technology such as technology using supercritical fluids ▪ Development of technology for ultra high efficient photovoltaic power generation ▪ Development of innovative hydrogen production technology ▪ Development of technology for CO₂ storage and fixation ▪ Development of technologies for ultra-steel and super heat-resistant materials, etc. to improve energy use efficiency ○ Promotion of study to create strategy for global warming countermeasures and basic studies aimed at construction of mechanism to promote study into resource cycling, and consumption limitation, and the efficient use of energy ○ Promotion of basic studies aimed at construction of mechanism to promote study into creation of strategy for global warming countermeasures, resource cycling, and consumption limitation, and the efficient use of energy 	<ul style="list-style-type: none"> ○ Strengthening promotion of innovative technological development beyond current technological standards (approx. 7.44 million t-CO₂) <ul style="list-style-type: none"> ▪ Innovative energy conversion technology for storing energy and reducing losses during electricity distribution ▪ Fundamental technology that significantly improves energy efficiency of products, such as electronic equipment and transport equipment ▪ Innovative process system technology aimed at significant energy savings for industries that consume large amounts of energy 	<ul style="list-style-type: none"> ◎ Strengthening measures as the priority field under the Science and Technology Basic Plan ◎ Comprehensive promotion under the global warming research initiative of the Council for Science and Technology Policy ◎ Implementation of support for new technological development ○ Support measures for development of prospective technologies whose results will take a long time to see ○ Further studying of research and development themes
	<p>Emission reduction through measures: total about 7.44 million t-CO₂ (approx. ▲0.6% compared to total greenhouse gas emissions in the base year)</p>	

3.4.6 Further Activities to prevent Global Warming carried out by various sectors and layers of the public

The current socioeconomic system and living/working styles, as well as people's sense of values, are closely tied in to the emission of greenhouse gases. The implementation of global warming prevention measures is also changing the current socioeconomic system. Thus, an awareness campaign and provision of information to seek the better understanding, action and cooperation of various sectors and layers of the public must be promoted strongly in cooperation between them while fully utilizing the existing mechanisms, such as the various media channels.

In this Guideline, these measures, which can be realized by special efforts made by various sectors and layers of the public, are to be promoted through an awareness campaign by providing information,

education and PR activities mainly by the government, and are defined as “Further Activities to prevent Global Warming carried out by various sectors and layers of the public”, with the aim of a 2% emission reduction compared to the total greenhouse gas emissions in the base year as well as innovative technological development within the first commitment term by implementing those measures. For example, if various sectors and layers of the public implement the measures stipulated in the attached table as further global warming prevention activities, an emission reduction of up to about 1.8% is possible compared to total greenhouse gas emissions in the base year.

However, according to the “public opinion survey concerning global warming prevention and lifestyles” carried out by the Cabinet Office in July 2001, insufficient measures have been implemented so far despite the public’s positive intentions towards such measures.

The reasons are thought to be as follows.

- 1) The awareness campaign and information provision concerning global warming prevention activities to various sectors and layers of the public have not been sufficient.
- 2) Most measures are temporary, and a system to continuously provide an awareness campaign and information has not been sufficiently established. In particular, the basis for promoting partnership measures involving the government, various businesses, and the public has not been sufficiently prepared at the regional level.
- 3) The requisite information and advice for implementing specific measures to prevent global warming when purchasing and using products have not adequately been provided to each family.

Various awareness campaign activities have been carried out by the Japan Center for Climate Change Actions, Prefectural Centers for Climate Change Actions, global warming prevention activities advisors, and through implementation of national resource and energy conservation campaign in accordance with the Law for the Promotion of Measures to Cope with Global Warming. In addition to those measures, “global warming prevention measures diagnosis” that provides instruction and advice by inspecting measures implemented by each family shall be carried out for the following purposes.

- 1) Nationwide implementation of a campaign to create a lifestyle suited to the global environment era by holding the Conference on “Wa-no-kuni-Kurashi”, which means the lifestyles emphasizing simplicity, quality and sustainability, and so on.
- 2) Establishment of the basis for implementing regional measures
- 3) Implementation of measures for creating economic benefit

Furthermore, an awareness campaign for global warming prevention activities should be promoted while utilizing the promotion and support system for measures implemented by each family, preparing the basis for promoting regional measures, and developing a national campaign.

(1) Establishment of the basis for promoting global warming prevention activities

① Implementation of a national campaign to create a lifestyle suited to the global environment era
As part of the measures reviewing individual lifestyles, the Conference on “Wa-no-kuni-Kurashi” is to be held to encourage everyone to voluntarily undertake measures and to submit messages of encouragement. At the same time, studies into effective methods to be promoted in the future should be carried out for lifestyle innovation (lifestyle action) through cooperation between the government and each sector and layer of the public.

② Strengthening the basis for promoting regional measures

In order to establish the system and basis for regional measures, conditions specified for Prefectural Centers for Climate Change Action (hereafter, Prefectural Centers) should be expanded to specified non-profit corporations as well as for public service corporations, and promote the nationwide development of Prefectural Centers. At the same time, regional partnership measures through the establishment of a Global Warming Prevention Regional Council comprising of local authorities, Prefectural Centers, global warming prevention activities advisors, businesses, and the public should be promoted.

③ Promotion of measures implemented by individual families

A global warming prevention measures diagnosis that provides instruction and advice on cost-effective ways with minimum greenhouse gas emissions should be promoted by inspecting the efficiency of houses and buildings, such as their thermal insulation, lighting, kitchens, air

conditioners, and water heaters, as well as economic evaluations by global warming prevention activities advisors.

Furthermore, the Japan Center for Climate Change Action should be actively utilized as well as encouraging the development and selection of products with minimal greenhouse gas emissions to businesses and the public through labeling, and suchlike, and information concerning each product's greenhouse gas emissions should be recovered and provided. In addition, we promote studies of the evaluation methods into the effects of global warming measures, such as lifecycle assessments.

(2) Promotion of awareness campaigns for global warming prevention activities

- 1 National debate on the introduction of a daylight saving time system is being attempted while taking into account the "Citizen's Conference report to think about the Global Environment and Daylight Saving Time" (May 1999) in order to gain a consensus.
- 2 Awareness campaign to promote teleworking, etc.
- 3 Awareness campaign to promote bicycle use.
- 4 General subjects and "general studies" measures at school should be supported to further environmental and energy-related education and study, with efforts made to achieve substantiality. Furthermore, preparation of regional environmental study programs and information provision should be promoted to support various measures implemented by each organization, with efforts made to achieve substantiality. In addition, "environment-friendly school facilities (eco schools)" should be established.
- 5 Public involvement awareness campaigns should be implemented as well as continuously carrying out PR using the full media range.
- 6 In order to carry out extensive awareness campaigns to introduce the importance of greenery as a means of removing carbon dioxide, a greening campaign should be implemented with public involvement, by implementing national greening campaigns such as developing a Greenery Week, and City Greening Month, and the promotion of greening activities and afforestation carried out by the public using green feather fund movement and urban green space development fund.
- 7 Awareness campaign to promote comprehensive measures to prevent heat islands.
- 8 Environmental information concerning housing/buildings, residential and commercial equipment, and vehicles including greenhouse gas emissions should be provided continuously.
- 9 The government should take the lead in implementing global warming prevention measures such as promoting the purchase of recycled goods in line with the Law for Promotion of Procurement of Recycled Products by the National Organizations and Local Authorities on its own Initiative, and also will continuously implement model projects geared towards social system innovation.

Table 3.9 Promotion of further global warming prevention activities by various sectors and layers of the public

	Current measures and their reduction amount	Additional measures and their reduction amount	Measures of the government and so on; (Current○, Additional◎)
I . Measures implemented by the general public			

Residential and commercial sector	<p>○ Raising air conditioners temperatures to 28°C, and lowering heater temperatures to 20°C or lower [30%] (approx. 440,000 ~ 850,000 t-CO₂)</p>	<p>○ Positive purchase and use of products with smaller energy consumption for equipment other than those specified by the Law Concerning the Rational Use of Energy (3.54 ~ 4.12 million t-CO₂)</p> <ul style="list-style-type: none"> ▪ Changing incandescent lamps to fluorescent lighting [60%] (740,000 ~ 1.41 million t-CO₂) ▪ Purchase of microwaves with lower electrical consumption [30%] (350,000 ~ 680,000 t-CO₂) ▪ Introduction of dish washers (reduction in hot water consumption) [40%] (1.6 ~ 1.18 million t-CO₂) ▪ Introduction of water-saving shower head [30%] (850,000 t-CO₂) 	<p>◎ Information provision taking into account proposals at the Conference on "Wa-no-kuni-Kurashi", and promotion of model projects, etc.</p> <p>◎ Implementation of "global warming prevention measures diagnosis"</p> <p>◎ Information provision by the Japan Center for Climate Change Actions and Prefectural Centers for Climate Change Actions</p> <p>◎ Promotion of regional measures through the "Global Warming Measures Regional Council"</p> <p>◎ Carrying out PR and information provision, etc. through various regional organizations</p> <p>○ Establishment of a system for education, awareness campaign and information provision</p> <p>○ Distribution of environment and energy conservation household account books</p> <p>○ Strengthening PR</p> <p>○ Provision of information concerning residential and commercial equipment</p> <p>○ Preparation, analysis, and provision of environmental information for products</p>
-----------------------------------	--	--	---

		<p>○Implementation of global warming prevention lifestyle [30%] (approx. 6.76 ~ 9.37 million t-CO₂)</p> <ul style="list-style-type: none"> ▪ 20% reduction in use of heaters and lighting by family members spending more time in the same room (3.41 ~ 4.67 million t-CO₂) ▪ More selective TV viewing and reducing time spent watching TV by one hour a day (190,000 ~ 350,000 t-CO₂) ▪ Reducing shower use by one minute a day with all of family (930,000 t-CO₂) ▪ Efficient use of refrigerator (150,000 ~ 280,000 t-CO₂) ▪ Using bathwater to wash clothes (240,000 ~ 460,000 t-CO₂) ▪ Eliminating the use of electric thermostat in pots and rice cookers (440,000 ~ 850,000 t-CO₂) ▪ Using one's own shopping bags, and selecting vegetables with minimum packaging, etc. (830,000 t-CO₂) ▪ Distribution of eco cooking (100,000 t-CO₂) ▪ Water-saving measures while washing (stop water running while cleaning teeth and washing face) (90,000 ~ 170,000 t-CO₂) <p>,etc.</p>	
	<p>○ Restraint in vehicle use</p> <p>○ Promoting 'No idling' while cars are stopped or parked: 20 ~ 40% (140,000 ~ 280,000 t-CO₂)</p>	<p>○ Implementation of eco drive [20 ~ 40%] (approx. 810,000 ~ 1.62 million t-CO₂)</p> <ul style="list-style-type: none"> ▪ Raising vehicle cooler temperatures by 1 degree ▪ Part-filling gasoline tanks ▪ Smooth (non-aggressive) acceleration ▪ Elimination of unnecessary loads on vehicles ▪ Thoughtful driving ▪ Appropriate control of tire pressure <p>,etc.</p>	<p>◎ Information provision taking into account proposals at the Conference on "Wa-no-kuni-Kurashi", and promotion of model projects, etc.</p> <p>◎ Implementation of "global warming prevention measures diagnosis"</p> <p>◎ Information provision by the Japan Center for Climate Change Actions and Prefectural Centers for Climate Change Actions</p> <p>◎ Promotion of regional measures through the "Global Warming Measures Regional Council"</p>

Transportation sector		<ul style="list-style-type: none"> ○ Introduction of goods contributing to reduced environmental impact (approx. 20,000 ~ 30,000 t-CO₂) <ul style="list-style-type: none"> ▪ Installation of solar-proofing film on vehicles without reducing driver's view [20 ~ 40%] ▪ Installing/featuring other parts and goods that contribute to reduced CO₂ emissions while driving ,etc. 	<ul style="list-style-type: none"> ◎ Carrying out PR and information provision, etc. through various regional organizations ○ Establishment of a system for education, awareness campaigns, lectures and information provision ○ Strengthening PR ◎ Efficiency evaluation of environmentally friendly goods and distribution of information provision are implemented from fiscal 2002. ○ Awareness campaign for bicycle use
II. Measures implemented by companies			
Commercial sector	<ul style="list-style-type: none"> ○ Raising air conditioners temperatures to 28°C, and lowering heater temperatures to 20°C or lower [40%] (Estimated emission reduction is included in the same type of measures implemented by the general public as shown before) 	<ul style="list-style-type: none"> ○ Positive purchase and use of products with smaller energy consumption for equipment other than those specified by the Law Concerning the Rational Use of Energy (Estimated reduction is the figure included in the same type of measures implemented by the general public as shown before + approx. 830,000 ~ 1.56 million t-CO₂) <ul style="list-style-type: none"> ▪ Changing incandescent lamps to fluorescent lighting [60%] (640,000 ~ 1.22 million t-CO₂) ▪ 50% reduction in upwards luminous lux of outdoor lighting in the evening as a measure to prevent light pollution [50%] (170,000 ~ 320,000 t-CO₂) ▪ Use of energy-efficient cookers [20%] (20,000 t-CO₂) ○ Establishment of global warming preventing work style [30%] (approx. 230,000 ~ 410,000 t-CO₂) 	<ul style="list-style-type: none"> ◎ Information provision taking into account proposals at the Conference on “Wa-no-kuni-Kurashi”, and promotion of model projects, etc. ◎ Information provision by the Japan Center for Climate Change Actions and Prefectural Centers for Climate Change Actions ◎ Promotion of regional measures through the “Global Warming Measures Regional Council” ◎ Carrying out PR and information provision, etc. through various regional organizations ○ Establishment of a system for education, awareness campaign, lectures and information provision ○ Strengthening PR ○ Promotion of information provision ○ Wider use of environment management systems, etc.

		<ul style="list-style-type: none"> ▪ Temporarily turning off lights in offices (at lunchtime, etc.) (180,000 ~ 310,000 t-CO₂) ▪ Reduction in wasteful copies (10,000 ~ 30,000 t-CO₂) ▪ Switching off PCs at lunchtime (40,000 ~ 70,000 t-CO₂) ,etc.	
Transportation sector		<ul style="list-style-type: none"> ○ Promotion of eco drive for company cars, etc. [20 ~ 40%] (Estimated reduction is included in implementation of eco drive as shown before) 	
III. Measures implemented by the government and local authorities			
Commercial sector and Transportation sector	<ul style="list-style-type: none"> ○ Implementation of measures to reduce greenhouse gas emissions with regard to clerical work and projects of government (approx. 150,000 t-CO₂) ○ Implementation of measures to reduce greenhouse gas emissions with regard to clerical work and projects of prefectures (approx. 600,000 t-CO₂) ○ Implementation of measures to reduce greenhouse gas emission with regard to clerical work and projects of city, town, and village (approx. 2 million t-CO₂) 	<ul style="list-style-type: none"> ○ Introduction of energy-saving facilities (figures included in the current measures implemented by the government, prefectures, cities/towns/villages) <ul style="list-style-type: none"> ▪ For example, inverter- control motors for water supply facilities 	<ul style="list-style-type: none"> ○ Obligating the establishment of execution plan for clerical works and projects of government and local authorities based on the Law Concerning the Promotion of the Measures to Cope with Global Warming ○ Promotion of green purchasing such as environmentally friendly goods with minimum greenhouse gas emissions based on the Law for Promotion of Procurement of Recycled Products by the National Organizations and Local Authorities on its own Initiative ○ Promoting establishment of environmentally friendly school facilities (eco school)
Cross-sector		Introduction of daylight saving time system (approx. 250,000 ~ 1.23 million t-CO ₂)	○Establishing national debate on the introduction of a daylight saving time system, and gaining consensus.
	Emission reduction through current measures: total about 3.18 ~ 3.88 million t-CO ₂ (0.3%)	Emission reduction through additional measures: total about 12.44 ~ 18.34 million t-CO ₂ (1.0 ~ 1.5%)	

3.4.7 Promotion of Measures Involving sinks of greenhouse gas

(1) Promotion of forests and forestry measures

The Basic Plan on Forest and Forestry was set as a Cabinet decision, in October 2001, based on the Basic Law on Forest and Forestry. It is approximately estimated that if the targets set forth in this plan to fulfil the multiple functions forests have and the targets pertaining to the supply and utilization of forestry products are achieved as per the plan, it is possible to ensure removals around the upper limit (3.9 percent of total greenhouse gas emissions in the base year, 47.67 million tons of CO₂) of the obtainable removals through forest management across the forests under Article 3, 3 and 4 of the Kyoto Protocol.

Since the above is an estimate based on accomplishment of the Basic Plan on Forest and Forestry, further scrutiny and examination of the calculation method is required. Also, there is a concern that if forest management, timber supply and utilization continues at current levels, the removals will fall below 3.9 percent of total greenhouse gas emissions in the base year.

Ensuring the removals is a matter in the public's interest and utmost efforts need to be made by all of those involved including the government, forest owners, operators of forestry and timber products businesses, as well as local authorities and organizations involved in forests and forestry. Moreover, it is essential to steadily and comprehensively implement the forest management, timber supply and efficient utilization of timber, etc. required to achieve the targets of the Basic Plan on Forest and Forestry.

In order to ensure the necessary removals, Japan must strongly promote the measures described below as well as try to enhance the removals reporting and verification systems for the removals.

① Sound forest management

- a) Rolling out of a variety of forest management measures including establishment of multi-storeyed forest, introduction of broad-leaved tree species and so on according to the functional classification of the forest
- b) Promotion of the necessary human intervention in forests where it is necessary to implement tending practices such as urgent thinning
- c) Promotion of re-establishment (re-planting) and weeding after felling
- d) Promotion of afforestation and tending in non-forested areas, waste land, forests that have been hit by natural disaster, and abandoned agricultural land

② Appropriate management of protected forests

- a) Promotion of forest management through systematic designation of forests as protected forests and ensuring forest permanency through regulations on the alternate use of forests and felling regulations under the protected forests system
- b) Appropriate implementation of erosion control in protected forests with declining functionality
- c) Prevention of damage caused by diseases and pests
- d) The use of systems, based on the Nature Parks Law and the Nature Conservation Law, for forests where management of the forest and natural environment that makes up an impressive natural landscape is particularly necessary

③ Promotion of forest related activities with citizen participation

- a) Promotion of forest management activities through direct participation from a broad group of the community
- b) Promotion of education about forest environments

④ Promotion of utilization of timber and wood biomass

- a) Proactive utilization of timber in order to reduce the usage of fossil fuels and to contribute to reducing carbon dioxide emissions. Measures include the promotion of education of the citizens to popularize the efficient use of timbers as renewable resource, promotion of the use of timbers in wooden housing and public facilities, and improvement of timber and wooden material utilization and processing technology
- b) Use of woody biomass, such as logging residues and saw mill residues, as energy source

Table 3.10 Promotion of Measures for Forests and Forestry

Current measures and their reduction amount	Additional measures and their reduction amount	Measures of the government and so on; (Current○, Additional◎)
<ul style="list-style-type: none"> • Current state of demonstration of the multiple functions forests have (as at 2000) <Forest area> Managed single- storied forest 10.3 million ha Managed multi-storied forest 0.9 million ha Natural forest 13.9 million ha Total 25.1 million hectares < Total growing stock > 3,930 million m³ • Current state of the supply and utilization of forestry products <Timber supply and utilized volume> 20 million m³ 	<p>Setting forth targets for demonstrating the multiple functions forests have including preventing global warming and for the supply and utilization of forestry products as well as establishing a plan (the Basic Plan on Forest and Forestry) promoting comprehensive and systematic measures pertaining to forests and forestry.</p> <ul style="list-style-type: none"> • Targets pertaining to fulfilling the multiple functions forests have (by 2010) <Forest area> Managed single-storied forest 10.2 million ha Managed multi-storied forest 1.4 million ha Natural regeneration forest 13.5 million ha Total 25.1 million hectares (Total growing stock) 4,410 million m³ • Targets pertaining to the supply and utilization of forestry products <Timber supply and utilized volume> 25 million m³ 	<p>○Roll out of measures based on the Basic Law on Forest and Forestry and the Basic Plan on Forest and Forestry</p> <p>◎Strong and systematic promotion of forest management based on the Basic Plan, over the decade from 2003 through to the final year of the first commitment period, which is up to 2012. Further enhancement of the reporting and verification systems on the removals (Roll out of the 10-year Forest Sink Measures to Prevent Global Warming)</p>
<p>○Sound forest management</p> <p>Implementation of afforestation, and the necessary tending and thinning (track record for the 3 years from 1998 to 2000)</p> <ul style="list-style-type: none"> • Planting 40,000 ha per year • Weeding 300,000 ha per year • Thinning 315,000 ha per year • Guided felling into multiple-layered forest -- • Improvement of natural forest 25,000 ha per year • Road network operations 2,500 km per year 	<p>○Sound forest management</p> <p>Implementation of the forest management required to achieve the targets of the Basic Plan on Forest and Forestry</p>	<p>◎Promotion of forest management in accordance with the important functional classification (water and land conservation forests, symbiosis of forest and people, forests for the cyclical use of resources)</p> <p>○Implementation of 5-year urgent thinning measures</p> <p>○Implementation of long-term cyclical forest management</p> <p>◎Upgrading and expanding of public management of forests</p> <p>○Promotion of thinning measures</p> <p>◎Acceleration of guided felling into multi-storied forests</p> <p>◎Implementation of special “Re-greening” measures</p>

	○Promotion of appropriate management of protected forests	○Promotion of systematic designation of forests as protected forests ○Promotion of conservation measures in protected forests ○Prevention of damage caused by diseases and pests ◎Promotion of urgent upgrading measures for protected forests with declining functionality ◎Management of disaster prevention information in mountain villages and enhancement of disaster prevention systems
○Promotion of forest related activities with citizen participation	○Promotion of forest related activities with citizen participation	○Promotion of forest management and conservation activities with participation by citizens ◎Enhanced participation and coordination between diverse groups such as community residents, NPOs, etc. ○Promotion of forest environment education
○Promotion of the efficient use of timber resources ▪ Current state of supply and utilization of forest products <Timber supply and utilized volume> 20 million m ³	○Promotion of utilization of timber and wood biomass ▪ Targets pertaining to the supply and utilization of forestry products <Timber supply and usage volume> 25 million m ³ ▪ Promotion of the utilization of unutilized timber resources	○Developing new demand for forestry products ○Promotion of the use of timber in construction and facilities ○Promotion of comprehensive measures to promote the utilization of timber ◎Putting in place model facilities using local timbers, such as school interiors and school-related facilities ○Use of wood biomass energy ◎Putting in place model facilities using wood biomass energy
If forest management, timber supply, utilization, etc. continued at the same level as it is currently (average of the actual figures for 1998 to 2000) the forest removal amount would be approx. 35.5 million t-CO ₂	If the targets set out in the Basic Plan on Forest and Forestry, of demonstrating the multiple functions forests have and for the supply and utilization of forestry products, were achieved as set out in the plan, the removal amount in forests would be approx. 47.7 million t-CO ₂	

(2) Promotion of Urban Greening

Urban greening is to be promoted continuously based on comprehensive action plans, pertaining to the creation and conservation of green areas by the government and local authorities, such as the “Green Policy Guidelines” and “Basic Plan of Green” set by cities, towns, and villages. Under these plans, urban greening, such as upgrading urban parks, the greening along roadways, rivers, and erosion

prevention areas etc., the conservation of existing privately-owned green spaces, the creation of new green areas on building rooftops and sides of walls etc., and so on will be pro-actively promoted. In addition, the greening etc. of ports and harbors etc. will continue to be promoted through the “Eco Port Policy.”

If these measures are implemented as planned, it is estimated that removals equivalent to around 0.02 percent of the total greenhouse gas emissions in the base year (280,000 tons of CO₂) will be secured on an annual average in the first commitment period.

These are estimates based on the plans for planting of arboreal vegetation in urban greening and future scrutiny and examination of the target activities that are counted in the removals and the calculation method etc. is required.

Table 3.11 Promotion Urban Greening

Current measures and their reduction amount	Additional measures and their reduction amount	Measures of the government and so on; (Current○, Additional◎)
○Greening of public facilities Planting of arboreal vegetation along public facilities such as urban parks, roadways, and rivers <Target amount: The increase in the number of trees planted from 1990 to 2010 is estimated at 75 million trees and the estimated absorption volume calculated based on this.> (Forecast reduction in emissions (removals)) 280,000 t-CO ₂ (Ratio of the total greenhouse gas emissions in the base year around 0.02%)		○Promotion of greening based on the “Green Policy Guidelines” etc. ○Promotion of the greening of ports and harbors based on the “Eco Port Policy” ○Drafting of “Basic Plan of Green” drafted by cities, towns, and villages and the promotion of greening based on these plans. ○Promotion of education in order to popularize the creation of greenery and promotion of greening by a broad range of groups such as residents, companies, NPOs, etc.

3.4.8 Making use of the Kyoto mechanisms

(1) Basic philosophy

The Kyoto Protocol permits the use of the Kyoto mechanisms (Joint Implementation (JI), clean development mechanism (CDM), and emissions trading), which enable Parties to the Protocol to use a part of the emissions reductions in other Parties or a part of the other Parties’ assigned amount (the assigned amount is an emission “quota” allocated to each Party), as flexibility measures, to achieve their commitments. In light of such functions of the Kyoto mechanisms, it is necessary to use them appropriately in order to achieve the commitment of the Kyoto Protocol in a cost-effective manner, while keeping in mind that the use of the Kyoto mechanisms shall be supplemental to domestic actions.

(2) Measures necessary to make use of the Kyoto mechanisms

① Implementation of immediately necessary measures

Joint Implementation (JI) is one of the Kyoto mechanisms based on the Article 6 of the Kyoto Protocol. It allows an Annex I Party to acquire from another Annex I Party, as “emission reduction unit”, the emissions reduction or the removals resulting from emissions reduction projects or sink projects. The clean development mechanism (CDM) is provided in the Article 12 of the Protocol. It

allows an Annex I Party to acquire from a non-Annex I Party, as “certified reduction emissions”, the emissions reduction or the removals resulting from an emissions reduction project or an afforestation or reforestation project in the non-Annex I Party. Furthermore, emissions trading is a mechanism, based on the provisions of Article 17 of the Protocol, which allows trading of a part of the assigned amounts between Annex B Parties.

The Kyoto mechanisms also allow the participation of private sectors. Therefore, it is expected that these mechanisms will be used by them to achieve their own emission reduction target more cost-effectively. However, when private sectors carry out JI or CDM and obtain “emission reduction units” or “certified emission reductions” (credits), it is necessary to be approved by the Parties involved, based on the provisions of Article 6.1 and Article 12.5 (a) of the Protocol. Moreover, these credits need to be verified after the project has commenced by an internationally accredited organization which has no conflict of interest with its other functions in proceeding to the verification. (For JI projects, verification by the host country is also possible.)

Projects starting as of the year 2000 are eligible as the JI or CDM projects. In addition, with regard to the CDM, “certified emission reductions” pertaining to the reduction of emission realized since the year 2000 can be obtained.

Therefore, the systems to enable the utilization of these two mechanisms should be promptly put into place.

Also, in order to meet the eligibility requirements to use the Kyoto mechanisms from the beginning of the first commitment period, Japan will put in place national systems to calculate Japan’s greenhouse gas emissions and removals, and will establish the national registry to track and record its assigned amount, “emission reduction units” and “certified emission reductions” (credits) that arise from JI and CDM projects respectively, and will report to the secretariat by the summer of 2006, at the latest, giving an overview of these systems.

To this end, following measures will be taken shortly.

a) Putting in place a project approval system for approving the JI and CDM projects

When project participants conduct a JI or CDM project, and wish to obtain “emission reduction units” or “certified emission reductions”, it is necessary to obtain approval on these projects from the Parties involved based on the provisions of Article 6.1 (a) and Article 12.5 (a) of the Protocol.

Therefore, the government organizations concerned will jointly and promptly establish the systems for accepting and checking the applications for the approval of projects pertaining to the JI or CDM.

b) Setting up the national registry etc.

Japan will promptly set up the national registry to track and record its assigned amount, the “emission reduction units” and “certified emission reductions” that arise from JI and CDM projects in accordance with the results of the COP8. In addition, Japan will also put in place national systems to calculate greenhouse gas emissions and removals.

c) Other measures

Japan will implement following measures with a view to achieve the smooth operation of the Kyoto mechanisms.

1) Assistance for the use of Kyoto mechanisms by private sector etc.

- Strengthening of project finding, feasibility study and other related project preparation functions for JI or CDM projects, and provision of relevant information to private sector etc;
- Assistance on negotiations with the other governments involved in the project and their human resources development in order to promote initiatives by private sector in JI and CDM;
- Assistance with the training in the private sectors so that Japanese private sector companies be designated as operational entities under the CDM or independent entity under the JI;
- Establishment of advisory offices for private sector’ queries and requests relating to the Kyoto mechanisms;
- Elaboration and dissemination of the guides on how to use the Kyoto mechanisms in order to ensure the smooth use of the Kyoto mechanisms by private sectors, which will be regularly updated in accordance with the development of relevant domestic and/or international rules;

2) Initiatives to promote the understanding of governments of the countries involved in projects

- Improvement of the understanding about the Kyoto mechanisms of the governments of the key partner countries where JI and CDM projects will be conducted, through intergovernmental consultations and the implementation of projects, as well as encouragement for such key partner countries to establish transparent systems to domestic project approval procedures etc.;
 - Capacity building assistance for the potential key partner countries in JI and emissions trading so that they satisfy the participation requirements of the Kyoto mechanisms;
- 3) Contributing to the elaboration of international rules
 Given that a member from Japan has been appointed to the CDM Executive Board, Japan will pro-actively contribute to the elaboration of international rules so that they will be economically rational and ensure environmental integrity.

② Examination of the systems in view of the full operation of the mechanisms after 2008

In principle, the full operation of the Kyoto mechanisms such as transfer of credits under the emissions trading will commence from 2008. Some of the technical rules are referred to future international negotiation, and real knowledge and experience obtained with regard to the mechanisms are not sufficient.

Therefore, in the meantime the measures described in ① above will be implemented, and we will work to accumulate knowledge and experience about the actual conditions of relevant policies and initiatives in other countries and international negotiation on the rules of the Kyoto mechanisms with a view to preparing for the full use of the mechanisms from 2008 onwards.

Also, given this situation, we will continue examination of how the systems necessary for the utilization of the Kyoto mechanisms should be, and consider the necessary measures based on the results of such examination.

3.4.9 Others

(1) Promotion of understanding and publicly announcing the volume and per unit production of greenhouse gas emissions involved in project activities

Businesses conduct a variety of business activities from the manufacture, through the use, to the disposal of products, and each and every one of those activities is an emission source of greenhouse gases. In order to ensure that all businesses devise the most technologically and economically effective measures for each of these various emission sources, it is important to that the operators grasp an understanding of the current state of emissions (emission volume and per unit production) related to their business activities. Furthermore, businesses are a social presence and will be encouraged to voluntarily make public information pertaining to the current state of their emissions (emission volume and per unit production).

(2) Promotion of understanding the volume of greenhouse gas emissions involved in household energy consumption

In order for households to grasp an understanding of their own emission volumes and promote people taking concrete actions relating to these, we will promote activities such as environment and energy conservation household account books as well as examine a broad range of various types of methods to gain an understanding of what levels of greenhouse gases emissions are involved in their energy consumption, and stimulate further initiatives in households.

(3) Use of policy mix

A policy mix is one approach in order to effectively and efficiently reduce greenhouse gas emissions, by organically combining and making use of the characteristics of all of the policy measures, such as voluntary methods, regulatory methods, and economic methods.

So-called economic methods used to achieve highly cost effective reductions include guiding actions along the lines of economic rationalism by various groups through the granting of economic incentives based on market mechanism premises. However, economic methods, such as taxes and levies, should be compared to other methods and afforded continued comprehensive examination in a variety of forums while continuing to consider international cooperation to ensure that global environmental conservation results are secured appropriately from the focal points of their effectiveness in terms of environmental conservation, and of the effects on the domestic economy, such as macro economics and industrial competitiveness, and the current state of initiatives in other foreign countries.

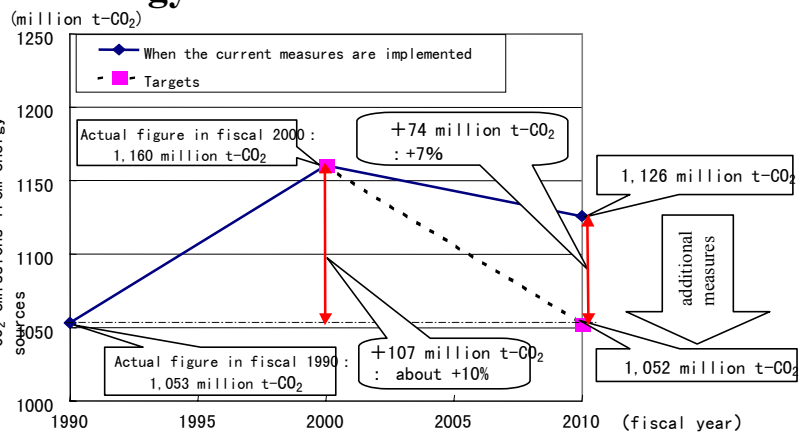
Measures to reduce CO2 emissions from energy sources

If the framework of the existing policies will be maintained, CO₂ emissions from energy sources in fiscal 2010 will be approximately 1,126 million tons of CO₂, which is 73 million tons more than fiscal 1990 (about 1,053 million tons of CO₂).

(Major reasons)

- Demand side : Energy demand mainly in the residential/commercial and transportation (passenger vehicle) sectors have increased significantly.
- Supply side : The introduction of non-fossil energy such as nuclear power has not progressed as much as anticipated when the old Guideline were established, and use of cheap coal is increased significantly.

Japan shall implement further energy conservation measures, new energy measures and other new measures such as fuel switching, as well as continuing to implement the measures stated in the old Guideline to reduce CO₂ emissions from energy sources in fiscal 2010 to the fiscal 1990 level. Japan also continues to promote its nuclear power policy.



Demand side measures

	Industrial Sector	Residential and Commercial Sector	Transportation Sector	
Energy conservation measures	<ul style="list-style-type: none"> ● Steady implementation and follow-up of the voluntary action plan (Target of the Keidanren Voluntary Action Plan on the Environment is to reduce CO₂ emissions for 2010 to no more than 1990 levels.) ● Factory measures based on the Law Concerning the Rational Use of Energy (Approx. 20.1 million kl, Approx. 60.5 million t-CO₂) 	<ul style="list-style-type: none"> ● Strengthening to improve efficiency of equipment (Approx. 5.4 million kl, Approx. 30.4 million t-CO₂) ○ Through revision of the Law Concerning the Rational Use of Energy in 1998, the Top Runner Approach has been adopted for domestic electric appliances and OA equipment (i.e. air conditioners, TVs, VCRs, fluorescent lights, copiers, computers, magnetic disc systems, refrigerators, freezers). ◆ Expansion of equipment to which Top Runner Approach applies (Approx. 1.2 million kl, Approx. 2.9 million t-CO₂) ○ Gas/oil equipment, and commercial equipment, etc. that were not previously targeted are added based on the Top Runner Approach. ◆ Promotion of distribution of high efficiency water heater (Approx. 500,000 kl, Approx. 1.1 million t-CO₂) ○ Assistance system to promote its spread has been established. ◆ Reduction of standby power consumption (Approx. 400,000 kl, Approx. 1.1 million t-CO₂) ○ A system enabling consumers to identify products with minimal electricity consumption during standby will be established in the near future. ◆ Technological development and result distribution (High efficiency lighting, Approx. 500,000 kl, Approx. 1.8 million t-CO₂) ○ Support is provided for technological development of highly efficient lighting, etc. 	<ul style="list-style-type: none"> ● Strengthening measures to improve car fuel efficiency (Approx. 5.4 million kl, Approx. 13.9 million t-CO₂) ● Promoting distribution of clean energy vehicles (Approx. 800,000 kl, Approx. 2.2 million t-CO₂) ◆ Rapid introduction of vehicles that meet Top Runner Approach through the green automobile taxation and automobile acquisition tax reduction, and accelerating the development and distribution of low emission vehicles through the procurement of low emission official vehicles by the government (Approx. 1 million kl, Approx. 2.6 million t-CO₂) ○ Following revision of the Law Concerning the Rational Use of Energy in 1998, the Top Runner Approach has been applied to vehicles. ○ Introduction of green automobile taxation ○ Extension of reduction of automobile acquisition tax ○ Establishment of fuel measuring methods to consider fuel standards of freight vehicles weighing 2.5t or more ○ Promotion of measures to replace general low emission official vehicles within about three years following FY 2002 ○ Promotion of technological development and practical proof testing for the earliest possible use of fuel-cell vehicles ○ Promoting development of next generation low emission vehicles (including clean energy vehicles) ○ Development of an IT network to promote the distribution of low emission vehicles, including clean energy vehicles ○ Provision of assistance for low emission vehicles, including clean energy vehicles ○ Support for practical use of electric vehicle joint-use system ○ Promotion of assistance to establish enhanced fuel supply infrastructure (eco stations) ○ Measures on car fuel quality to ensure sufficient functioning of the emissions post-processing system (Reduction of sulfur content from 500 ppm to 50 ppm by the end of 2004 for light oil. Further improvements such as reducing sulfur from gasoline should be pursued.) 	<ul style="list-style-type: none"> ○ Promotion of domestic sea freight and rail freight (Approx. 500,000 kl, Approx. 1.5 million t-CO₂) ◆ Review and steady promotion of current measures ◆ Studying institutional arrangements to promote freight systems with reduced impacts on the environment ○ Studying institutional arrangements including legislation to support improved efficiency of urban freight services ○ Promotion of Traffic Demand Management (TDM) proof tests that contribute to improved efficiency of urban freight services ○ Conducting proof tests to reduce environmental impact of trunk line from FY 2002 ○ Submission of proposal to the ordinary session of the Diet in 2002 to revise the law on freight transportation business to relax regulations on participation and pricing ○ Promotion of modal shift to shipping by reviewing regulations, strengthening competitiveness through introduction of new technologies and improving transport efficiency (Approx. 1 million kl, Approx. 2.6 million t-CO₂) ○ Increasing the share of domestic shipping to 44% or more by strengthening its competitiveness ○ Development of a marine highway network to reduce time for domestic shipping operations through non-stop coastal shipping services ◆ Increasing rail convenience by increasing transport capacity (Approx. 100,000 kl, Approx. 300,000 t-CO₂) ○ Increasing rail freight transportation capacity ○ Submitting a proposal to the ordinary session of the Diet in 2002 to revise the law on rail business to relax regulations on fare and participation ○ Preparation of a cold chain system of foods by rail, etc. ◆ Improving efficiency of freight services (Approx. 1.8 million kl, Approx. 4.7 million t-CO₂) ○ Reviewing current measures and effects and promoting measures as follows ○ Improving efficiency of transportation by truck (Approx. 1.1 million kl, Approx. 2.9 million t-CO₂) ○ Reduction in overland transportation of international freight (Approx. 700,000 kl, Approx. 1.8 million t-CO₂) ○ Submitting proposal to the ordinary session of the Diet in 2002 to revise the law for freight vehicle transportation business to activate freight services through deregulation ○ Promoting the use of large vehicles and trailers ○ Strengthening bridges in line with the increase in the vehicle size ○ Constructing international marine container terminals in main and core international harbors ○ Development of multipurpose international terminals ○ Preparation of joint delivery facilities of fresh foods, etc. ○ Establishing, upgrading, and central control of signals
Energy conservation effect	<ul style="list-style-type: none"> ◆ Promoting the introduction of high performance industrial furnaces (Approx. 400,000 kl, Approx. 1.1 million t-CO₂) ○ Extensive support is provided for such measures in line with the voluntary action plans and so on of companies and industries with regard to assistance systems for companies to introduce energy saving facilities. 	<ul style="list-style-type: none"> ◆ Technological development and result distribution (Highly efficient boilers, highly efficient lasers, Approx. 500,000 kl, Approx. 1.5 million t-CO₂) ○ Until fiscal 2001, support has been provided for the technological development of highly efficient lasers and so on. 	<ul style="list-style-type: none"> ◆ Review and promotion of existing measures to promote eco drive of buses and trucks, etc. ◆ Promotion of measures to reduce impact on the environment through consideration of driving style of business vehicles, etc. ○ Distribution of vehicles featuring idling prevention systems (Approx. 400,000 kl, Approx. 1.1 million t-CO₂) ○ Installation of Speed limiting device on large trucks (Approx. 300,000 kl, Approx. 800,000 t-CO₂) ○ Promotion of green management promotion by car transportation companies from FY 2002 ○ Mandatory installation of speed limiting device on large trucks (Production vehicles: from September 2003 onward, Existing vehicles in use: from September 2003 onward) 	<ul style="list-style-type: none"> ○ Measures to prevent illegal parking and stopping on roads ○ Implementation of appropriate car parking regulations ○ Establishment of a system to minimize illegal car parking and a car parking indication system, etc. ○ Promoting patrols to counter illegal car park ○ Reduction in amount of engineering work on roads (Approx. 100,000 kl, Approx. 400,000 t-CO₂) ○ Improvement of public drains, promotion of intensive engineering work and joint implementation, appropriate operation of road use permission ○ Preparation of traffic safety facilities (Approx. 200,000 kl, Approx. 700,000 t-CO₂) ○ Establishment, systemization, and improvement in signal induction ○ Increasing efficiency of traffic control ○ Promoting measures to counter bottlenecks by preparing traffic indications and rail crossing signals ○ Promoting the change of signal lights to LEDs ○ Promotion of commuting alternatives using data communications such as teleworking (Approx. 1.3 million kl, Approx. 3.4 million t-CO₂) ○ Improving data communication environment in companies, tax-related measures and financial support to contribute to introducing teleworking and support for SOHO ○ Providing information and diffusion promotion to promote teleworking and SOHO ○ Increasing energy consumption efficiency of railway transportation (Approx. 100,000 kl, Approx. 400,000 t-CO₂) ○ Increasing aeronautical energy consumption efficiency (Approx. 400,000 kl, Approx. 1.1 million t-CO₂) ◆ Promoting the development of new technologies ○ Promoting the introduction of new rail carriages and aircraft materials ○ Supporting the development of new technologies such as Super Eco-Ships ○ Research and development of new-generation energy-saving transportation
current measures:	About 50 million kl			
additional measures:	About 7 million kl			

About 22 million t-CO₂ through additional measures

New energy measures	<ul style="list-style-type: none"> ◆ Current new energy measures (New energy measure completed in 1998 aimed at introducing 19.1 million kl worth of new energy by fiscal 2010 [Estimated introduction amount in fiscal 2010: 8.78 million kl]) ○ Support at introduction stage ○ Promotion of introduction support for local authorities and businesses, etc. ○ Promotion of introduction support for photovoltaic power generation, etc. ○ Support with regard to taxation or financing ○ Support at the stages of technological development and demonstration ○ Promotion of technological developments and demonstration tests for fuel cells and photovoltaic power generation ○ Preparation of environment and awareness campaign, etc. ○ Preparation of regulations and systems ○ Promotion of awareness campaign, etc. ◆ Additional new energy measures (Additional new energy measure completed in 2001 aimed at introducing 19.1 million kl worth of new energy by fiscal 2010 (Estimated emission reduction) Approx. 34 million t-CO₂) [Targeted introduction amount in fiscal 2010: 19.1 million kl] Photovoltaic power generation: 4.82 million kW (including photovoltaic power generation for housing: estimated approx. 1 million units), Wind power generation: 3 million kW, Waste power generation: 4.17 million kW, Biomass power generation: 330,000 kW, Solar thermal utilization: 4.39 million kl (including solar thermal utilization for housing: Estimated approx. 9 million units) Unutilized energy: 580,000 kl, Thermal utilization of biomass: 670,000 kl, Black liquor, refused wood, etc.: 4.94 million kl ○ Support at the introduction stage ○ Placement biomass energy and snow ice cryogenic energy in the Law Concerning Promotion of the Use of New Energy ○ Promotion of introduction support for local authorities and companies, etc. ○ Promotion of introduction support for photovoltaic power generation, and solar thermal utilization, etc. ○ Promotion of green purchases and procurement ○ Strengthening the support for technological developments and demonstration tests, etc. concerning fuel cells, photovoltaic power generation, and biomass energy, etc. ○ Promotion of technological development and so on bearing in mind regional characteristics ○ Studying grid-connection system measures ○ Promoting the establishment of a software infrastructure for practical use of fuel cells, ○ Strengthening awareness campaign, etc. ○ Preparation of environment and awareness campaign, etc. ○ Studying grid-connection system measures ○ Promoting the establishment of a software infrastructure for practical use of fuel cells, ○ Strengthening awareness campaign, etc. ○ Measures to expand new markets in the electricity sector ○ Proposal to establish the Bill Concerning the Use of New Energy by Electric Utilities 	<p>About 34 million t-CO₂ through additional measures</p>		
Nuclear power, Fuel switching, etc.	<ul style="list-style-type: none"> ● Promotion of nuclear power generation (increasing nuclear-generated electricity by around 30% by fiscal 2010 compared to fiscal 2000) ◆ Additional measures for fuel switching, etc. such as electricity (Approx. 18 million t-CO₂) ○ Subsidization towards part of the cost of converting old coal fired power generations to natural gas power generations ○ Subsidization towards part of the cost of fuel switching such as industrial boilers expected to downsize or cut CO₂ emissions ○ Preparation of safety standards for natural gas pipelines ○ Low interest financing for domestic natural gas development projects (developing wells and linked pipelines, etc.) 	<p>About 18 million t-CO₂ through additional measures</p>		
Emission and consumptions outlook for 2010 in each sector	<p>462 million t-CO₂ (Approx. 185 million kl)</p>	<p>260 million t-CO₂ (Approx. 120 million kl)</p>	<p>250 million t-CO₂ (Approx. 94 million kl)</p>	<p>Total emissions 1,052 million t-CO₂</p>

(Note) 1. Energy conversion sector is included with total emissions.

2. ● = Current measures, ◆ = Additional measures, ○ = Current governmental measures, ◎ = Additional Governmental measures

3. kl: Energy conservation effect or introduction amount of new energy, t-CO₂: amounts of CO₂ emission reductions

4. Additional measures refer to extra measures established as of this Guideline review, or measures whose details have been completely reviewed and strengthened, while current measures covers all other existing measures.

5. Reduction amount indicates approximate estimated amount contributing to CO₂ emissions as of 2010 by energy conservation effects or introduction amount of new energy when the relevant measures are implemented.

Chapter 4

Projections and the Total Effect of Policies and Measures

4.1 Basic approach

Japan was charged by the Kyoto Protocol with the task of realizing a 6% reduction in overall emissions of greenhouse gases by 6% below the base year (1990 for carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O) and 1995 for hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆)) in the first commitment period from 2008 to 2012. On the other hand, our total greenhouse gas emissions in 1999 had already increased by 6.8% over the base year, thus requiring a reduction equivalent to 12.8%.

The Guideline of Measures to Prevent Global Warming (“old Guideline”) was established in 1998 and measures had just been adopted for the purpose of reducing greenhouse gases; however, reflecting changes in various corporate circumstances, it is not necessarily possible to expect that emissions will be reduced as planned. Therefore, a reexamination of global warming countermeasures was promoted by the concerned government ministries beginning in 2000 and, by March 2002, new Guideline of Measures to Prevent Global Warming was established setting forth quantitative targets for each measure.

In this task, emissions were predicted as of 2010, the central year of the first commitment period, premised on currently existing measures and additional measures were formulated and examined to cover insufficiencies in the goals set for each sector.

Cases for the future outlook are listed as indicated below in the same manner as those items in the Report Guideline.

Table 4.1 Setting of cases in the estimation of future outlook

Cases	Meaning
With measures	Future forecast premised on the implementation of policies and measures decided prior to the time of assessment (estimate under the old Guideline)
With additional measures	Future forecast premised on additional policies and measures expected after the time of assessment (estimate under the new Guideline)
Without measures	Future forecast with no policies or measures

The case without measures is reckoned from 1998 taking into account the fact that the major measures were drafted at that time in the old Guideline, the case with measures is reckoned from 1999 when the most recent inventory data was obtained and the case with additional measures is reckoned from 2002 when measures under the new Guideline were launched. It is moreover necessary to be aware that the case without measures, is not fixed but is revised frequently in response to changes in forecasts of the future taking into account frequent revisions of future forecasts (with no direct connection to global warming measures) for 2010 relating to various socioeconomic activities.

4.2 Future Outlook

Japanese aggregate anthropogenic carbon dioxide equivalent emissions of greenhouse gases listed in Annex A of Kyoto Protocol (hereafter, ‘total greenhouse gas emissions’) is 1,314 million tons of CO₂* in 1999. When the old Guideline was established, it was estimated that greenhouse gas emissions would increase

significantly if no special measures were taken. As a result of promoting various measures based on the old Guideline, total greenhouse gas emissions in 2010 (assuming existing measures) is estimated at about 1,320 million tons of CO₂, and it is expected to be reduced to about a 7% increase compared to the base year. On the other hand, our total greenhouse gas emissions in the base year is 1,229 million tons of CO₂*. In order to achieve the 6% reduction commitment for Japan stipulated in the Kyoto Protocol, a reduction to 1,155 million tons of CO₂ (6% off the above value) is required. Thus, in order to achieve the 6% reduction commitment stipulated in the Kyoto Protocol, we must also strive to reduce emissions by about 13% (approximately 165 million tons of CO₂) over and above existing measures.

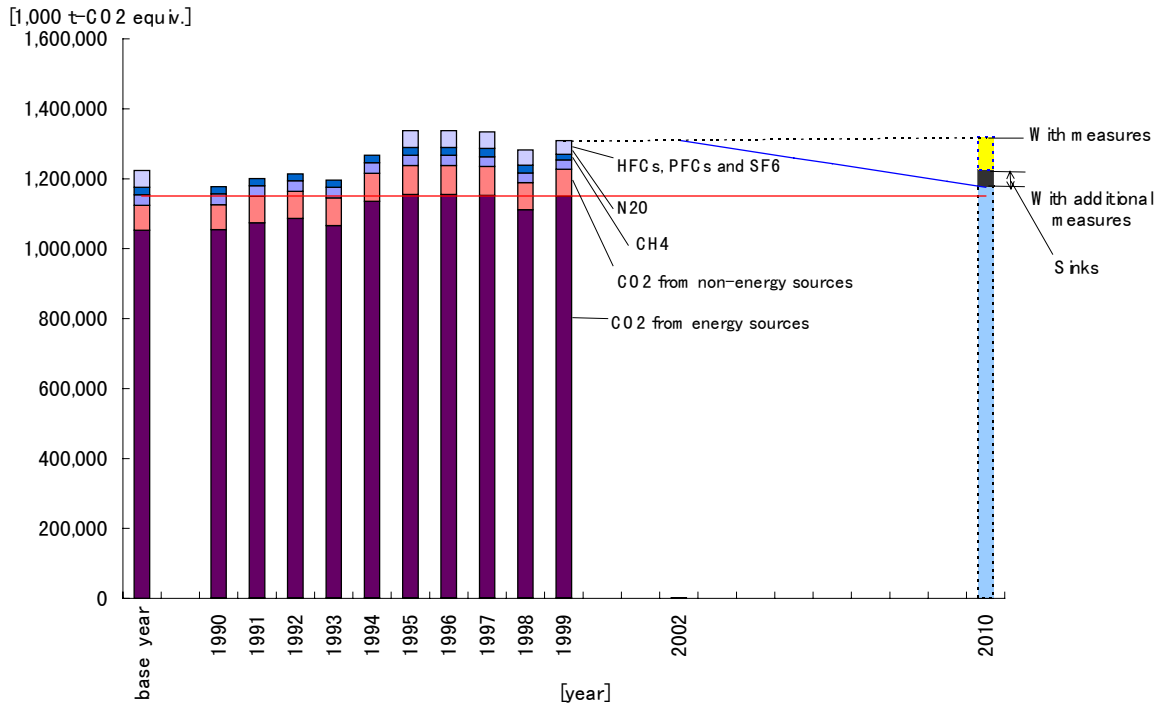


Fig. 4.1. Future outlook for the emissions of greenhouse gases

Note: Emissions from "the land-use change and forestry sector" are excluded from all gases.
HFCs, PFCs and SF6 were first recorded in 1995.
The horizontal solid line indicates the emission volume reduced 6% against the base year.

* Total emissions and removals of greenhouse gases in base years (1990 for CO₂, CH₄ and NO₂ and 1995 for HFCs, PFCs and SF6) and total emissions in 1999 were set as 1,223.8 million tons and 1,300.7 million tons, respectively, in the greenhouse gas emissions and removals inventory submitted in 2001 and in Chapter 2. However, it has become clear that the volume of waste incineration and cement production have been underestimated in the examination of emissions in the task of formulating the new Guideline and, therefore, revised figures are used.

The total effect of the additional policies and measures is 144.0 million tons of CO₂ in 2010 (corresponding to the difference between the case with measures and the case with additional measures).

Table 4.2. Actual emissions and future outlook for greenhouse gases by sector
(unit: million tons of CO₂)

Sector	Actual emissions			2010 projection			
	Base year	1999	% Change	Without measures	With measures	With additional measures	% Change
CO ₂ from energy sources	1,053	1,148	9.0%	※ ²	1,126	1,052	-0.1%
Following 3 substances	128 (123)	127 (121)	-0.1%	140	122※ ³	122※ ³	-4.8%
CO ₂ from non-energy sources	77 (72)	77 (77)	-0.3%	88	85	85	10.1%
CH ₄	29 (30)	25 (27)	-12.4%	25	24	24	-18.2%
N ₂ O	22 (21)	25 (17)	10.6%	27	16	16	-27.1%
Other greenhouse gases	48	39	-19.3%	107	73	73	51.4%
HFC	20	19	-2.7%				
PFC	11	11	-3.4%				
SF ₆	17	8	-50.1%				
Development of innovative technology, further extensive efforts by the public	—	—	—		-4	-26	—
Sinks	—	—	—		—	-48	—
Total	1,229 (1,224)	1,314 (1,307)	6.9% (6.8%)		1,317	1,173	-4.6%

※1 : Figures in parentheses () are the reported values (Chapter 2) of the inventory submitted in 2001 (refer to the footnote of 4.2. Future outlook)

※2 : Forecast for 2010 of CO₂ from energy sources (case without measures) has not been carried out.

※3 : The reason why it is 3 million tons of CO₂ less than total CO₂ from non-energy sources, CH₄ and N₂O is because there is considered to be a reduction of 2.60 million tons of CO₂ due to measures that do not specify the amount of reductions resulting from the expanded use of mixed cement, etc., in this sector in the Guideline.

4.2.1 Future outlook for CO₂ from energy sources

In the old Guideline of 1998, it has been estimated that CO₂ emissions from energy sources in fiscal 2010 will represent more than 20% increase on fiscal 1990 levels if the measures mentioned in the old Guideline were not implemented. Since 1998, we have been actively promoting measures related to energy supply and demand based on the old Guideline, but even though the framework of the existing policies will be maintained, it is estimated that CO₂ emissions from energy sources in fiscal 2010 will be approximately 1,126 million tons of CO₂, which is about 73 million tons of CO₂ compared to fiscal 1990 (about 1,053 million tons of CO₂). The reason on the demand side is that energy demand mainly in the residential/commercial and transportation (passenger vehicle) sectors have increased significantly

compared to fiscal 1990. The reason on the supply side is that the introduction of non-fossil energy such as nuclear power has not progressed as much as anticipated when the old Guideline was established, and use of coal – which relatively cheap – is expected to increase significantly.

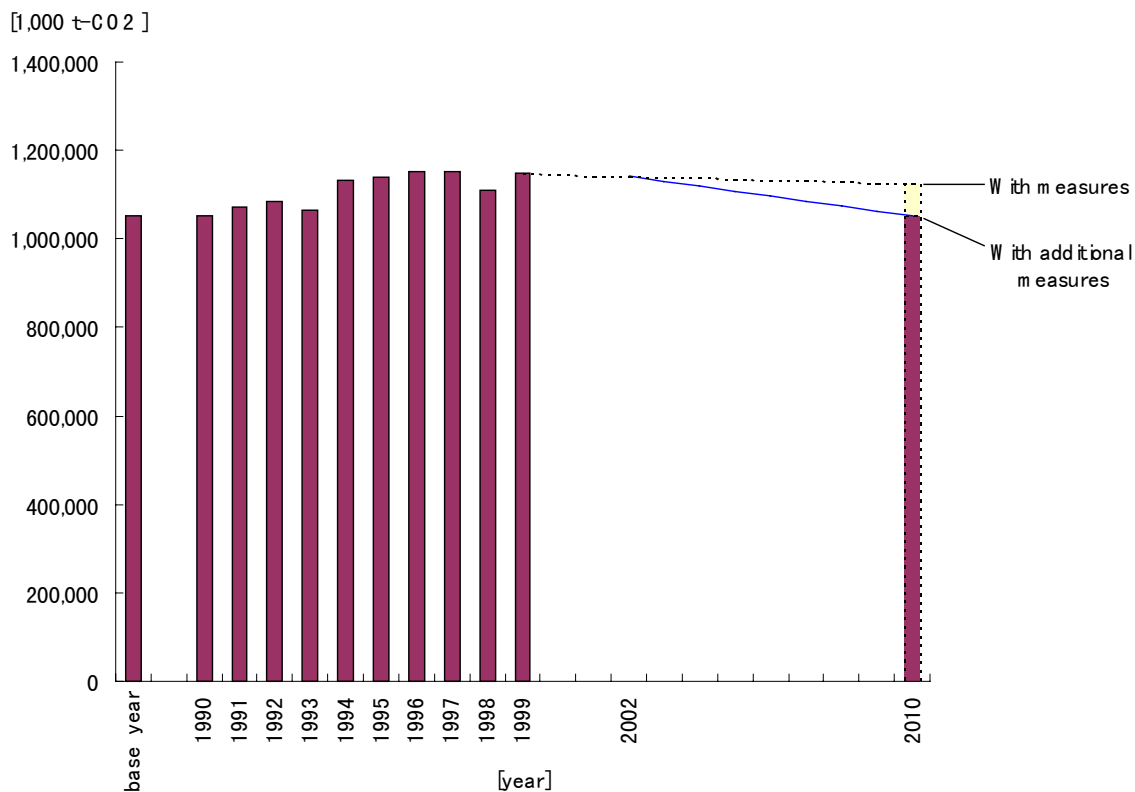


Fig. 4.2. Future outlook for CO₂ emissions from energy sources

Table 4.3. Actual emissions and future outlook for CO₂ from energy sources

(unit: million tons of CO₂)

Sector	Actual emissions			2010 projection		
	Base year	1999	% Change	Without measures	With measures	With additional measures
CO ₂ from energy sources	1,053	1,148	9.0%	*	1,126	1,052

*Forecast for 2010 of CO₂ from energy sources (case without measures) has not been carried out.

The reduction of emissions in fiscal 2010 as a result of the additional measures is about 22 million tons of CO₂ due to measures to restrain emissions in terms of demand (energy conservation measures), about 34 million tons of CO₂ for new energy measures and about 18 million tons of CO₂ for fuel switching. In addition, emissions in fiscal 2010 in each sector when these measures are implemented are about 462 million tons of CO₂ in the industrial sector (-7%), about 260 million tons CO₂ in the residential and commercial sector (-2%) and about 250 million tons of CO₂ in the transport sector (+17%) (the figures in parentheses () are the percentage of reduced emissions in each sector from fiscal 1990 to 2010). The emission reduction targets in each sector are set as benchmarks estimated to be achievable in the event that

the promotion of nuclear power conditioned on safety, measures for the introduction of new energy, fuel switching and other measures on the energy supply side demonstrate their intended effect and that the measures in each sector on the energy demand side achieve their intended effect as economic growth in Japan is achieved in line with the latent growth rate.

4.2.2 Future outlook for CO₂ from non-energy sources

CO₂ emitted through the processing of limestone and production of ammonia in industrial processes for fiscal 1999 (54 million t-CO₂) was reduced by 12.8% compared to the same emissions in fiscal 1990. The primary reason is a 12.4% reduction in cement production for fiscal 1999 compared to fiscal 1990. CO₂ emissions through incineration of waste originating from fossil fuels (waste oil and plastics, etc.) only accounts for about 2% of total CO₂ emissions, but a comparison of fiscal 1999 emissions (23 million t-CO₂) against the same for fiscal 1990 shows an increase of about 1.5 times.

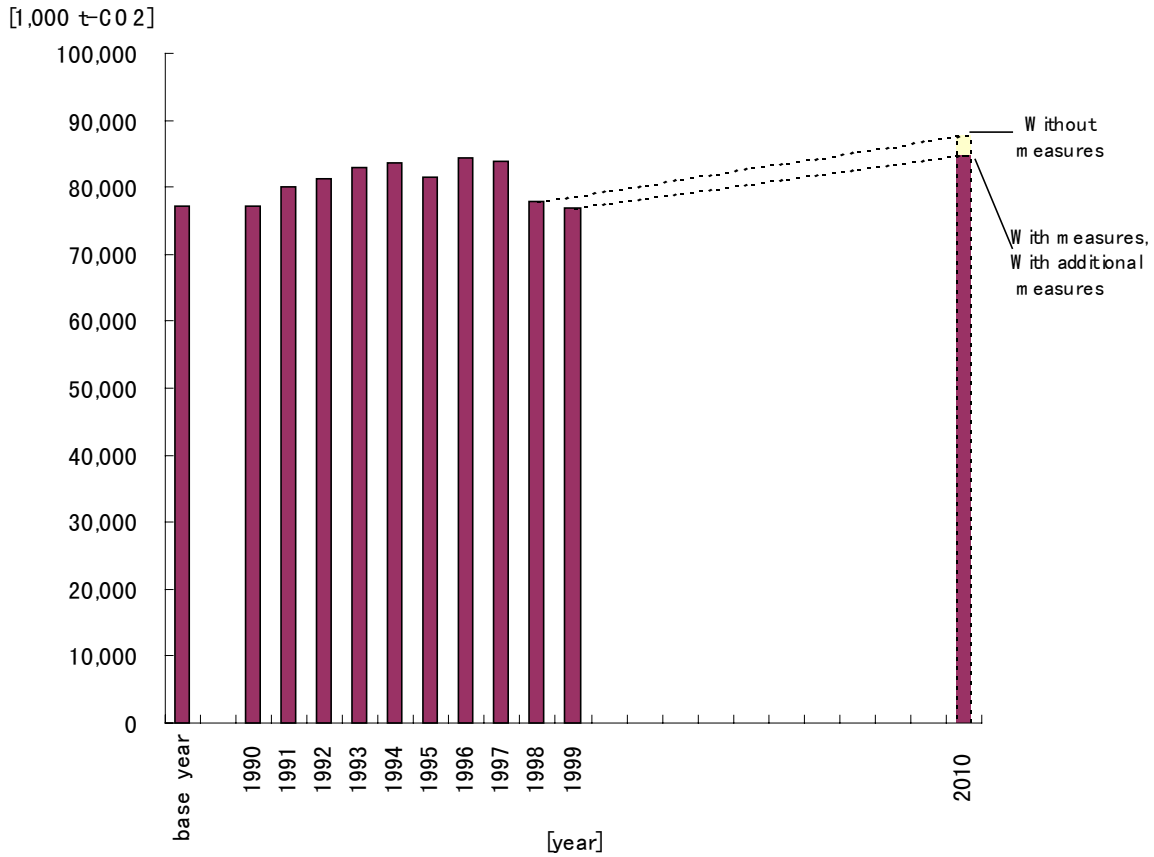


Fig. 4.3. Future outlook for CO₂ emissions from non-energy sources

Note: Though there are some additional measures in the new Guideline, individual reductions are not specified and, therefore, both the case with measures and the case with additional measures are combined here into one line.

Table 4.4 Actual emissions and future outlook for CO₂ from non-energy sources
(unit: thousand tons of CO₂)

Category	Actual emissions			2010 projection			
	1990	1999	% Change	Without measures	With measures	With additional measures	% Change
Industrial processes	61,867 (58,795)	53,969 (53,233)	-12.8%	64,109	64,109	64,109	3.6%
Waste (Waste Incineration)	15,119 (12,773)	22,816 (23,802)	50.9%	23,619	20,643	20,643	36.5%
Total	76,986 (71,568)	76,785 (77,035)	-0.3%	87,728	84,752 (No te2)	84,752 (No te2)	10.1%

Note1 : Figures in parentheses () are the reported values (Chapter 2) of the inventory submitted in 2001 (refer to the footnote of 4.2. Future outlook)

Note2 : In the same sectors as in the Guideline, a further reduction of 2.6 million tons of CO₂ is expected as a result of measures that do not specify the reduction amount resulting from the expanded use of mixed cement, etc.; however, this reduction is not subtracted from the total. CO₂ emissions in agricultural areas are not yet included in the inventories but are expected to be as soon as the calculation method is established. Measures for the reduction of these emissions are indicated in the Guideline.

The overall effect as of 2010 in the event that the current policies and measures are implemented is about 3 million tons of CO₂ (equivalent to the difference between the case with measures and the case without measures), but, as indicated in the footnote, more 2.6 million tons of CO₂ is expected as a result of the current policies and measures and additional policies and measures.

4.2.3 Future outlook for methane emissions

Methane emissions in fiscal 1999 were 25 million tons of CO₂ and there was a reduction of 12.4% compared to fiscal 1990 associated with the reduction in coal production, the reduction of rice cultivation acreage and other measures. This trend is expected to continue.

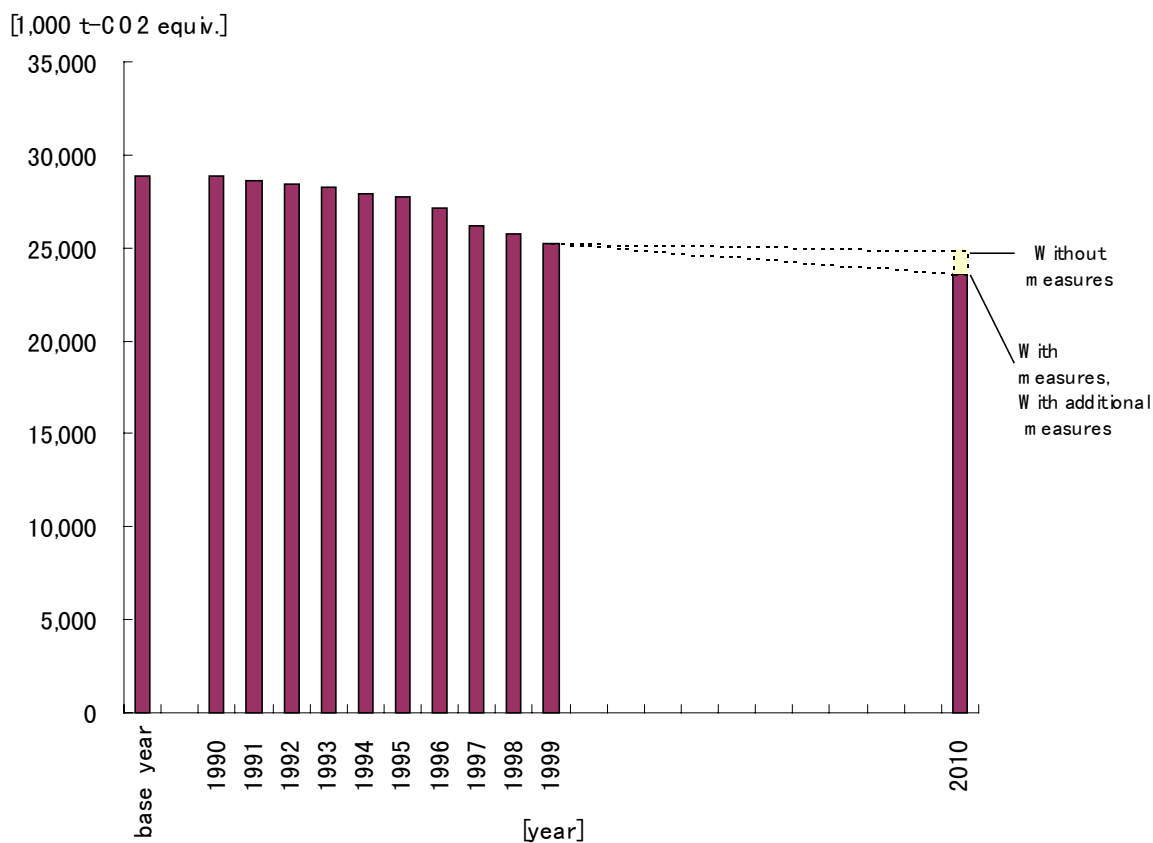


Fig. 4.4 Future outlook for methane emissions

Note: Though there are some additional measures in the new Guideline, individual reductions are not specified and, therefore, both the case with measures and the case with additional measures are combined here into one line.

Table 4.5 Actual emissions and future outlook for methane
(unit: thousand tons of CO₂)

Category	Actual emissions			2010 projection			
	1990	1999	% Change	Without measures	With measures	With additional measures	% Change
Fuel combustion activities	1,879	1,208	-35.7%	1,225	1,225	1,225	-34.8%
Fugitive emissions from fuels	3,354	2,777	-17.2%	2,693	2,693	2,693	-19.7%
Industrial processes	1,019	1,006	-1.3%	1,004	1,004	1,004	-1.5%
Agriculture	15,908	14,307	-10.1%	15,281	15,281	15,281	-3.9%
Waste	6,694 (8,279)	5,973 (7,725)	-10.8%	4,645	4,645	3,402	-49.2%
Total	28,853 (30,438)	25,272 (27,023)	-12.4%	24,848	23,605	23,605	-18.2%

Note1 Figures in parentheses () are the reported values (Chapter 2) of the inventory submitted in 2001 (refer to the footnote of 4.2. Future outlook)

The overall effect as of 2010 in the event that the current policies and measures are implemented is about 1.2 million tons of CO₂ (equivalent to the difference between the case with measures and the case with no measures). As indicated in the footnote of Table 4.4, a further reduction is expected to a certain extent.

4.2.4 Future outlook for nitrous oxide emissions

N₂O emissions in fiscal 1999 (18 million t-CO₂) fell by 21.1% compared to fiscal 1990. The main reason for the reduction in N₂O is the introduction of a decomposition equipment during the manufacture of synthetic fiber materials.

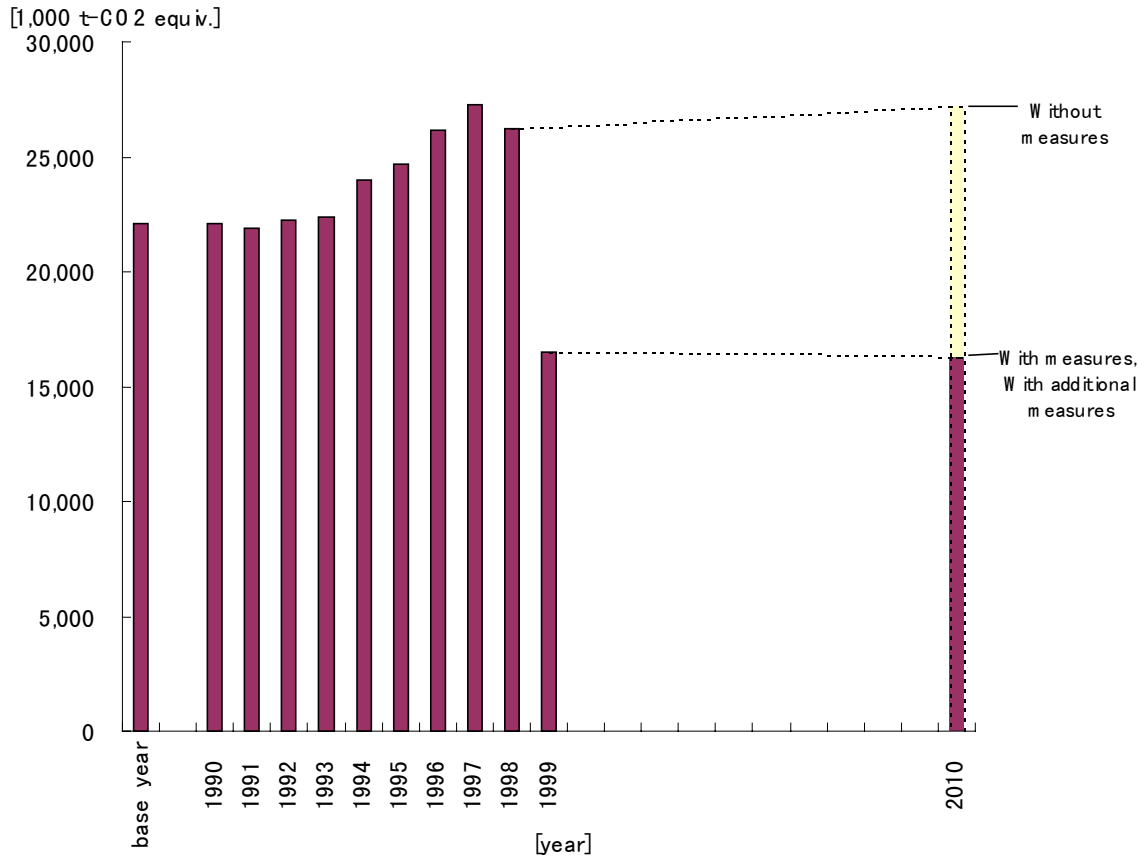


Fig. 4.5. Future outlook for nitrous oxide emissions

Table 4.6. Actual emissions and future outlook for nitrous oxide
(unit: thousand tons of CO₂)

Category	Actual emissions			2010 projection			
	1990	1999	% Change	Without measures	With measures	With additional measures	% Change
Fuel combustion activities	5,969	7,587	27.1%	7,691	7,691	7,691	28.8%
Industrial processes	7,422	1,469	-80.2%	9,980	1,238	1,238	-83.3%
Solvent and other product use	287	377	31.4%	377	377	377	31.4%
Agriculture	5,577	4,899	-12.2%	5,163	5,163	5,163	-7.4%
Waste	3,138 (1,515)	3,341 (1,952)	6.5%	3,986	1,857	1,857	-40.8%
Total	22,392 (20,769)	17,673 (16,536)	-21.1%	27,197	16,327	16,327	-27.1%

Note: Figures in parentheses () are the reported values (Chapter 2) of the inventory submitted in 2001 (refer to the footnote of 4.2. Future outlook)

The overall effect as of 2010 in the event that the current policies and measures are implemented is about 10.90 million tons of CO₂ (equivalent to the difference between the case with measures and the case without measures). As indicated in the footnote of Table 4.4, a further slight reduction is expected. Moreover, a broad reduction has already been achieved as a result of the introduction of the above decomposition equipment in 1999.

4.2.5 Future outlook for HFCs, PFCs and SF₆ emissions

Emissions of HFCs, PFCs and SF₆ have been decreasing since the base year (1995) as a result of voluntary action plans by industries; however, since they are alternatives to ozone depleting substances whose production and consumption are being phased out in accordance with the Montreal Protocol, in the event that no measures are adopted in the future, a considerable increase (total greenhouse gas emissions in the base year + 5%) would be expected as indicated in Fig. 4.6. The target is to limit the increase to total greenhouse gas emissions in the base year + 2% by 2010 by reducing the emissions by 34 million tons of CO₂.

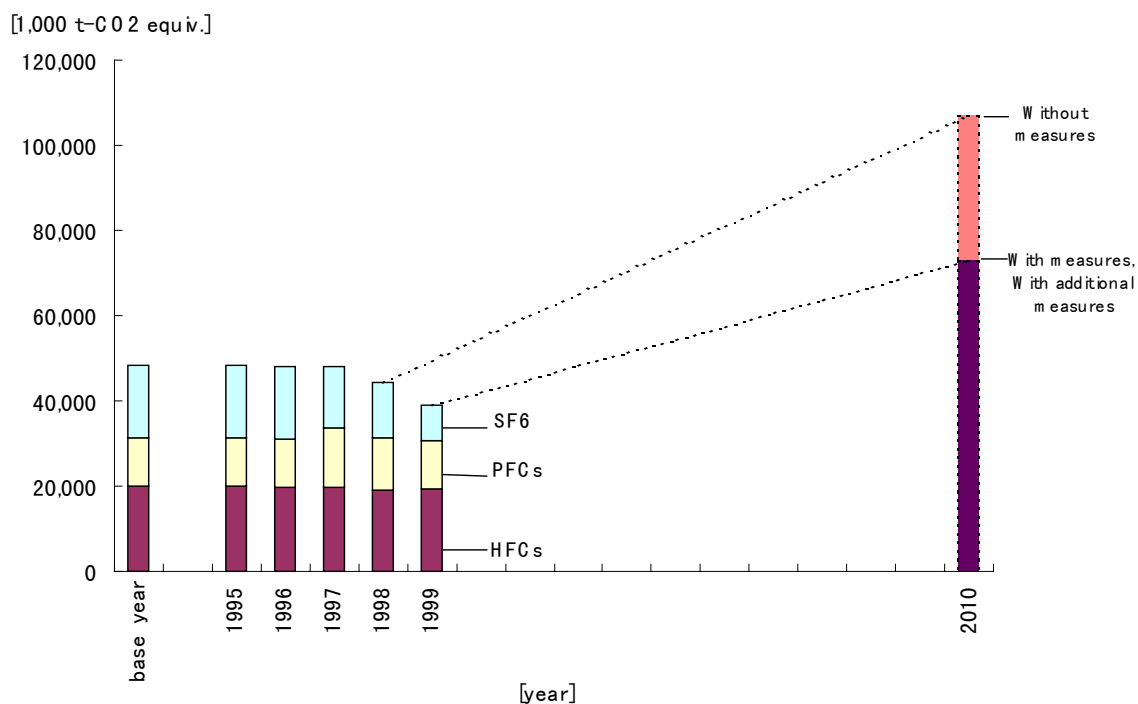


Fig. 4.6. Future outlook for HFC, PFC and SF₆ emissions

Table 4.7. Actual emissions and future outlook for HFCs, PFCs and SF₆
(unit: thousand tons of CO₂)

Category	Actual emissions			2010 projection			
	1995	1999	% Change	Without measures	With measures	With additional measures	% Change
HFCs	20,044	19,497	-2.7%	107,000	73,000	73,000	51.4%
PFCs	11,433	11,043	-3.4%				
SF ₆	16,730	8,351	-50.1%				
Total	48,207	38,891	-19.3%				

4.2.6 Future outlook for CO₂ emissions and removals in the land-use change and forestry sector

The Basic Plan on Forest and Forestry was set as a cabinet decision, in October 2001. It is approximately estimated that if the targets set forth in this plan to fulfil the multiple functions forests have and the targets pertaining to the supply and utilization of forestry products are achieved as per the plan, it is possible to ensure removals around the upper limit (47.67 million t-CO₂) of the obtainable removals through forestry management across the forests under Article 3, 3 and 4 of the Kyoto Protocol.

Since the above is an estimate based on accomplishment of the Basic Plan on Forest and Forestry and further scrutiny and examination of the calculation method is required. Also, there is a concern that if forest management, timber supply and utilization continues at current levels, the obtainable removals will fall below the above figure.

4.3 Estimation methods

4.3.1 CO₂ emissions from energy sources

Due to the need to take future economic trends as well as the balance of energy supply and demand, demand for electrical power, electrical power composition in response to fuel prices, interindustry relations and other factors into account, when estimating the emission outlook in 2010, CO₂ emissions from energy sources are calculated based primarily on the KEO model (general equilibrium model) developed at Keio University with the addition of a cumulative energy conservation factor model and an electrical power composition model and the results are verified using a regression analysis model.

The volume of emissions in 2010 in the case with measures in which the current policies and measures are implemented is estimated based on the following premises.

Table 4.8. Premises used in estimating future outlook

	Actual values		Estimated values
	1990	1999	2010
Population (per 10,000)	12,361	12,669	12,762
No. of households (per 10,000)	4,067	4,669	4,914
Working population (per 10,000)	6,384	6,779	6,953
Exchange rate level	145	114	110
Oil price (\$/bbl)	23	21	30
LNG price (\$/t)	202	183	248
Steaming coal price (\$/t)	51	35	45
Private power generation (private consumption) (%)	—	12.7	10.2

4.3.2 Emissions of CO₂ from non-energy sources, CH₄ and N₂O

Since the targets values for carbon dioxide (CO₂) from non-energy sources, methane (CH₄) and nitrous oxide (N₂O) are all stipulated together as one target value in the Guideline and industrial processes, waste, agriculture and other emission sources fluctuate virtually independently, the overall future outlook was estimated here while promoting consistency with the premises of the estimation of the future outlook for CO₂ from energy sources.

In this sector, emissions in the case without measures were first of all estimated and the case with measures was then calculated by subtracting the reduction effect of current measures. Emissions in the case with additional measures were furthermore calculated by subtracting the reduction effect of additional measures. The following three methods suited to each emission category were used to estimate the case without measures.

- ① The activity data of 2010 was multiplied by the emission intensity of 1999 in cases in which the activity data of 2010 was estimated and in which there was thought to be little fluctuation in the emission intensity unless some sort of measure is taken.
E.g., CO₂ emissions resulting from cement production
CH₄ and N₂O emissions resulting from fuel combustion
CH₄ emissions resulting from enteric fermentation of domestic livestock
- ② The estimation method considered appropriate for each category was used in cases in which the activity data of 2010 was not estimated, and, if estimated, there were fluctuations in the emission intensity due to fluctuations in the component ratio of sub-categories, etc.
E.g., CO₂ emissions resulting from waste incineration
- ③ The same emission amount as 1999 was used in cases in which there was no sizable change in emission fluctuations since 1990 and no benchmark for estimating future values.
E.g., CH₄ emissions resulting from carbon black production

Table 4.9. Premises used in estimating future outlook

		Unit	Actual values		Estimated values
			1990	1999	2010
Rice cultivation acreage		1,000 ha	2,050	1,780	1,860
Domestic livestock	Milk cows	10,000 head	207	176	180
	Beef cattle	10,000 head	280	282	317
	Hogs	10,000 head	1,134	981	929
Landfilled waste		1,000 t.	2,511	997	1,098
Incinerated waste		1,000 t.	5,833	8,828	9,125
Wastewater treatment		100 million m ³	103	126	138
Energy consumption	Total	PJ	17,331	19,089	19,346
	Petroleum	PJ	11,900	12,247	10,889
	Coal	PJ	3,368	3,922	5,265
	Natural gas	PJ	2,063	2,920	3,192

Note 1: Landfilled waste includes general waste and kitchen waste, paper, cloth, wood, bamboo and straw of industrial waste.

Note 2: Incinerated waste includes waste plastic of general waste and waste oil and waste plastic of industrial waste.

4.3.3 HFCs, PFCs and SF₆

HFC, PFC and SF₆ emissions are estimated separately and calculated using either a bottom-up or top-down method, whichever is appropriate, for each emission category while referring to industry-submitted data.

Since they are to replace substances that deplete the ozone layer set for phase-out of production and use under the Montreal Protocol, if no measures are adopted in the future, a considerable increase (total greenhouse gas emissions in the base year + 5%) would be expected. Meanwhile, by promoting implementation of voluntary action plans of industries, developing alternative substances and taking other measures (refer to section 3.4.4.), it is estimated that the amounts of emission reduction will be 34 million tons of CO₂ and total emissions will be controlled (total greenhouse gas emissions in the base year + 2%) in 2010.

4.3.4 CO₂ in the land-use change and forestry sector

The specific detailed methods (Good Practice Guidance) is supposed to be developed by IPCC in calculating carbon removals by forest ecosystems. The present approximate estimation is calculated by deriving net growth by subtracting amount of harvested wood from the gross amount of growth of the target forests of Article 3.3 and 3.4 of the Kyoto Protocol based on the target values for 2010 as set forth in the Basic Plan on Forest and Forestry, and converting this value to CO₂ by multiplying conversion factor. The calculation method will require further examination taking into account the Good Practice Guidance to be prepared in the future.

Table 4.10 Primary numerical premises used in the calculation of removals outlook
(Case with additional measures)

Forest area (2010)	25.1 million ha
Timber supply (2010)	25 million m ³
CO ₂ conversion coefficient	1.25t-CO ₂ /m ³

4.4 Future outlook for CO₂ emissions from international bunker fuel sold in Japan

Carbon dioxide emissions from international aviation bunker fuel sold in Japan in 2010 were estimated. The estimations are based on the following assumptions.

- 1 International aviation transport arriving in and departing from Japan is as indicated in the table below, when the domestic economic growth rate of Japan through 2010 is 2.2% p.a. (high case) and 1.8% p.a. (low case).

Table 4.11. Actual international air transport volume in 1995 and estimates for 2010 arriving in and departing from Japan

	No. of passengers (10,000 person)	Cargo volume (1,000 tons)
Actual figures, 1995	4,357	2,126
Low case	6,944	3,463
High case	7,818	4,009

Source: Report of Transport Policy Council, "Basic direction of comprehensive transport policies for the early 21st century"

- 2 The average transport distances of passenger and freight transport were estimated from average values for the periods 1985-1999 and 1990-1999, respectively.
- 3 Carbon dioxide emissions per revenue ton-kilometer were estimated from the average value for the period of 1985-1998.

CO₂ emissions in 2010 originating in international aviation bunker fuel sold in Japan based on the above assumptions is estimated to be 27.93 – 31.85 million tons of CO₂.

It should be noted that, for the following reasons, uncertainties exist in the above estimate.

- 1 The estimation of transport volume is based on an assumption that the annual economic growth rate through 2010 in Japan is 2.2% and 1.8%. However, these rates may have some uncertainties because (i) the economic growth rates themselves may have uncertainties, (ii) although it is expected that CO₂ emissions per revenue ton-kilometer may decrease with the technological innovation, the values were assumed to be same as the present average values. These uncertainties in the assumptions would cause uncertainties in the projections.
- 2 The transport volume used in the present estimation is the transport volume on international routes arriving in or departing from Japan. There is a possibility the effect of international transport arriving

into Japan, which is fuelled overseas, is not eliminated, when CO₂ emissions are estimated from bunker fuel sold in Japan.

Regarding oceangoing shipping sector, it was not possible to find a correlation between various indices relating to oceangoing shipping arriving in or departing from Japan and the volume of sales in Japan of marine bunker fuel for oceangoing shipping. This is possibly due to the fact that locations where oceangoing vessel refuel are not necessarily at ports of arrival and departure, and the ship may select fuelling locations at low prices along its route. It is not possible therefore to report estimations of CO₂ emissions from bunker fuel for oceangoing shipping sold in Japan.

Table 4.12. Actual emissions and future outlook for CO₂ associated with international bunker fuel sold in Japan

(unit: million tons of CO₂)

Sector	Actual emissions			2010 projection			
	1990	1999	% Change	Without measures	With measures	With additional measures	% Change
International aviation	13	19	40.5 %	28~32	—	—	—
Oceangoing shipping	17	17	-0.2 %	—	—	—	—

Source: Estimates by the Ministry of Land, Infrastructure and Transport

Chapter 5

Vulnerability Assessment, Climate Change Impacts and Adaptation Measures

This chapter is a summary of the present knowledge and understanding regarding the projected impacts of climate change in Japan. Specifically, this chapter reviews the results of research being conducted on climate change in Japan (please refer to Chapter 7) and presents quantitative evaluations of the projected impacts.

Research to date indicates that climate change may have a major effect on Japan's agriculture, forestry, fisheries, water resources, coastal management, natural ecosystems, and human health. For example, it is estimated that, due to global warming, the number of typhoons will decrease and their maximum intensity will increase slightly. In terms of rice cultivation in paddy fields, it is estimated that the production volume will increase in upper latitudes while problems may occur with growth due to higher temperatures in lower latitudes. It is thought that demand for water supply will increase by 1.2 ~ 3.2 percent per 3°C increase in temperature. Furthermore, it is thought that heat stress will increase due to higher temperatures in summer, with effects also seen on human health due to increased vectors and improved growth conditions for pathogenic organs and parasites.

Meanwhile, several important items are considered to be issues for future research but are not addressed in this report. These include forecasting climate changes per area, and indirect effects on Japan's socioeconomic system such as problems with importing foodstuffs, energy, and other resources. It is also clear that climate changes will have a massive effect on natural ecosystems, but at present it is extremely difficult to quantitatively assess such an effect.

Thus, among the vast and diverse impacts of global warming, this chapter only addresses a small number of items for which concrete research results have already been obtained. Accordingly, in using this report for evaluating performance under Article 4.1 (b) and (e) of the Framework Convention on Climate Change, it is important to recognize that there could be serious impacts from global warming that are not discussed herein.

5.1 Impacts on Japan's Climate

5.1.1 Impacts on Temperature

The potential impact of global warming on Japan's climate is evaluated based on projections made from experiments using 11 coupled atmosphere-ocean general circulation models (CGCMs) at nine of the world's leading research institutes.¹⁾

The experiments with 11 models indicate that when an increase in atmospheric concentration of carbon dioxide by 1 percent per year (compound) is assumed (or in cases IS92a scenario), the annual mean surface temperature would increase by +4°C in southern Japan and + 5°C in northern Japan over the 100 years. The experiments also indicate that the annual mean global surface temperature would increase by +3.6°C, which would be slightly lower than that around Japan. The differences of temperature increase among the models are within the range of about 2°C in and around Japan.

5.1.2 Impacts on Meteorological characteristics of Japan

The results of climate model projection are summarized as follows, although we cannot discuss in details due to coarse spatial resolutions of the coupled atmosphere-ocean GCMs and a limited performances of current regional climate models:

- During winter, Asian monsoon will become significantly weak, but there are large inconsistencies in predicted precipitation among models.
- Many models show that precipitation will increase during the summer monsoon in India. As for changes in summer rainfall in East Asia, many models show an increase if only greenhouse gases increase is taken into account, but no consistency is shown among models when the effects of aerosols are also considered.
- Uncertainties are still large on changes in typhoon behaviors due to global warming. However, it is estimated that the number of typhoons will decrease and their maximum intensity will increase slightly. The amount of precipitation produced by typhoons is estimated to increase by 10 - 30 percent.

(Note 1) Canadian Center for Climate Modelling and Analysis (CCCma); Center for Climate Research Studies (CCSR), University of Tokyo / National Institute for Environmental Studies (NIES), Japan; Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO); Deutsches Klimarechenzentrum (DKRZ), Germany; Geophysical Fluid Dynamics Laboratory (GFDL), USA; Hadley Centre for Climate Prediction and Research (HCCPR), UK [2 types]; Max Planck Institute for Meteorology (MPIfM), Germany; Meteorological Research Institute of the Japan Meteorological Agency (MRI), Japan [2 types]; and National Centre for Atmospheric Research (NCAR), USA

5.2 Impacts on Agriculture, Forestry and Fisheries

5.2.1 Impacts on Agriculture

Blessed with a mild climate and abundant precipitation averaging 1,800 mm per year, Japanese agriculture has supported a large population, primarily through the production of rice, despite the nation's relatively small land resource. Since 1950, Japan's agricultural technology has progressed rapidly through the development of new varieties, fertilizers, agricultural chemicals, and agricultural machinery. The advance of agriculture has also been supported by farm land consolidation. As a result, contemporary Japanese farming takes place under highly sophisticated management. Nevertheless, agricultural production is already significantly influenced by climate change, and future global warming is projected to have a severe effect on the nation's agriculture in general.

Rice is staple crop in Japan, accounting for more than 90 percent of the total grain production, most of which is cultivated in paddy fields. 9 million tons of rice is produced on 1.7 million hectares of paddy fields. It is expected in general that production will increase in relatively high latitude due to global warming, while problems will occur at lower latitudes due to high temperatures. In order to maintain the same amount of production as at present, the cultivation period will need to be brought forward in the Tohoku and Hokkaido regions, and delayed in other regions.

Recent studies have evaluated the effects of increased carbon dioxide finding that the number of days from seeding to the heading for the current varieties will be reduced by about 5 percent if the density of carbon dioxide is doubled, and the weight of dried products and harvested crops will increase by about 25 percent. However, some negative effects are anticipated when various factors are considered, for example, the increase in sterility due to high temperature when carbon dioxide density is high.

The effects on crop cultivation other than rice are as follows. With wheat, the length of time until the heading is shorter when cultivated at higher temperature. As a result, for wheat sown in winter, the maturity period (period during which the seeds grow) is in early spring when the temperature rapidly changes, so it is thought that risks related to low temperature cultivation are high. As for soybeans, it has been proved that their growth is restricted if the ground temperature around their roots increases. It has also been proved that for corn, there is a risk of sterility if temperature is too high during the latter half of its growth period.

5.2.2 Impacts on Forestry

Even though the percentage of non-forest land such as agricultural, industrial, and residential has increased, Japan is covered with forest of 252,300 km², or 67 percent of the national land area, which is far more than the international average of 29 percent. In terms of the effects of global warming, if we consider Sugi (Japanese cedar : *Cryptomeria japonica*) as a representative example of tree species, higher temperatures and longer periods of sunshine may offer some advantageous effects, but worse water-related conditions resulting from increased temperatures may cause reduction of growth rate and death of old trees generally due to dehydration. Furthermore, increased temperature may cause an expansion in areas blighted by diseases and pests.

Although numerous points concerning the effects on forestry have not been analyzed yet, it may have an effect on forestry as an extremely long period of time is required to nurture forestry resources, and function for the public benefits from forests such as conservation of headwaters may be hindered as a result.

5.2.3 Impacts on Fisheries

The subtropical Japan Current (*Kuroshio*) and the subarctic Kurile Current (*Oyashio*) meet in Japan's coastal waters, which provide the habitat for a rich variety of fish and make for some of the most productive fishing areas on Earth. The most direct effect from global warming is projected to be changes in epipelagic fish resources. Japan's future fishery production will mostly depend upon changes in the course and flow of the Japan Current caused by global warming.

As for phytoplankton, it is expected that species that used to live in the lower latitudes will appear in seas nearer Japan in line with increased water temperatures. When the stratification is strengthened in line with increased water temperatures and the supply of nutrients from such stratification becomes more difficult, a transition from large diatoms to small flagellum alga is expected. Furthermore, it is expected that the production capability of the Sea of Okhotsk will degenerate as the amount of ice algae attached to ice in the sea declines in line with the reduction in the actual amount of ice in the sea.

It is expected that zooplankton will be smaller in line with any increase in water temperature. If warmer winters continue in line with increases in the water temperature, the number of jellyfish that can survive the winter increases, and the fishery value of coastal waters may decline due to competition with sardines, which are rivals at the effective stage of the food chain.

5.2.4 Impacts on Food Security

If Japan's food security is threatened, the followings may occur in Japan. New harmful insects will rapidly be produced in line with any warming, abnormal weather will become more frequent, and rainfall patterns will change markedly. However, accurate forecasting is difficult based on existing data. It is thought that drought will be occurred by global warming, and the harvests will reduce in major countries and areas from which food is exported. That has the possibility to cause a very great influence in Japan in which the self-sufficiency ratio is low. Soybeans, corn and wheat are very dependant on rainfall and their crop status rapidly changes. Slight climatic changes may cause significant fluctuations in production and chaos on the market, leading to irregular supply of various other agricultural products.

5.3 Impacts on Hydrological Conditions and Water Resources

5.3.1 Impacts on Hydrological Conditions and Water Resources

Despite abundant precipitation, it is difficult for Japan to fully utilize its water resources due to its physical constraints. The precipitation varies greatly by time and place, and the nation's rivers are short and steep, with relatively small catchment basins. Numerous studies using warming scenarios and long-term discharge models have been carried out. The following conclusions have been gained from such research so far.

- The effects on flow from a 10 percent change in precipitation are greater than those from a 3°C temperature increase.
- If a 3°C temperature rise is accompanied by a 10 percent increase in precipitation, on average the flow will not decline significantly in low-flow conditions and will increase by about 15 percent in high-flow conditions. However, if evaporation and melting winter snow are excessive, even though rainfall increases by 10 percent, highland flow may decline.
- Temperature increases lead to less snowfall and earlier snow melting. As a result, the flow will increase from January through March, and decrease from April through June.

It is important to analyze the relationship between water demand caused by various human activities, natural water resource systems, and artificial water resource systems such as dams to consider the effects on water resources. It is considered that water supply demand would increase by 1.2 - 3.2 percent per 3°C increase in temperature.

5.4 Impacts on Social Infrastructure and Economy

5.4.1 Characteristics and Impacts on Coastal Zone in Japan

Japan is an island nation with long coastlines, and the nation's population and economic activities are concentrated in coastal zone. Accordingly, there is great concern about the possible effects of rising sea levels and increasingly frequent storm surges on the nation's natural environment and socioeconomic system. The existing social infrastructure and socioeconomic system has been optimized for the present climate conditions. With global warming, the effects from higher sea levels and temperatures and from changing precipitation and typhoon patterns would be serious and wide-ranging.

The functions and stability of shore protection facilities (facilities and equipments for countermeasures against disaster) will be degraded in the event of raised sea levels. Waves will pound harder on embankments, and revetments will need to be higher while overtopping quantity will also increase. In order to maintain safety at the current level, coastal embankments will need to be raised by 2.8 meters per one-meter increase in sea level, while quaywalls within bays will need to be raised by 3.5 meters. It is anticipated that global warming would have a deleterious effect on all types of social infrastructures located in coastal zone including harbors, fishing port facilities, man-made islands, reclaimed land, inland water drainage and sewerage systems, etc.

In particular, rising subterranean water tables may lower the loading strength and liquefaction resistance of the subsoil. Many social infrastructure facilities and buildings are concentrated on weak ground in coastal areas, so any increase in the risk of loading strengths and liquefaction resistance of subsoil in the event of an earthquake would cause serious problems for urban safety.

At present, about two million people reside on the 861 km² of Japanese land which is located below the high water level, and 54 trillion yen of assets have accumulated in these areas. If sea levels rise by one meter (slightly higher than the 88 cm projected for the global mean rise in 2100 under the highest case scenario of the IPCC Third Assessment Report), the land area below the high water level will increase by more than 2.7 times to 2,339 km². The susceptible population and assets will grow to 4.1 million people and 109 trillion yen.

5.4.2 Economic Assessment on Social Infrastructure in Coastal Zone

Potential damage through flooding in harbor areas in Japan, and fees to maintain the functions and stability of port and harbor facilities, and coastal structures have been estimated. 7.8 trillion yen will be required to maintain port and harbor facilities, and 3.6 trillion yen will be required to maintain coastal structures, giving a total of 11.5 trillion yen if sea levels were to rise by one meter, which is close to the 88 centimeters projected as the global mean rise in 2100 under the highest case scenario of the IPCC Third Assessment Report.

5.4.3 Impacts on Industries and Energies

According to an analysis, one direct effect on human habitation is that the consumption mechanism will change. It is estimated that if the average temperature between June and August increases by 1°C, consumption of summer-related goods will increase by about 5 percent.

40 percent of electricity demand in summer relates to air conditioner use. When the temperature goes up by 1°C, electrical demand increases by about 5 million kW (equivalent to normal use in 1.6 million typical houses). It is estimated that demand for electricity in summer will increase in line with increases in factory operations resulting in increased production of summer-related goods and thus an increase in demand for air conditioners in cities.

Global warming also has various other effects on electricity supply. Changes in snow and rainfall will have significant effect on the generation of hydropower. Furthermore, it is estimated that changes in river and sea water temperature will have an impact on the operational efficiency of power generators at thermal and nuclear power plants where such water is used as a coolant.

5.5 Impacts on Nature

5.5.1 Vulnerability of Japan's Natural Environment

Japan is blessed with a great variety of natural environments. The nation's forest ecosystems occupy diverse climate zones that range from subtropical to subarctic and are located in close proximity to one another. If global warming results in an average temperature rise of 3°C over the next 100 years, existing ecosystems will have to move approximately 500 kilometers to the north or to altitudes about 500 meters higher than at present. This is equivalent to an annual movement of five kilometers or an altitude gain of five meters per year, respectively. It is not possible to make a simple projection of how the ecosystems will respond to this change because each species has a different environmental tolerance and a different capacity for migration, and because of the competition with existing ecosystems.

Moreover, there are numerous obstacles that may interfere with the migration of ecosystems. Japan is geographically complex, with many intricate mountain folds, and also geologically diverse. Other obstacles include ocean straits, cities, roads, and railroads. These may represent major restrictions when biota and ecosystems try to adapt to global warming. Species which are isolated in small habitats may find it impossible to migrate and become extinct.

Lake, marsh, and coastal ecosystems located adjacent to densely inhabited districts are already subject to stress from human activities, and experts have noted that such ecosystems are highly sensitive to the additional stresses that will be brought about by global warming. For all of these reasons, it is currently nearly impossible to conduct a macro-scale quantitative evaluation of the effects of global warming on Japanese ecosystems.

5.5.2 Impacts on Mountainous Ecosystems

One of the major factors in deciding the blooming period for many alpine plants is when the snow melts. Changes in the amounts of snow falling due to global warming have not yet clarified, but if temperatures increase when the snow melts, it is anticipated that this will affect the timing of any future blooming.

Recently, the outer fringes of '*Hai-matsu*' pine tree branches have died off in early spring mainly in the Chubu mountainous region as well as in Hokkaido. One reason that has been suggested for this is that the diminished protection offered by the snow in line with the reduced snowfall.

5.5.3 Impacts on Forest Ecosystems

Japan lies in the monsoon region of East Asia between latitudes 25 degrees and 45 degrees north, extending 3,000 kilometers from north to south. The quantity of precipitation in Japan is sufficient for the establishment of forests. One characteristic of Japan is that changes in snowfall resulting from global warming would have a significant effect on the spread of forests and the composition of species as well as a direct effect on the temperature.

Buna (beech : *Fagus crenata*) forests, typical in cool-temperate zone, are located in cool, moist areas or those with lots of snow. On the other hand, Mizunara (Japanese oak : *Quercus crispula*) forests are located in drier areas or regions with less snow. However, as a result of global warming, even in areas which will remain relatively cool in temperature terms, the climate will be drier with reduced snowfall due to the general increase in temperature, and the buna (beech) forests may be replaced by other type of forest such as mizunara (Japanese oak) forests, while the southern limits of buna (beech) forests may change to evergreen broad-leaved forests. For example, it is expected that most of the beech forests in western Japan will be outside the appropriate area.

Movement of insects to higher latitudes and altitudes has already been recognized as a result of global warming. Under such circumstances, the existing environment will be fundamentally altered and – as the movement of plants is comparatively difficult – so the extinction of insects in unique environments (such as high in the mountains), and species whose distribution is restricted by temperature give cause for concern, such as increased damage of the Pine wilt disease caused by the pine wood nematode (*Bursaphelenchus xylophilus*) resulting from the expanding inhabiting area of the Japanese Pine Sawyer (*Monochamus alternatus*).

Areas inhabited by larger mammals such as Sika Deer, Japanese macaque, and wild boar have recently been expanding. It is thought that this is mainly because the amount of snow falling and the duration of its cover have been reduced due to climate changes. In little snow conditions, due to rising the survival rate of wildlife, their numbers will increase and their habitat will expand. This may result much damage to agriculture and forestry.

5.5.4 Impacts on Grasslands

Most natural grasslands in Japan have been subjected to natural or artificial pressures in some way. Thus, the relationship between grassland vegetation and climatic factors were unknown until now. Therefore, vegetation zone classification has been studied based on the relationship with climatic factors, and the results were standardized based on temperature and snowfall measurements. Changes in the vegetation zone at the global warming stage created based on such criteria were estimated.

According to the estimate, subarctic zone vegetation will become extinct in the Ishikari lowlands or southern area within about 50 years, and vegetation typical of cool temperate regions will become extinct in Kyushu, Shikoku, and the Kii peninsula, while subtropical vegetation will appear at the southern tip of Kyushu. After 100 years, subarctic vegetation will become extinct everywhere except in mountainous areas of Hokkaido, cool temperate vegetation will be reduced to only mountainous areas in Honshu, warm temperate vegetation will occupy most of Honshu, and subtropical vegetation will expand to low-lying plains in Kyushu, Shikoku and southern Honshu.

5.5.5 Impacts on Biodiversity

In particular, there is concern that global warming will affect species whose distribution is geographically restricted in Japan. For example, this applies to many species of yakutanegoyo (*pinus armandii var amanminana*) found only on the Yakushima and Tanegashima islands, most of which are struggling to survive. It is considered that plants unique to the temperate zone in the southwestern islands and other small islands may face a critical situation due to global warming.

5.5.6 Impacts on Coral Reefs

Japan's coral reefs are at the northern extremity of global distribution. Higher water temperatures from global warming will have a positive effect on coral growth.

However, the maximum rate of coral growth in the past has been about 4 meters per 1,000 years. If the rate of sea level rise exceeds 40 centimeters per 100 years, coral growth cannot keep pace, and it too may wither. The optimal water temperature for hermatypic coral to grow is between 18 and 28°C, so if the water temperature peaks at 30°C or higher, the coral will die and bleach out. Just before and after the El

Nino phenomenon occurred in 1997 to 1998, large-scale destruction of coral reefs – as evidenced by its whitening – was seen in most seas throughout the world, including those around the Okinawan islands.

5.5.7 Impacts on Mangroves

Mangrove ecosystems, whose north limit is at Kiire in Kagoshima prefecture, are located along shorelines, and they neutralize the interaction between sea and land. If the rate of sea level rise is 50 centimeters or less per century, their ecosystems can be maintained through the accumulation of their own corrosion and so on. In the case of tides, there is at least a 2-meter difference between high and low tides, so even if the sea level rises by about 50 centimeters per 100 years, most of the area will be at a depth above the average sea level, so mangroves can be maintained. Large-scale mangrove distribution around Iriomote Island will shift in line with raised sea levels in the near future, and it is anticipated that vegetative distribution within the forest will also change.

5.5.8 Impacts on Desertification

There is currently no danger of desertification in Japan. However, climatic change caused by desertification on the Eurasian continent may indirectly affect the climate in Japan.

5.6 Impacts on Human Health

Global warming may directly affect human health via the increased heat stress from high temperatures during the summer months. The indirect effects on human health may include conditions promoting the growth of parasites, pathogens, and creatures that function as carriers of infectious diseases. Global warming may also harm human health via the increase of photochemical air pollution.

5.6.1 Direct Impacts from Increased Heat Stress

The direct effects on human health from increased heat stress include higher incidences of heat stroke and thermoplegia, and research is being conducted in these fields.

Studies show that the number of heat stroke and pneumonia patients amongst the elderly (65 and older) whose capability to handle heat is lower will increase in line with the rise in maximum temperatures recorded in summer in a relationship between high-risk ailments, maximum daily temperatures, and air pollution. It has already been clarified that there is a V-shaped relationship between the maximum daily temperature and the mortality rate amongst the elderly. Studies have shown that the V shape shifts in the higher temperature direction in line with increases in temperature.

5.6.2 Indirect Impacts from the Spread of Infectious Diseases via Animal Vectors

Global warming will expand the habitat and activity periods of animals that serve as carriers of infectious diseases. This may result in increases in the number of cases of malaria, dengue fever, and other infectious diseases carried via animal vectors. The areas where these diseases occur may expand.

In Japan, the northern limit of the habitat of the anopheles, the mosquito which carries malaria, is said as Miyako Island and Isigaki Island. However, so that their habitat will go north and their activity will become active as a result of global warming, it will have the possibility of increasing malaria in subtropical zone of Japan

5.7 Adaptive Measures

While various measures, including the restriction of greenhouse gas emissions, are being implemented to

arrest global warming, the Framework Convention also calls for measures to mitigate the adverse effects of climate change and for adaptive measures that will facilitate adaptation to climate change. With this in mind, Japan is studying adaptive measures related to coastal areas, social infrastructure, and agricultural production.

5.7.1 Countermeasures for Coastal Zone and Social Infrastructure

As proposed by the IPCC, there are three countermeasures, namely, deliberate withdrawal, adaptation, and prevention. In Japan, where coastal land is used to the maximum, adaptation and prevention on assumption of continuous use of risky areas must be considered the main priority. There are a variety of strategies from software-related ones such as planning and systems to hardware-related ones such as physical structures, so studies must be promoted with a view to the future to minimize any effects.

In order to better understand the trend of increasing sea levels for ports, harbors, and coasts, continuous monitoring must be undertaken by each organization, and the observation results must be evaluated regularly.

5.7.2 Countermeasures for Agriculture

It is anticipated that global warming will have an effect on future domestic agricultural production. Any environmental changes can be adapted to by developing varieties better suited to the changed climate, and by changing crop types and cultivation methods.

References

- 1) IPCC (2001): The IPCC Third Assessment Report
- 2) Global Warming Impacts Assessment Working Group, Committee for Studying Global Warming Issues, Ministry of the Environment(2001): Environmental and Socio-economic Impacts of Climate Change in Japan 2001
- 3) Nishioka, S and Harasawa, H ed. (1997):, Global Warming and Japan, Kokin Shoin (in Japanese).

Chapter 6

Financial Resources and Transfer of Technology

In June 1992, the Cabinet adopted Japan's Official Development Assistance Charter (the ODA Charter), which spells out the philosophy and principles of Japan's official development assistance. The ODA Charter includes environmental conservation as a basic philosophy underlying Japanese aid and states that "the pursuit of environmental conservation and development in tandem" must be one of the basic principles of ODA. Japan's 'Medium-term Policy on ODA' published in August 1999, also lists environmental conservation as a priority task. By so doing, the government of Japan tries to realize sustainable development on a global scale through assisting the self-help efforts of developing countries.

While bearing the above points in mind, Japan's environmental cooperation follows Initiatives for Sustainable Development toward the 21st Century (ISD) announced in June 1997 at the Special Session of the United Nations General Assembly for the overall Review and Appraisal of the Implementation of Agenda21 (UNGASS). In particular concerning global-warming issue, which threatens sustainable development on a worldwide scale, the government of Japan announced the Kyoto Initiative on aid for global warming programs in developing countries during the Third session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP3) held in Kyoto in December 1997. Under the Initiative, the government of Japan provides active support for global warming programs and projects.

The Basic Environment Law stipulates that the government must endeavor to take all necessary measures to promote international cooperation for the conservation of the global environment as well as specifying the promotion of international measures by demonstrating international initiatives as a leader in international society for global environmental conservation under the 'Basic Environment Plan' (2000) drawn up on the basis of the Basic Environment Law. Also, the 'Guideline of Measures to Prevent Global Warming (2002)' specifies the promotion of international cooperation in the field of global warming-related measures.

6.1 Measures Concerning New and Additional Financial Resources pursuant to Article 4.3 of the Convention

6.1.1 Comprehensive Assistance for Arresting Global Warming

- Cooperation with the Global Environment Facility (GEF)

The GEF 1 (1st phase) was initiated in 1994. Total funding for GEF 1 is US\$ 2.02 billion over four years, of which Japan has contributed US\$ 410 million. From 1998, GEF 2 (2nd phase) started with total funding for four years of US\$ 2.75 billion, of which Japan contributed US\$ 410 million out of newly secured funds of US\$ 2.06 billion.

- Cooperation with IPCC

Japan has provided the IPCC with SFr. 180,000 annually since 1997. Furthermore, it has handled the organization of technical support for the inventory task force that was established in 1999, and funded its operational costs (1999: ¥175.867 million; 2000: ¥175.983 million).

In addition, Japan cooperates with the IPCC in terms of human resources. For example, it participates in the formulation of reports, both as a bureau member and a lead author.

6.2 Assistance for Developing Countries that are Particularly Vulnerable to Adverse Effects of Climate Change

6.2.1 The Kyoto Initiative (December 1997~)

The government of Japan announced the Kyoto Initiative consisting of strengthened environmental support that focuses on assisting developing countries to combat global warming at the Third session of the Conference of the Parties to the United Nations Framework Convention on Climate Change held in Kyoto in December 1997, which will be implemented mainly through the Government of Japan's ODA program. The Kyoto Initiative is based on the three Philosophies, namely, 1) Global Human Security; 2) Ownership and Partnership; and 3) Sustainable Development, just the same as the ISD, and assistance is specifically carried out based on the following three pillars.

- **Cooperation in Capacity Development**
In the five years beginning in fiscal 1998, Japan will train 3,000 people in developing countries in fields related to global warming (i.e. air pollution, waste disposal, energy saving technologies, forest conservation and afforestation).
About 4,600 people have already been fostered during the three years from fiscal 1998 to fiscal 2000 through training courses both in Japan and developing countries, and by the experts and JOCV members dispatched by Japan.
- **Official Development Assistance loans on the most concessional conditions (interest rate: 0.75%; repayment period: 40 years) (yen loans)**
The government of Japan will provide ODA loans at the most concessional terms (interest rate: 0.75%; repayment period: 40 years) available internationally primarily with regard to energy saving technologies, new and renewable energy sources, forest conservation and afforestation, and air pollution-related measures in order to achieve sustainable development while dealing with global warming issues.
- **Exploitation and transfer of Japanese technology and know-how**
The government of Japan will support developing countries efforts by using technology and know-how acquired in the process of combating its own pollution and energy problems, and developing and transferring such global warming-related know-how as best suited to the actual status in developing countries, as well as sending survey groups and holding workshops.

6.2.2 Other specific assistance

- **Development Study**
As well as supporting the drawing up of development plans for sustainable development in developing countries, planning methods and survey/analysis skills, etc. are transferred to counterparts in those countries in the process. In particular, research into environment management projects for rivers, lakes and marshes, waste disposal and air pollution-related measures, and conservation projects for marine creatures and suchlike are actively conducted for developmental research in the environmental field. Specifically, in Indonesia, specific study was carried out on a coral reef management project in the Sulawesi Utara (North Celebes) area.
- **Loan Aid**
Loan aid and transfer of technology is provided for adaptive measures (i.e. countermeasures against flooding and riparian works) taken by developing countries via low-interest, long-term yen loans (average repayment period: about 33 years and 7 months; average grace period: about 9 years and 5 months; average interest rate: 1.41% (fiscal 2000)) offered by the government as part of its development assistance.
Specifically, cooperative action is being carried out for flood prevention projects in Indonesia and the Philippines, etc.

Since fiscal 1995, special interest rates that are lower than loans for other fields have been established for addressing environmental issues in middle and low income countries (excluding least developed countries) for promotional purposes.

Furthermore, efforts are being made to formulate projects in developing countries via the Special Assistance for Project Formulation.

- Grant Aid

Funds are provided and technology is transferred for adaptive measures (i.e. preparation of weather observation networks and flood prevention work) taken by developing countries using grants provided by the government as part of its development assistance policy.

Specifically, assistance has been afforded for construction of bank protection in the Maldives.

- Project-Type Technical Cooperation

To improve adaptive technology in developing countries, Japan cooperates in projects related to adaptive measures by participating in comprehensive project-type technical cooperation that includes dispatch of experts, acceptance of trainees, and provision of equipment.

Specifically, cooperative activities geared towards forest preservation and recovery have been implemented in various countries, including projects concerning forest-fire prevention and tree planting in Indonesia.

- Dispatch of experts, and Acceptance of trainees

Training has been held in both Japan and third world countries, in addition to which experts and JOCV members have been sent abroad to train personnel in global warming-related fields (air pollution, waste, energy conservation, forestry conservation and afforestation).

Specifically, clerical workers from emergency assistance organizations in each country are accepted as trainees, and training courses are held to contribute to improved disaster prevention countermeasures in each trainees' country by introducing Japan's own international emergency assistance system and training courses concerning countermeasures against disasters in Japan.

- Asia-Pacific Seminar on Climate Change

Much effort has been made to cope with climate change in the Asia-Pacific Region. The Ministry of the Environment has held the 'Asia-Pacific Seminar on Climate Change' every year since 1991. Administrators, experts from each country in the Asia-Pacific region, and international organizations have been invited to the seminars. The main purpose of these seminars is to facilitate further activities to address climate change in the Asia-Pacific region through the exchange of views, experiences, and information concerning the issue.

In the 11th seminar held in August 2001, opinions were exchanged under the following main themes: The IPCC Third Assessment Report, possibility of CDM, adaptation measures, and national communications from developing countries. Opinions were also exchanged about APNET, a regional information network using Internet on climate change developed by the Ministry of the Environment, and local initiatives concerning global warming issues.

- Studies of global warming issues in the South Pacific region

The South Pacific Islands Countries are most vulnerable to the impacts of global warming, and therefore international support is particularly essential to implement appropriate adaptation measures. For this purpose, the Ministry of the Environment has, since fiscal year 1999, conducted a cooperative study (Pacific-Japan Project) for the South Pacific Island Countries, which explored the needs for cooperation relating to responses to global warming. Currently, the 'A Resource Book for Policy and Decision Makers, Educators, and other stakeholders titled 'Climate and Sea-level variability and change in Pacific Islands region' is being prepared in cooperation with SPREP, based on the results of the former study .

6.3 Financial Resources related to the implementation of the Convention

Refer to the tables shown later.

6.4 Measures Related to Transfer of Technologies

6.4.1 Government Measures related to the promotion, facilitation and financing of the transfer of technologies

6.4.1.1 The Kyoto Initiative (December 1997~) (as previously mentioned)

- Cooperation in Capacity Development (as previously mentioned)
- Official Development Assistance loans at the most concessional conditions (interest rate: 0.75%; repayment period: 40 years) (yen loans)
Approximately ¥580 billion has been committed for a total of 48 projects in 11 countries, such as a thermal power complex in Azerbaijan and construction of a small hydroelectric power plant in China from December 1997 to March 2001.
- Exploitation and transfer of Japanese technology and know-how (as previously mentioned)

6.4.1.2 Other Assistance Details

- Loan Aid
Loan aid and transfer of technology is provided for global warming countermeasures taken by developing countries via low-interest, long-term yen loans (average repayment period: about 33 years and 7 months; average grace period: about 9 years and 5 months; average interest rate: 1.41% (fiscal 2000)) offered by the government as part of its development assistance.
Specifically, cooperation is being afforded for reinforcement work on an elevated light railway in the Philippines.
Since fiscal 1995, special interest rates for environmental issues that are lower than those on loans for other fields have been applied to middle and low income countries (excluding least developed countries) for promotional purposes.
Furthermore, efforts are being made to formulate projects in developing countries via the Special Assistance for Project Formulation.
- Grant Aid for Afforestation (fiscal 2000)
Supporting the development of forests for national land and environmental conservation such as maintaining forest ecosystems, water resource functions, and landslide prevention to improve sustainable forest management and living environments.
Specifically, cooperation is being afforded to restoration projects following the fires in national parks in Indonesia, and afforestation projects along coastal areas of Senegal.
- Grant Aid for Clean Energy (fiscal 2000)
Funds have been contributed for preparation of energy-related facilities and equipment to reduce and control carbon dioxide emissions in developing countries as a part of the aim to strengthen Japan's measures directed at energy environment-related issues such as global warming. By using these funds, Japan seeks to improve the efficiency of electricity generation and supply systems as well as electrification of areas previously without mains electricity.
Specifically, cooperation is being afforded to the refurbishment of a power plant in rural Mongolia.
- Grant Aid for Global Environment (fiscal 2001)
In order to resolve global environmental issues, support is being provided in the energy-related and afforestation fields which lead to reduce and limit the emission of greenhouse gases through the establishment of 'Grant Aid for Global Environment' by unifying grant aid for afforestation and grant aid for clean energy. Contributions totaled ¥5 billion in fiscal 2001.
- Development Study (as previously mentioned)

Specifically, a study was implemented to formulate a plan for waste disposal project for rural cities in Syria.

- Development Cooperation

Specifically, carbon dioxide fixation has been carried out as extensively as possible while striving to maintain the local environment in Indonesia, and implementation of a forest management survey on carbon dioxide fixation has been initiated to establish appropriate forest management methods that prevent a net discharge of carbon dioxide.

- Asia-Pacific Seminar on Climate Change (as previously mentioned)

- Feasibility Studies on Climate Change Mitigation Projects for clean development mechanism (CDM) and Joint Implementation (JI)

Clean development mechanisms (CDM) and Joint Implementation (JI) that were introduced in the Kyoto Protocol are flexible international measures for Annex I countries to achieve their respective targets for reducing greenhouse gas emissions in tandem with developing countries or other Annex I countries.

Since 1999, Feasibility Studies on Climate Change Mitigation Projects for CDM/JI have been carried out for the accumulation of knowledge to formulate domestic and international rules for such CDM/JI mechanisms as well as to identify effective means of reducing greenhouse gas emissions and enhancing CO₂ sink.

Twenty-three feasibility studies into such areas as biomass, afforestation, and renewable energy have been adopted between fiscal 1999 and 2001 through official solicitation from private sector companies and Non-Government Organizations (NGOs).

- Scoping Study to Promote Joint Implementation

This is to identify, further research (in the form of feasibility studies) and bring to fruition – by introducing effective energy use technology which Japan possesses (energy conservation and oil substitute energy technology) – any private projects that are effective means of reducing greenhouse gas emissions and have the potential to be linked to any future Joint Implementation (JI)/clean development mechanism (CDM) in order to actively implement the flexible international JI and CDM measures to reduce greenhouse gases as detailed in the Kyoto Protocol.

Research themes were solicited from the public, and 40 research projects were carried out in fiscal 1998, 49 in fiscal 1999, and a further 49 in fiscal 2000. 45 research projects were adopted in fiscal 2001, for which research is currently being conducted.

- Activities Implemented Jointly (AIJ)

In accordance with the decision adopted at the First Framework Convention on Climate Change (COP1), Japan engaged in discussions concerning the Japan's Fundamental Framework for Activities Implemented Jointly (AIJ) under the Pilot Phase of the Framework Convention on Climate Change (AIJ Japan Programme) at the joint sessions of the Council of Ministers for Global Environment Conservation and the National Energy Council of Ministers in 1995. This program serves as the main implementing body for Japan's participation in AIJ projects. While encouraging the participation of a wide range of entities, including regional public bodies, general corporations, NGOs, and public corporations, Japan has also established the Inter-Ministerial/Agency Coordination Committee for AIJ, as well as the Secretariat for that committee, as part of efforts to establish standards for a system that will promote AIJ. At the meeting of the Inter-Ministerial/Agency Co-ordination Committee for AIJ in 1996, the following documents were formulated: Manual for AIJ Pilot Project Proposal in the Japan AIJ Pilot Program; AIJ Project Application Form; and Evaluation Guidelines for Approving AIJ Projects.

Currently, the number of Japan programs authorized is 20, 12 of which have also been approved by the other countries concerned. Five programs have already been reported to the treaty secretariat.

- Climate Change Technological Initiative (CTI)

The New Earth 21 was internationally proposed based on the Council of Ministers for Global Environmental Conservation's Houston Summit in 1990. The framework for the Technology Renaissance for Environment and Energy (TREE) was proposed at the Tokyo Summit in 1993 to establish comprehensive concrete strategies for the 'New Earth 21'. In the same year, a scoping study

was carried out into the implementation of joint international research and development concerning environmental energy technologies at the conference for promoting of environmental energy technology development.

IEA/OECD members in 23 countries and the EC proposed the establishment of the Climate Technology Initiative (CTI) at the 1st United Nations Framework Convention on Climate Change in 1995.

International cooperation such as transferring and promoting technologies to contribute towards the reduction of greenhouse gases, promotion of the market, and promotion of the transferal of innovative technological developments was provided.

In fiscal 2000, workshops on transferring technologies to developing countries were held, in addition to exchanging eight studies under the theme of technological developments between advanced countries involved in such areas.

- Asia-Pacific Network for Global Change Research (APN)

This is an inter-governmental network established to promote regional cooperation on global environmental studies related to the Asia Pacific region, encourage the participation of developing countries in the study, and strengthen links between researchers and the administration. It also strives to improve the capabilities of researchers by providing training, supporting participation in international study meetings, and holding workshops. Currently, 'climate changes and fluctuations' is one of the priority issues for the APN science program. Japan has also been positively supporting its activities.

- Supporting the ITTO

Japan continues to offer its full support to International Tropical Timber Organization (ITTO) activities, such as through the establishment and popularization of felling methods considered considerate towards the environment in productive tropical forests, verifying the guidelines established by the ITTO, forest conservation along borders, countermeasures to illegal felling, and mangrove conservation projects that combine both conservation and utilization of tropical forests. Japan considers that its contributions to the ITTO must be continued and strengthened if it is to continue to play a leading role as a major importer of tropical timber and as the host country of the headquarters, and contributed ¥111 million as its assigned portion and contributed an additional optional ¥1.075 billion in 2000.

- Support for FAO

Japan has voluntarily contributed to a trust fund to implement 14 projects from 1983 to the present aimed at promoting sustainable forest management in developing countries in addition to covering about 20% of its regular budget. In fiscal 2000, Japan voluntarily contributed to and supported the implementation of a project to promote stakeholder participation in forest management in Asia and a project to analyze the impact of forest products trade in the promotion of sustainable forest management.

- Indonesian carbon-fixation forest management onsite inspections

Inspections are to be carried out to establish new afforestation techniques and forest management methods for carbon fixation in Indonesia scheduled from 2001 to 2006 in order to contribute to an easing in climatic changes through the reduction and removal of greenhouse gases using carbon fixation via afforestation.

6.4.2 Government Support Measures to Develop and Enhance the Capabilities and Technologies of Developing Countries

- Developmental Research (as previously mentioned)

- Project-type Technical Cooperation

To improve adaptive technology in developing countries, Japan cooperates in projects related to adaptive measures by participating in comprehensive project-type technical cooperation that includes dispatch of experts, acceptance of trainees, and provision of equipment.

Specifically, cooperation is being afforded to environmental center projects in six countries including China, Chile, and Mexico, an energy conservation center project in Bulgaria, and a forest planning study project in Papua New Guinea.

- Dispatch of experts and Acceptance of trainees (as previously mentioned)
Specifically, training courses have been established to provide the information required to formulate global warming-related measures and improve skills so that developing countries can prepare lists of greenhouse gases by themselves, for which trainees have been accepted and experts have been sent.
- Asia-Pacific Seminar on Climate Change (as previously mentioned)
- Feasibility Studies on Climate Change Mitigation Projects for clean development mechanism (CDM) and Joint Implementation (JI) (as previously mentioned)
- Scoping Study to Promote Joint Implementation (as previously mentioned)
- Climate Change Technology Initiative (CTI) (as previously mentioned)
- Activities Implemented Jointly (AIJ)
- Green Aid Plan (GAP)
Japan continues to actively promote the Green Aid Plan to effectively integrate tools for training personnel, cooperate with writing reports and studies in order to support the individual efforts of developing countries concerning energy and environmental issues through effective solutions to global warming and suchlike through technological cooperation with new energy sources and energy conservation.
- APEC-VC
Japan proposed and approved of an ‘APEC Virtual Center for Environmental Technological Exchanges’ for mutual submission and exchange of environmental technology-related information held by governments, companies and environmental organizations in the region by establishing homepages covering environmental technologies, such as those related to global warming, on the Internet between each APEC country/region. Since the virtual center was established in Japan in April ’97, virtual centers have been established in 11 countries/regions, namely Australia, Taiwan, New Zealand, China, The Philippines, Vietnam, Thailand, Chile, Indonesia, and Malaysia so far, and they are linked via the Internet. Efforts are being made to improve usability, such as by installing standard search engines and ensuring sufficient contents as well as promoting the establishment of more centers in those countries or regions that have yet to do so.
- Asia-Pacific Network for Global Change Research (APN) (as previously mentioned)
- Criteria and Guidelines for Sustainable Forest Management
ITTO specifies the promotion of information sharing, financial and technological support, and improving the capability of member countries to implement the ‘Target 2000’ strategy of “striving to achieve targets from supply sources while implementing management so that the import of tropical timber and tropical wooden products can be sustained”. In order to achieve this, Japan has positively participated in discussions of policies concerning conservation and use of tropical forests at the ITTO meetings of the board of directors and other committee meetings. Also, it has been involved in many projects in various fields such as the establishment of forestry conservation areas, afforestation, countermeasures against illegal felling, conservation of mangroves, improvement in wood product processing quality, and statistical data, as well as supporting various projects and holding workshops on the application of the ‘Criteria and Guidelines for Sustainable Tropical Forest Management’.
- International Workshop on Model Forests for Field-Level Application of Sustainable Forest Management
Between 1998 and 2000, Japan hosted a series of four International Workshop on Model Forests for Field-Level Application of Sustainable Forest Management to exchange views and improve understanding on field level initiatives carried out in model forests among participants from abroad, and thereby to contribute to promoting sustainable forest management in each respective country.

- A country-led initiative in support of the United Nations Forum on Forests (UNFF): International Expert Meeting on Monitoring, Assessment and Reporting on the Progress toward Sustainable Forest Management

In November 2001, Japan hosted a country-led initiative in support of the United Nations Forum on Forests (UNFF) entitled *the International Expert Meeting on Monitoring, Assessment and Reporting on the Progress toward Sustainable Forest Management* in Yokohama, Japan with the aim of contributing to deliberations in support of the UNFF. Experts from developing and developed countries, international organizations, regional processes and NGOs have attended the meeting. The meeting provided a forum for exchanging views on monitoring, assessment and reporting within the UNFF context, including the means for monitoring, assessment and reporting and how countries could report to the UNFF on their progress in the implementation of already-agreed proposals for action under the UN. The meeting report was submitted to the UN, which contributed to the deliberation as a document for the second substantial session of the UNFF held in March 2002.

- Support for afforestation by private sector parties
Since 1991, Japan has been supporting NGO activities promoting international greenery. Since 2000, about ¥100 million has been contributed annually to support the implementation of preliminary research, acceptance of overseas colleagues, and providing technical instruction through the dispatch of experts to afforestation projects carried out by NGOs in developing countries. Furthermore, technical training has been provided to develop personnel involving in afforestation, technological information has been collected and provided, while understanding and recognition of approval source projects based on the Kyoto mechanism has been shared by inviting the heads of government forestry departments from South East Asia, etc., in addition to which international forum have been held to exchange and discuss opinions on how Japan can continuously promote cooperation with private afforestation projects overseas both domestically and abroad.
- Observation of forestry statuses using satellite data
The Japan Forest Technology Association has been developing systems to provide information and analyze forestry resources using satellite-obtained data targeted on tropical forests in Asia in order to check for any degradation since 1990. From 2001, in order to resolve the worsening degradation that has been observed in forests in the eastern part of Asia, about ¥200 million has been contributed to efficiently check degradation statuses in forests using high-resolution satellite data, to estimate future degradation, and appropriately reflect such data concerning degradation in forests throughout Japan into its forestry policies.
- Support for Global Environmental Conservation Using “Postcards with a Donation” and Other Programs
Japan has collected contributions through postcards with a donation sales since 1992, some of which have been distributed to organizations working to conserve the global environment. In fiscal 2000, a total of ¥60.63 million was distributed to 15 groups concerned.

6.4.3 Prevention of Acid Rain

Nitrogen oxides have been identified as one cause of acid rain; they are also considered a greenhouse gas in that they contribute to the formation of ozone in the troposphere. Thus, countermeasures to acid rain also contribute to the arrest of global warming. Furthermore, by preventing damage to forests, countermeasures against acid rain contribute to the preservation of sinks for carbon dioxide, which is the most widespread greenhouse gas.

- Acid rain monitoring network in East Asia
In order to establish a framework for countermeasures against acid rain through international cooperation across East Asia through the participation of 11 countries; namely, China, Indonesia, Japan, Malaysia, Mongolia, the Philippines, Korea, Russia, Thailand, Vietnam, and Cambodia; full-scale action has been implemented from January 2001, following a trial period from April 1998. The aim is to improve

common recognition by those participating countries concerning the current status of acid rain issues in East Asia by preparing and evaluating reliable data that can be crosschecked using a standardized method.

6.4.4 Prevention of Desertification

The loss of forests and other green land through desertification leads to the loss of important carbon dioxide sinks. In this sense, the prevention of desertification is important as a means of preventing global warming. Japan has been promoting a variety of desertification prevention-related projects through conservation of water resources, forest conservation and afforestation, agricultural development, and Official Development Assistance (ODA) including capacity building. In September 1998, Japan accepted the Convention to Combat Desertification that was adopted in June 1994 and became a party to the Convention, and has been working to support the formulation of national action programmes and holding of related workshops for developing countries affected by desertification to ensure effective implementation of the Convention. As a Party to the Convention, Japan has also been studying what the comprehensive desertification prevention-related measures should be with due consideration for socioeconomic viewpoints, in order to contribute more actively in the implementation of the Convention. Studies have been carried out concerning the monitoring and assessment of desertification using desertification guidelines as well as establishing a network to provide technological contributions and study support for the Thematic Programme Network (TPN) in the Asian region, particularly the TPN 1 'desertification monitoring and assessment' field.

6.5 Promoting International Cooperation in the Private Sector

- Cooperative Activities of Private Sector Groups

In Japan, many of the existing environmental conservation technologies were developed by private sector companies. Parallel to this, direct foreign investment by private sector companies to developing countries plays a very significant role in technology transfer. In addition, Japanese government and Japan's various NGOs, (such as the Japan Wildlife Research Center; the International Lake Environment Committee Foundation; the Overseas Environmental Cooperation Center Japan; the Organization for Industrial, Spiritual and Cultural Advancement - International (OISCA); the Federation of Economic Organizations; the Japan International Volunteer Center and the Shanti Volunteer Association), promote international environmental cooperation by implementing environmental conservation projects, hosting symposiums, lectures, and seminars, and by supporting environmental conservation activities.

NGOs have been afforded cooperation regarding afforestation in various ways, such as through afforestation instruction in developing countries, the dispatch of volunteer afforestation workers, and providing environmental education. For example, grassroots level groups, namely, the Green Earth Network; the Japan Association for Greening Deserts; the Defense of Green Earth Foundation; the Green Earth Center; the International Society for Mangrove Ecosystems; the Action for Mangrove Reforestation; the Organization for Industrial, Spiritual, and Cultural Advancement - International (OISCA) and the International Charcoal Cooperative Association play important roles in providing cooperative assistance to forestry in various ways.

- Support for Private Sector Activities

Activities in the private sector are supported by funding from sources such as the Ministry of Foreign Affairs' Subsidy Framework for Japanese NGO Projects and Grant Assistance [Aid] for Grassroots projects; and the Japan Environment Corporation's assistance to private sector organizations from its Japan Fund for the Global Environment.

- Research into clean development mechanism projects as global warming-related measures (as previously mentioned)

- Debt/Environment Swaps

Private sector companies are beginning to participate in natural conservation swaps for the protection of

forests and other natural resources. To lend support to these efforts, Japan formulated guidelines in fiscal 1993 for the appropriate implementation of such swaps. Also, to facilitate smooth debt/conservation swaps, the Overseas Environmental Cooperation Center established a network to provide needed information.

6.6 Other

6.6.1 Considerations in Undertaking International Cooperation Projects

In pursuing development assistance, it is important to take into account environmental conservation – including elements that might contribute to the mitigation of global warming – in order to promote sustainable development.

- In 1989, the Council of Ministers for Global Environmental Conservation agreed that greater consideration must be given to environmental issues when implementing ODA projects. The ODA Charter adopted by the Cabinet in 1992 includes environmental conservation as a basic philosophy underlying Japanese aid, and states that “the pursuit of environmental conservation and development in tandem” must be one of the basic principles of ODA. Environmental considerations was also mentioned as a point to be followed in the implementation and management of ODA in Japan’s Medium-term Policy on ODA published in August 1999.
- JICA is in charge of Japan’s technical cooperation with other countries. Since 1990, JICA has formulated environmental guidelines for specific fields of international cooperation, such as the ‘Environmental Guidelines for Social and Economic Infrastructure Development Projects’, and the guidelines were undertaken in 20 sectors. These guidelines are mainly used for screening and scoping for environmental effect assessments in development studies.
Japan Bank for International Cooperation (JBIC), which is an executing agency of yen loans, has implemented environmental considerations based on the environmental consideration guidelines established in 1995 and 1999 by its predecessors, namely the Overseas Economic Cooperation Fund (OECF) and the Japan Export Import Bank (JEXIM). These guidelines specify screening criteria for projects, obligate the implementation of environmental assessments as needed, and also establish a checklist for the major sectors. As of December 2001, the bank is preparing consolidated guidelines that considered environment more taking into account international trends and external opinions.

Table 6.1 Contributions to Multilateral Institutions and Programs and Global Environmental Facilities (GEF)

Institution or programme	Contribution		
	1997	1998	1999
Global Environmental Facility (GEF)			
1. Promissory notes	0	¥12,188 million	¥12,188 million
2. Note encashments	¥4,737 million	¥5,522 million	¥5,573 million
Multilateral institutions:			
1. World Bank	¥19.5 billion	¥17.6 billion	¥8.9 billion
2. International Finance Corporation (IFC)	¥600 million	¥600 million	¥300 million
3. African Development Bank	¥200 million	0	0
4. Asian Development Bank	¥10.4 billion	¥7.3 billion	¥25.7 billion
5. European Bank for Reconstruction and Development	¥2.8 billion	¥1.3 billion	¥1.0 billion
6. Inter-American Development Bank	¥2.2 billion	¥1.4 billion	¥900 million
7. United Nations Development Programme (UNDP)	\$99 million	\$80 million	\$80 million
8. United Nations Environment Programme (UNEP)	\$6 million	\$4.93 million	\$4.85 million
9. United Nations Framework Convention on Climate Change – Supplementary Fund	\$228,321	\$75,000	\$160,000
10. International Tropical Timber Organization (ITTO)	\$13.6 million	\$11.05 million	\$11.24 million
Multilateral scientific, technological and training Programs			
1.			
2.			
3.			
4.			
5.			

Notes:

- 1) The amounts listed above are for the Japanese accounting year (from April to March of the following year) and are generally in yen (rounded down to the nearest unit).
- 2) The amounts listed above represent the total initial budgetary provision for contributions to specific multilateral financial institutions, not the amounts used for areas related to climate change.
- 3) The amounts listed above represent the budgeted amounts for the fiscal year, in units of ¥1 million rounded down to the nearest ¥1 million.

Table 6.2.1 Bilateral financial contributions related to the implementation of the Convention for 1999 (Loan aid)
(millions of U.S. dollars)

Recipient country	Mitigation						Adaptation		
	Energy	Transport	Forestry	Agriculture	Waste management	Industry	Capability-building	Coastal zone management	Other vulnerability assessments
1. Philippines						180.24		10.25	
2. China						150.60		421.42	
3. Bangladesh	47.79								
4. Azerbaijan	160.95								
5. Thailand		563.90							
6. Malaysia	621.23								
7. Tunisia			35.82						
8. Turkey		109.43							
9.									
10.									
11.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
19.									
20.									

Notes:

1. This table contains fiscal 1999 figures (based on agreed amounts) for non-grant aid.
2. The figures in the table are estimates only of those projects related to global warming from among all non-grant aid.
3. The figures in the table are converted with the DAC designated rate (end of December) for 1999 (¥113.9 = US\$1).

Table 6.2.2 Bilateral financial contributions related to the implementation of the Convention for 1999 (Grant aid)
(millions of U.S. dollars)

Recipient country	Mitigation						Adaptation		
	Energy	Transport	Forestry	Agriculture	Waste management	Industry	Capability-building	Coastal Zone management	Other vulnerability assessments
1. Mongolia	6.12								
2. Indonesia	9.96		0.99						
3. Burkina Faso			5.31						
4. Palau									2.41
5. Maldives	1.16							7.74	
6. Philippines								5.65	
7. Honduras								12.71	
8. Bangladesh								21.82	
9.									
10.									
11.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
19.									
20.									

Notes:

1. This table contains fiscal 1999 figures (based on agreed amounts) for general grant aid projects.
2. The figures in the table are estimates only of those projects related to global warming from among all general grant aid projects.
3. The figures in the table are converted with the DAC designated rate (end of December) for 1999 (¥113.9 = US\$1).

Table 6.2.3 Bilateral financial contributions related to the implementation of the Convention for 1999 (Technological cooperation)
(millions of U.S. dollars)

Recipient country	Mitigation						Adaptation		
	Energy	Transport	Forestry	Agriculture	Waste management	Industry	Capability-building	Coastal Zone management	Other vulnerability assessments
1. DAC List Assistance Recipient Countries	11.92		36.11		7.78	20.53	46.65	18.31	39.68
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									
11.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
19.									
20.									

Notes:

1. This table contains (JICA-based) fiscal 1999 figures for technological cooperation.
2. The figures in the table are estimates only of those projects related to global warming from among all (JICA-based) technological cooperation.
3. The figures in the table are converted with the DAC designated rate (end of December) for 1999 (¥113.9 = US\$1).

Table 6.2.4

Bilateral financial contributions related to the implementation of the Convention for 1998 (Loan aid)
(millions of U.S. dollars)

Recipient country	Mitigation						Adaptation		
	Energy	Transport	Forestry	Agriculture	Waste management	Industry	Capability-building	Coastal Zone management	Other vulnerability assessments
1. Philippines	8.89	180.82	43.01		22.05	277.33		54.95	
2. China	291.48				24.73	164.07		45.90	
3. Thailand		405.95		19.21					
4. Malaysia	375.02								
5. Tunisia									54.89
6. Turkey									
7. Vietnam	130.80		29.07						
8. Bosnia Herzegovina	31.40								
9.									
10.									
11.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
19.									
20.									

Notes:

1. This table contains fiscal 1998 figures (based on agreed amounts) for loan aid.
2. The figures in the table are estimates only of those projects related to global warming from among all loan aid.
3. The figures in the table are converted with the DAC designated rate (end of December) for 1998 (¥130.89 = US\$1).

Table 6.2.5

Bilateral financial contributions related to the implementation of the Convention for 1998 (Grant aid)
(millions of U.S. dollars)

Recipient country	Mitigation						Adaptation		
	Energy	Transport	Forestry	Agriculture	Waste management	Industry	Capability-building	Coastal Zone management	Other vulnerability assessments
1. Mongolia	9.89								
2. Indonesia	9.03								
3. Palau									0.27
4. Maldives	5.27							3.80	
5. Philippines								6.56	
6. Honduras								3.39	
7. China			9.53					11.13	
8. Nepal								4.10	
9. Senegal			5.65						
10. Laos			3.18						
11.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
19.									
20.									

Notes:

1. This table contains fiscal 1998 figures (based on agreed amounts) for general grant aid projects.
2. The figures in the table are estimates only of those projects related to global warming from among all general grant aid projects.
3. The figures in the table are converted with the DAC designated rate (end of December) for 1998 (¥130.89 = US\$1).

Table 6.2.6 Bilateral financial contributions related to the implementation of the Convention for 1998 (Technological cooperation)
(millions of U.S. dollars)

Recipient country	Mitigation						Adaptation		
	Energy	Transport	Forestry	Agriculture	Waste management	Industry	Capability-building	Coastal Zone management	Other vulnerability assessments
1. DAC List Assistance Recipient Countries	13.82		34.79		12.92	16.11	48.93	15.70	25.83
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									
11.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
19.									
20.									

Notes:

1. This table contains (JICA-based) fiscal 1998 figures for technological cooperation.
2. The figures in the table are estimates only of those projects related to global warming from among all (JICA-based) technological cooperation.
3. The figures in the table are converted with the DAC designated rate (end of December) for 1998 (¥130.89 = US\$1).

Table 6.2.7 Bilateral financial contributions related to the implementation of the Convention for 1997 (Loan aid)
(millions of U.S. dollars)

Recipient country	Mitigation						Adaptation		
	Energy	Transport	Forestry	Agriculture	Waste management	Industry	Capability-building	Coastal Zone management	Other vulnerability assessments
1. Philippines									
2. China					30.40	33.97			
3. Indonesia								262.36	
4. Azerbaijan	170.82								
5. India			51.18						
6. Indonesia								262.36	
7. Tunisia								25.87	
8.									
9.									
10.									
11.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
19.									
20.									

Notes:

1. This table contains fiscal 1997 figures (based on agreed amounts) for loan aid.
2. The figures in the table are estimates only of those projects related to global warming from among all loan aid.
3. The figures in the table are converted with the DAC designated rate (end of December) for 1997 (¥121.00 = US\$1).

Table 6.2.8 Bilateral financial contributions related to the implementation of the Convention for 1997 (Grant aid)
(millions of U.S. dollars)

Recipient country	Mitigation						Adaptation		
	Energy	Transport	Forestry	Agriculture	Waste management	Industry	Capability-building	Coastal Zone management	Other vulnerability assessments
1. Mongolia									0.21
2. Syria	5.36								
3. Maldives								6.41	
4. Philippines								9.73	
5. Honduras								0.50	
6. Bangladesh									12.17
7. Pakistan								3.68	11.30
8.									
9.									
10.									
11.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
19.									
20.									

Notes:

1. This table contains fiscal 1997 figures (based on agreed amounts) for general grant aid projects.
2. The figures in the table are estimates only of those projects related to global warming from among all general grant aid projects.
3. The figures in the table are converted with the DAC designated rate (end of December) for 1997 (¥121.00 = US\$1).

Table 6.2.9 Bilateral financial contributions related to the implementation of the Convention for 1997 (Technological cooperation)
(millions of U.S. dollars)

Recipient country	Mitigation						Adaptation		
	Energy	Transport	Forestry	Agriculture	Waste management	Industry	Capability-building	Coastal Zone management	Other vulnerability assessments
1. DAC List Assistance Recipient Countries	11.83		42.80		14.20	17.60	43.22	18.44	27.41
2.									
3.									
4.									
5.									
6.									
7.									
8.									
9.									
10.									
11.									
12.									
13.									
14.									
15.									
16.									
17.									
18.									
19.									
20.									

Notes:

1. This table contains (JICA-based) fiscal 1997 figures for technological cooperation.
2. The figures in the table are estimates only of those projects related to global warming from among all (JICA-based) technological cooperation.
3. The figures in the table are converted with the DAC designated rate (end of December) for 1997 (¥121.00 = US\$1).

Table 6.3.1 Description of selected projects or programmes that promoted practicable steps to facilitate and/or finance the transfer of, or access to, environmentally-sound technologies

Project/Program title: Private Activity Promotion Project of the Japan Fund for the Global Environment			
Purpose: Support for domestic and overseas private sector groups that implement environmental conservation activities including global warming countermeasures and strive to develop national awareness of environmental conservation			
Recipient countries	Sector	Total funding	Years in operation
Southeast Asia, such as China, Thailand, & Vietnam; Russia, Latin America	Supported by environmental NGOs Activities for preventing global warming (air environment conservation, prevention of global warming, others)	¥39.1 million	Fiscal 2000
Description Based on the adoption of the Kyoto Protocol under the United Nations Framework Convention on Climate Change and the establishment of the Law to Promote Measures to Arrest Global Warming, activities to prevent global warming have been prioritized, and environmental conservation activities carried out by private sector groups to prevent global warming have been supported.			
Indicate factors which led to project's success:			
Technology transferred:			
Impact on greenhouse gas emissions/sinks (optional)			

Table 6.3.2 Description of selected projects or programmes that promoted practicable steps to facilitate and/or finance the transfer of, or access to, environmentally-sound technologies

Project/Program title: Refurbishment plan for Ulan Bator thermal power plant No. 4 (loan aid)			
Purpose: Steady supply of energy and prevention of air pollution			
Recipient countries	Sector	Total funding	Years in operation
Mongolia	Energy	¥6.139 billion (amount committed in fiscal 2000)	Agreement signed in fiscal 2000
<p>Description</p> <p>Ulan Bator thermal power plant No. 4 is the largest such power plant in Mongolia (maximum designed supply capability: 360MW), and supplies about 70% of the electricity and 60% of the hot water for Ulan Bator City. However, it is an old system, so the combustion efficiency is low, the impact on the environment is high, it has been rather accident-prone, and numerous power cuts and drops in water temperature for heaters have occurred, seriously affecting their citizens' life and industrial production, particularly in winter (lowest temperatures: -40°C).</p> <p>Refurbishment is mainly carried out to improve the automatic boiler control system and changing the system to a direct combustion type to resolve such problems.</p>			
<p>Technology transferred:</p> <p>By carrying out this refurbishment, the operational ratio and combustion efficiency of the power plant will be increased, the impact on the environment will be reduced, the central energy system mainly based in Ulan Bator City will receive a steady electricity supply, and a significant reduction in air pollution is anticipated through the control of emissions of carbon dioxide, sulfur oxides, nitrogen oxides and particulates.</p>			
Impact on greenhouse gas emissions/sinks (optional)			

Table 6.3.3 Description of selected projects or programmes that promoted practicable steps to facilitate and/or finance the transfer of, or access to, environmentally-sound technologies

Project/Program title: Recovery project for post forest-fire reforestation of national parks (2/3 period) (grant aid)			
Purpose: To reestablish the natural vegetation in national parks that suffered from forest fires.			
Recipient country	Sector	Total funding	Years in operation
Indonesia	Forest preservation	¥153 million (promised amount for fiscal 2000)	Signed bills for fiscal 2000
<p>Description</p> <p>In Indonesia, huge forest fires have often decimated their forests and agricultural lands due to an irregular dry climate, causing significant damage to valuable flora and fauna. In particular, a colossal forest fire in 1997/8 became a global environmental issue covering environmental conservation and global warming as well as smoke damage to nearby countries such as Malaysia and Singapore.</p> <p>In Way Kambas national park on the island of Sumatra, about 8,500 hectares out of the park's total area of 130,000 hectares was damaged by forest fires, and it has been estimated that it will take long years for the natural forest ecosystems to fully recover.</p> <p>This project is being implemented to conserve biodiversity and natural ecosystem in the Way Kambas national park. Efforts are being directed to revive about 360 hectares of forest out of the total affected area, while also it is expected to make efforts to reestablish the environment for wildlife living within and outside the project area.</p>			
<p>Technology transferred</p> <p>Successful examples of forest recovery by existing species will eventually accumulate in Indonesia although the number of such cases there is currently limited, and models for forest recovery by existing species are to be established.</p> <p>Contributing to the establishment of guidelines on seedlings, cultivation, and maintenance/management skills for existing species required for the quick recovery of the remaining post forest-fire areas in the national park.</p> <p>Forest patrols, fire prevention monitoring, and forest fire detection systems for the national park are to be improved.</p>			
Impact on greenhouse gas emissions/sinks (optional)			

Table 6.3.4 Description of selected projects or programmes that promoted practicable steps to facilitate and/or finance the transfer of, or access to, environmentally-sound technologies

Project/Program title: Group Training Course to Develop National Inventories and Strategies Against Climate Change			
Purpose: This course provides the latest scientific and technological information on the United Nations Framework Convention on Climate Change and the Kyoto Protocol to developing countries, and supports implementation of obligations specified under the convention by simultaneously introducing Japan's countermeasures.			
Recipient countries	Sector	Total funding	Years in operation
DAC List Assistance Recipient Countries (two people each from Thailand and Sri Lanka, and one each from Indonesia, Philippines, Mexico, Brazil, Yemen, Ethiopia, Kenya, Senegal, and Latvia for fiscal 2000)	Other	¥35.28 million (accepted 13 people)	January 8 th 2001 ~ March 1 st 2001
Description The 'Seminar for Global Warming Countermeasures' that was provided from 1992 to 1996 was updated and re-presented each year from 1997. 1. Course outline: Lectures, discussions and study trip are provided covering the following points. Outline of the United Nations Framework Convention on Climate Change and Kyoto Protocol, important points of the IPCC Assessment Report, and Japan's actions on global warming issues, etc. Outline of the IPCC inventory guidelines, calculation methods for emission amounts of various greenhouse gases. Options for strategies and various political measures, current status of Japans global warming countermeasures. 2. Trainee eligibility: Administrators who are currently in charge of global warming related issues in the central government.			
Indicate factors which led to project's success			
Technology transferred: Raising skills enabling the self-creation of inventories for greenhouse gases, provision of and upgrading skills for information required to establish strategies to arrest global warming			
Impact on greenhouse gas emissions/sinks (optional)			

Chapter 7

Research and Systematic Observation

7.1 Comprehensive Government Policies and Fundraising for Research and Systematic Observation

The Council of Ministers for Global Environment Conservation draws up a Comprehensive Program for the Promotion of Global Environmental Research, Monitoring and Technological Development each fiscal year. This program is designed to build a solid foundation for global environmental conservation and to clarify the priority areas that Japan should address in order to contribute positively to international initiatives. The program comprehensively promotes surveys, research, observation, monitoring, and technological development for the protection of the global environment and follows up on the implementation of efforts in these fields.

While bearing in mind consistency with the annual program, a budgeting system for the Global Environmental Research Fund has been established for its promotion. This is a system to comprehensively promote all types of scientific and international research on global environmental conservation. The 'Fund for Global Environmental Conservation Tests and Studies' has been established since April 2001 to promote studies into global warming from mid and long-term perspectives. In addition, some related surveys and research are funded under two other national budget categories; "Promotion of Science and Technology" and "Government Subsidies for Scientific Research." The application of these funds is determined by the Council for Science and Technology Policy and the Japan Science and Technology Council, respectively.

In August 1990, the government's basic stance and policies on research and development for global science and technology were compiled as the 'Basic Program for Research and Development in Global Science and Technology', which was approved by the Prime minister.

The program specifies that Japan shall prioritize international activities for global scientific research and development, and also promote the construction of an observation network that combines observation on the ground with observation by artificial satellites, aircraft, and ships. Under such a concept, Japan has been promoting the 'Integrated Global Observing Strategy Partnership (IGOS-P)' that cooperates with and coordinates international study programs, observation systems, and international organizations, etc.

To promote studies of prediction of global changes comprehensively, including global warming, under cooperation with various universities, ministries and agencies concerned, Japan established 'Frontier Research System for Global Change' to implement process research in October 1997, and established 'Frontier Observing Research System for Global Change' to implement observation of global changes in August 1999. Furthermore, Japan is developing the world's fastest supercomputer system 'Earth Simulator' to be used for such prediction and studies, which is scheduled to begin operation in 2002.

In June 1998, the 'Global Warming Prevention Headquarters' drew up the Guideline of Measures to Prevent Global Warming, determined the items for strengthening research and development of innovative environmental and energy technologies, and specified guidelines for ways to address global warming.

In December 2000, the cabinet drew up a new Basic Environment Plan in accordance with the Basic Environment Law with the long-term target of creating a society in which recycling, symbiosis, participation, and international measures can be realized, and it strives to comprehensively and deliberately promote measures for environmental conservation with a view towards the mid-21st century. This states the promotion of global warming-related measures as one of its strategic programs, and also specifies measures for the government to take in this field by including sections on 'adequate surveys, research, monitoring, and observation, and promotion of proper technologies' and 'ensuring international cooperation for surveys, research, monitoring, and observation, etc.'

In March 2001, the Government of Japan decided the second Science and Technology Basic Plan in accordance with the Science and Technology Basic Law, and the academic field of 'Environment Sciences' was selected as one of the four priority fields for allocating research and development resources. Accordingly, a promotion strategy for the Environment Sciences was decided in September 2001, the

government as a whole will “carry out observation and prediction related to global warming; assess the effects of environmental changes such as temperature increase and sea level rise on nature, the economy, and society; and develop technologies and means to avoid or minimize any detrimental effects” in a global warming-related study as one of its priorities.

7.2 Research

7.2.1 Basic Principles

- Individual research projects should be integrated into the following research programs based on the ‘Global Warming Research Initiative’ included in the promotion strategy of environmental sciences decided by the Council for Science and Technology Policy, and research and development is promoted under collaboration among industry, academia, and government.
 - a. Comprehensive monitoring program for global warming
 - b. Research program for predicting global warming and climate change
 - c. Research program for assessing impacts and risks of global warming
 - d. Program for developing technologies to fix and sequester greenhouse gases
 - e. Technological development program for controlling emission of greenhouse gases caused by human activities, such as energy generation
 - f. Policy research program to control global warming
- Japan participates and cooperates in the World Climate Research Programme (WCRP), the International Geosphere-Biosphere Programme (IGBP), the International Human Dimensions Programme of Global Environmental Change (IHDP), and other international global environmental research programs, conducts surveys and research based upon an appropriate international division of tasks, and otherwise promotes joint research and other initiatives together with overseas research organs.
- Based on the agreement reached among the participating nations at the Sixth Inter-Governmental Meeting of the Asia-Pacific Network for Global Change Research (APN) held in March 2001, Japan is promoting research on global environmental change in the Asia-Pacific region in cooperation with researchers from throughout the area, as well as developing a regional research network on global environmental change.
- In an effort to contribute to the development of government policy on climate change and global warming, Japan actively promotes research on global environmental problems from a human and social perspective, academic research integrating the natural and social sciences, and research on socioeconomic systems.

Japan is also working to expand the international network of the Institute of Global Environmental Strategies (IGES) established in March 1998 as an international research institute for the study of political and practical strategies to realize sustainable development on a global scale, particularly with regard to the Asia-Pacific region.

7.2.2 Priority Fields

While giving full consideration to the United Nations Framework Convention on Climate Change and the Kyoto Protocol, the Government of Japan is comprehensively promoting surveys and research to better understand the present condition and predict the future impact of global warming, to fix, isolate, and reduce greenhouse gases, and to draw up appropriate countermeasures. While clarifying various issues related to the mechanisms behind global warming, and cooperating with the activities of the Intergovernmental Panel on Climate Change (IPCC), the Government of Japan will contribute to establish guidelines for the implementation of the Kyoto Protocol and methods for assessing the removal of greenhouse gases by forests, and so on. Moreover, the government will prioritize the promotion of relevant research to contribute to the IPCC Fourth Assessment Report, the preparation of which is scheduled to begin in the near future.

Also, studies based on ‘climate change and fluctuations’ and ‘societal viewpoints of global change’ which were defined as priority issues at the Sixth Inter-Governmental Meeting of the Asia-Pacific Network for Global Change Research (APN) are promoted.

7.2.3 Main Research Fields

7.2.3.1 Research on climate processes and the climate system, including paleoclimate research

Research has been carried out as follows: study on the monitoring and prediction of El Niño/La Niña events and the warm pool in the western Pacific; study on the trends in climate extremes in the Asia-Pacific region; the analysis of sea level rise in the Asia monsoon region based on the coral dendroclimatology; the integration of impact/countermeasure assessment models with climate models for a comprehensive analysis of global warming

7.2.3.2 Modelling and prediction study, including an overall circulation model

Research has been carried out as follows: assessment of impact on the generation of greenhouse gases and the amount removed from the terrestrial ecosystem resulting from changes in land use in tropical Asia; research into the mutual interaction of the ecosystem and substance circulation such as from aerosols with the aim of improving the future prospects for climate changes; research to determine the quantity of carbon fixation within the East Asian monsoon ecosystem through the establishment of the Asia Flux Network; analysis into the removal of carbon dioxide resulting from human activity throughout the Pacific Ocean; international joint research on global mapping for carbon circulation and its advancement; research into the biological production in and removal of carbon dioxide in the ocean surface process in the Northern Pacific Ocean; estimation of the equilibrium of greenhouse gases in Western Siberia and forecasting future changes; assessment of removal source functions of the terrestrial ecosystem; comprehensive research into the accuracy of methane and nitrous oxide inventories; research into the methodology for establishing a system of greenhouse gas inventories; research into climate changes in Japan resulting from global warming; assessment of the amount of airborne particulates and research on its impact on the climate; joint international research on Northern Pacific subarctic zone circulation and climate change; model creation and estimation of climate change; water circulation, global warming, changes in air composition and ecosystems, as well as research on formation of such models and the use of data from satellite observation, such as from ADEOS-II and ALOS.

7.2.3.3 Impact study on the climate change

Research has been carried out as follows: ‘Study of the prediction of regional climate over Japan due to global warming’; biosphere vulnerability assessment resulting from global warming, analysis of the impact of global warming and carbon statuses on alpine grassland ecosystems in the temperate zone; research into the impact on the distribution of viral diseases through arthropodan vectors resulting from global warming.

7.2.3.4 Socioeconomic analysis, including analysis of both the impact of climate change and its anticipated reaction

Research has been carried out as follows: forecasting disasters arising from climatic change; comprehensive assessment of the impact of sea level rise; research into the impact on domestic and international energy supply/demand resulting from trends in global environmental conservation policies and future plans; and comprehensive impact assessment of sea level rise and its countermeasures.

7.2.3.5 Research and development on reduction and adaptive technology

The following have been implemented; research and development into reductions in greenhouse gas emissions such as development of energy conservation technologies; innovative heat-resistant/insulation material project for controlling carbon dioxide emissions; research and development of global environment industrial technologies such as for the reduction of carbon dioxide; research and development of revolutionary coastal ship (Super Eco-Ship); projects for practical assessment of advanced low emission vehicles; projects for technological assessment of next generation low emission vehicles, and research and development into using alternative energies such as development of technology of using new/renewable energy and marine energy; technological development for practical use of biomass energy for agriculture and forestry; advanced technological developments for effective

use of natural gas, and research and development into the removal and isolation of greenhouse gases such as research and development of deep ocean sequestration system of carbon dioxide; research and development of underground sequestration system of carbon dioxide; technological developments to put carbon dioxide fixation and utilization into practical use; research and development of carbon dioxide recovery and utilization technology from coal and natural gas; technological survey on environmental friendly method for effective collection and use of colliery gas; research into the impact on the marine ecosystem and strengthening the marine function for carbon dioxide removal by controlling the density of iron which is a trace element in sea water, and others, research into the low environmental load-type urban system to prevent global warming; research into the verification of reduction effects in global and local environment impact at low environmental load-type office buildings; development of planning support system for independent recycling-oriented-type urban and housing; research into the integrated assessment of global warming prevention effects through national land policy; technological development for creating a recycling-oriented-type industrial system using biological functions; research into the creation of a database using various technologies such as carbon dioxide reduction and fixation.

7.3 Systematic Observations

7.3.1 Basic Principles

- Observation and monitoring of climate change should be implemented in accordance with ‘the Science and Technology Basic Plan (decided by the Government of Japan in March 2001)’, and promoted comprehensively based on the ‘Comprehensive monitoring program for global warming’ included in the ‘Global warming research initiative’. In this case, organizations that carry out such observations and monitoring shall mutually exchange the results setting coherent methods with the international observation and monitoring projects, and shall strive to utilize such data effectively.
- The Government of Japan participates and cooperates in the Global Environmental Monitoring System (GEMS), the Global Atmosphere Watch (GAW) Program, the Global Climate Observing System (GCOS), the Global Ocean Observing System (GOOS), the Joint World Meteorological Organization (WMO) / UNESCO Intergovernmental Oceanographic Commission (IOC) Technical Commission for Oceanography and Marine Meteorology (JCOMM), and other international observation and monitoring programs, and conducts wide-ranging observations based on an appropriate sharing of international tasks. The Government is also working to promote the Asia-Pacific Network for Global Change Research (APN) and to facilitate implementation of observation and monitoring throughout the Asia-Pacific region.
- It is important to promote global observation by satellites effectively with coordination on a worldwide scale. Accordingly, the Government of Japan is actively participating in the activities of the Committee on Earth Observation Satellites (CEOS) and other international forums and is promoting the development, launch, and operation of satellites in conformity with these activities.

7.3.2 Priority Fields

The Government of Japan places special priority on promoting the observation and monitoring to identify the status, causes, and impacts of global warming and climate change.

Observation and monitoring related to climate changes and global warming cover a wide area or even the entire globe, so Japan has actively been promoting the development of effective methods such as utilization of satellite centers, as well as operating geostationary meteorological satellites.

7.3.3 Main Systematic Observations

7.3.3.1 Atmospheric observing system for climate including atmospheric constituent measurements

Homogeneous and high quality climate observations have been implemented by more than 150 meteorological stations in Japan for more than several decades. CLIMAT reports from some of the above stations have been exchanged internationally on a monthly basis. Japan has also been monitoring the reception rates and data quality of CLIMAT reports from the world jointly with Germany under the framework of the World Meteorological Organization (WMO). Japan has been providing climate change-related information, based on climate data collected and analyzed through the above activities, in quasi-real time within and outside Japan. Data from geostationary meteorological satellites, such as the cloud amount, are used to monitor long-term changes in global radiation, and climate change. The following has also been promoted: development of the Advanced Earth Observing Satellite-II (ADEOS-II, scheduled for launch in fiscal 2002) to make an international contribution to global observation; development of a system to comprehensively check and analyze the status of the solar winds and upper atmosphere; as well as producing observation equipment that will be carried aboard the satellite to monitor the stratospheric ozone layer, etc. (Improved Limb Atmospheric Spectrometer-II (ILAS-II), Global Imager (GLI), and Advanced Microwave Scanning Radiometer (AMSR)); international joint research for the development of comprehensive observation systems for the middle atmosphere; joint research into advanced global environmental instrumentation in Asia; and research and development of a stratospheric platform for directly observing the atmosphere at various altitudes ranging from the troposphere to stratosphere.

Table 7.1.1 Participation in the Global Atmospheric Observing System for Climate

	GSN	GUAN	GAW	Others
Number of stations	14*	7	8	
Number of operating stations	14*	7	8	
Number of stations operating to GCOS standards	14*	1	8	
Number of stations expected to be operational in 2005	14	7	8	
Number of stations providing data to International Data Center	14*	7	8	

*As of February 2002, or as of December 31st 2001 for others, including the Syowa Station at the Antarctic

Table 7.1.2 Atmospheric observing systems for climate at the land surface (land surface meteorological observations)

Systems	Climate parameters	Total Stations	Appropriate for characterizing national/regional climates?			Time Series Stations [digitized]			Adequate Quality Control Procedures?			Meta data available Total stations [digitized (%)]	Continuity Stations expected to be operational in 2005
			Fully	Partly	No	30-50 years	50-100 years	More than 100 years	Fully	Partly	No		
Stations useful for national climate monitoring purposes	Atmospheric pressure	158	○			157[157]	0	0	○			158[100]	157
	Cloud	132	○			15[130]	57	58	○			131[100]	126
	Weather	157	○			19[157]	78	60	○			158[100]	156
	Humidity	158	○			19[157]	78	60	○			158[100]	157
	Precipitation	156	○			19[156]	77	60	○			157[100]	155
	Radiation	69	○			56[56]	0	0	○			69[100]	69
	Sunshine duration	157	○			18[155]	83	54	○			157[100]	156
	Temperature	158	○			19[157]	78	60	○			158[100]	157
	Visibility	156	○			15[155]	55	58	○			156[100]	155
Wind	158	○			17[157]	140	0	○			158[100]	157	
Stations reporting internationally	■	86											
CLIMAT reporting Stations	■	54											

As of December 31st 2001, including the Syowa Station at the Antarctic

Table 7.1.3 Available homogenous data sets for land surface meteorological observations

Data set name	Climate Parameters	Stations and Region covered	Time period	Enquiries
Surface meteorological observation monthly and 10-day mean/total data file	Atmospheric pressure, clouds, weather, humidity, precipitation, radiation, sunshine duration, temperature, wind	157 stations in Japan	1961 ~ 2001	Japan Meteorological Agency
Surface meteorological observation daily mean/total data file	As above	As above	1961 ~ 2001	Japan Meteorological Agency
Surface meteorological observation monthly mean/total data file	As above	As above	1880s ~ 2001	Japan Meteorological Agency

Table 7.1.4 Atmospheric observing system (Upper air meteorological observations)

System	Total observation points	Appropriate for characterizing national/regional climates?			Time series Stations [digitized]				Is the quality control appropriate?			Meta data available Stations [digitized (%)]	Continuity Stations expected to be operational in 2005
		Fully	Partly	No	5-10 years	10-30years	30-50 years	More than 50 years	Fully	Partly	No		
Radio Sonde Stations	19	○			0	1[1]	8[8]	10 [10]	○			19[100]	19
Stations reporting internationally	19												
CLIMAT TEMP Reporting stations	19												
Wind profiler stations	25				0	0	0	0	○			25[100]	31

As of December 31st 2001, including the Syowa Station at the Antarctic

Table 7.1.5 Available homogenous data sets for upper air meteorological observations

Data set names	Climate Parameters	Stations and Area covered	Time series	Enquiries
Upper air meteorological observation daily mean/total data file	Humidity, temperature, wind, altitude	18 stations in Japan data at standard atmospheric pressure levels	1981 ~ 2001	Japan Meteorological Agency
Upper air meteorological observation monthly mean/total data file	As above	As above	1951 ~ 2001	Japan Meteorological Agency

As of December 31st 2001

Table 7.1.6 Atmospheric constituent observing systems for climate

Constituent	Total stations	Appropriate for characterizing national climate?			Time Series Stations [digitized]				Is the quality control appropriate?			Meta data available Total stations [digitized (%)]	Continuity Stations expected to be operational in 2005
		Fully	Partly	No	10-20 years	20-30 years	30-50 years	More than 50 years	Fully	Partly	No		
Carbon dioxide	10	○			8[8]	0	0	0	○			10[100]	10
Surface ozone	5	○			3[3]	0	0	0	○			5[100]	5
Total ozone	6	○			0	1[1]	4[4]	0	○			6[100]	6
Vertical ozone distribution	7	○			3[3]	0	4[4]	0	○			7[100]	7
Other greenhouse gases	10	○			8[8]	0	0	0	○			10[100]	10
Aerosols	3	○			0	1[1]	0	0	○			3[100]	3

※As of December 31st 2001, including the Syowa Station at the Antarctic

7.3.3.2 Ocean observing system for climate

Japan has been promoting the development of the Global Ocean Observing System (GOOS), and also contributing actively to its regional pilot project, 'North-East Asian Regional Global Ocean Observing System (NEAR-GOOS).

Furthermore, continuous observation has been implemented at nationwide observation points to monitor the change in the sea levels. Japan has been making efforts to enhance the observation and monitoring systems, and other measurements to determine time-and-space-related distributions of carbon dioxide in the ocean. Oceanographic observations have also been carried out to monitor the climate changes in the western North Pacific. Japan is also been promoting the 'Construction of Advanced Ocean Observing System' (ARGO project) with the aim of improving long-range weather forecasts. Japan has been improving the marine observation system by deploying Triton buoys in the tropical Pacific since 1998, and deploying ARGO floats since 2000. Moreover, the following has been implemented: preparation of bases for monitoring the marine environment in accordance with the Northwest Pacific Action Plan (NOWPAP); development of the Advanced Earth Observing Satellite-II (ADEOS-II) for observation of the marine environments and Advanced Microwave Scanning Radiometer-E (AMSR-E); and research into remote sensing technologies.

Table 7.2 Participation in the Global Ocean Observing System

	VOS	SOOP	Tide gauges	SFC drifters	Sub-SFC floats	Moored buoy	ASAP
Number of stations	432	38	15※ ²	41※ ¹	78※ ¹	11※ ¹	6
Number of stations providing data to International Data Centers	332	38	15※ ²	35※ ¹	54※ ¹	10※ ¹	6
Number of stations expected to be operational in 2005	450	38	15※ ²	40	350	11	6

※¹ : As of August 31st 2001, or as of December 31st 2001 for others

※² : Tide gauges participating in GLOSS, including the Showa Station at the Antarctic

7.3.3.3 Terrestrial observing system for climate

Japan is continuously strengthening its observation and monitoring systems and other measurements to scrutinize time and spatial distribution of greenhouse gases such as carbon dioxide, methane, nitrous oxide, chlorofluorocarbons, tropospheric ozone, and has been carrying out the following: monitoring of greenhouse gas flux in northern forests; development of the Advanced Earth Observing Satellite-II (ADEOS-II); Advanced Land Observing Satellite (ALOS) and sensors carried aboard this satellite (Advanced Visible and Near Infrared Radiometer Type 2 (AVNIR-2), Panchromatic Remote Sensing Instrument for Stereo Mapping (PRISM), Phased Array type L-band Synthetic Aperture Radar (PALSAR); research into remote inspection technology that carries out terrestrial environmental observations of vegetation amounts (biomass), land use, changes in land coverage, ground moisture, snow and ice.

7.3.3.4 Support for developing countries to establish and maintain observation systems, concerned data and monitoring systems

Japan has been jointly carrying out research on global environment measuring technologies in Asia, and has also been promoting the establishment of a strategic environment monitoring system using a satellite in the Asia-Pacific region.

Chapter 8

Education, Training, and Public Awareness

8.1 Approaches to Policies and Measures

Carbon dioxide emissions have been consistently increasing in recent years in the residential/commercial and transport sectors, which are closely related to the lifestyles of citizen. To mitigate global warming, all citizens must shift from the mass consumption and disposal lifestyle to resource and energy conservation. At the same time, consideration should be given for the usage of non-fossil fuel energy, including new and renewable energy and nuclear energy. To that end, opportunities to learn about the global warming issue, as well as the energy issues closely involved with it, are provided for homes, schools, and society at large. Japan is also trying to develop the Prefecture Centers for Climate Change Actions nationwide, and promotes improved awareness through advertising in the mass media, distribution of pamphlets, and the holding of symposiums, etc. Also, Japan is committed to increasing the support for environmental NGOs, which promise to play a leading role as advisors in citizen efforts to address the global warming problem.

8.2 Promotion of Environmental Education and Study

8.2.1 Outline

To encourage citizen to act for preventing global warming in their daily lives, opportunities to study the importance of global environmental conservation, the relationship between global warming and daily lifestyles, energy issues closely involved with global warming, and examples of measures to mitigate global warming, etc., are being positively provided in homes, schools, society companies and other situation.

8.2.2 Specific Measures

- Promotion of environmental education provided by schools
Since 2002, adequate environment-related contents for each subject (natural science, etc.) have been upgraded and the environment can be studied comprehensively through cross-subject education within Period for Integrated study under new teaching guidelines. Furthermore, the followings have been carried out as actual promotion measures: the designation of model areas for the promotion of environmental education, providing environmental learning fairs and seminars for teachers in charge of environmental education, designating model GLOBE (Global Learning and Observation to Benefit the Environment) schools and environmentally friendly school facilities (eco-school). Japan has been promoting the use of recycled papers in textbooks to improve the further understanding of recycling for students. With an emphasis on the close relationship between global warming and energy consumption, Japan continues to upgrade the provision of education concerning resources and energy in schools, and the preparation of conditions for promoting education of the energy such as nuclear energy..
- Environmental Education and Studies through Social Education and Other Opportunities
To encourage citizens to address the problem of global warming in their daily lives, opportunities for people to learn about environmental issues should be provided for homes, schools, regions, companies and other situations. The content of these programs focuses on the importance of preserving the global environment, the relations between global warming and daily life, the energy issues that are the prime cause of global warming, and specific examples how to mitigate global warming.
- Green Education Model Project

The Japan Center for Climate Change Actions and the Energy Conservation Center, Japan jointly provide information on global warming-related issues, teaching materials for energy conservation education, and support energy and environmental education.

Since 2001, Japan has been soliciting ‘model schools for promoting energy conservation education’ through school boards and suchlike, for which support has been prioritized.

- Junior Eco Club Project

Since 1995, a ‘Junior Eco Club’ project has been operated in support of elementary and junior high school students’ environmental activities. Cooperative efforts are being pursued to increase the number of clubs and enhance the content of club activities.

- Junior Park Ranger Project

Since 1999, a ‘Junior Park Ranger’ project that provides opportunities for elementary and junior high school students to get hands-on experience of various environmental conservation activities through communication with nature such as in national parks has been operated, and has been promoted to provide opportunities to experience nature and improve understanding of environmental conservation.

- Environmental Education at Urban Parks

Since 1996, a project to prepare ‘environmentally friendly parks’ to provide a foundation for providing public environmental activities and training instructors has been implemented. In order to improve awareness and encourage greenery in urban cities, the ‘Green Consultation Center’ has been established, and the ‘Heisei Afforestation Project’ for the creation of more forests has been implemented with public involvement.

- Forest Environment Education using National Forests

Regional Forest Offices and District forest offices of national forest have been providing technical instruction and advice for activities such as forest environment education and experimental forest study using national forests.

8.3 Activities for Promoting the Prevention of Global Warming

8.3.1 Outline

In order to mitigate global warming, it is necessary for each member of the public to modify their own lifestyles, and public awareness and action is required to do so. The government promotes activities to improve awareness concerning global warming issues to further public understanding towards the prevention of global warming and motivate their actions. Japan also implements easy-to-understand measures for its citizens to prevent global warming.

8.3.2 Specific Measures

- Measures through the Japan Center for Climate Change Actions and the Prefecture Centers for Climate Change Actions

In accordance with the Law Concerning the Promotion of the Measures to Cope with Global Warming enacted in April 1999, the Japan Center for Climate Change Actions and Prefecture Centers for Climate Change Actions have been improving awareness and conducting promotional activities amongst local communities.

The Japan Environment Association was designated as the Japan Center for Climate Change Actions in July 1999, and eleven Prefecture Centers for Climate Change Actions were designated nationwide as of December 2001, and it is expected that they will play a leading role as local promoters for the mitigation of global warming.

- Activities of the Global Warming Prevention Activities Advisors

In accordance with the Law Concerning the Promotion of the Measures to Cope with Global Warming, activities to control the emission of greenhouse gases in relation to daily lifestyles by providing advice

and seeking to improve public awareness have been carried out by the global warming prevention activities advisors designated by prefectural governors.

- Promotion of Green Purchasing

The ‘Law Concerning the Promotion of Procurement of Eco-friendly Goods and Services by the State and Other Entities’ (Law on promoting Green Purchasing) established in 2000 stipulates the principle that environmentally friendly goods and services are to have minimal impact on the environment caused by greenhouse gases emitted in line with their use. Japan has been promoting the procurement of such environmentally friendly goods and services as a priority for each government organ in accordance with its ‘Basic Policy on Promoting Green Purchasing’ based on the above law, and also encourages local government, companies, and citizens to select such environmentally friendly goods and services.

- Measures centered on Environment Month

Both the national and local governments engage in various efforts to raise public awareness for environmental conservation. These activities are mainly conducted in June, which is Japan’s Environment Month, and particularly on June 5th, which is Japan’s annual Environment Day. Activities include: the Eco-Life Fair – an environmental exhibition; various lectures, symposiums, and events such as town meetings throughout Japan; the creation and distribution of pamphlets, posters, videos, etc.; the commendation of parties who provide environmental conservation services; and a PR campaign conducted in such media as television, radio, newspapers, and magazines.

- Measures centered on ‘Global Warming Prevention Month’

December has been designated Japan’s Global Warming Prevention Month and the central and local governments promote various activities to further this aim. Specifically, the following have been promoted: various events, such as global warming prevention symposiums and lectures, exhibitions of ecological goods, the creation and distribution of pamphlets, posters, videos, etc.; the commendation of parties who provide environmental conservation services; and a PR campaign conducted in various media.

- Measures centered on ‘Ozone Layer Conservation Promotion Month’

September has been designated Japan’s Ozone Layer Conservation Promotion Month associated with the international ozone layer conservation day (September 16th), and various ozone layer conservation-related activities have been promoted, such as the distribution of pamphlets or posters, offering various lectures and seminars, and exhibitions of panels. In fiscal 2001, promotion activities have also been conducted for better implementation of the ‘Law for ensuring the Implementation of Recovery and Destruction of Fluorocarbons concerning Specified Products’ (the Fluorocarbon Recovery and Destruction Law) established in June 2001 to mitigate global warming and better protect the ozone layer.

- Awareness Campaign for Energy Conservation

The council for promoting energy and resource conservation-related measures designated February as Energy Conservation Month, with the first day of each month being deemed an Energy Conservation Day, in addition to which August 1st is the Summer General Check-Up Day for Energy Conservation, and December 1st is the General Check-Up Day for Energy Conservation. The council requests individual government offices to implement intensive measures such as distribution of pamphlets and holding symposiums. Moreover, it decides the ‘summer (winter) energy conservation measure’ every year to be a guideline for each public level to implement energy conservation measures, and tries to strengthen its promotion in industrial circles and other sectors.

- Awareness Campaign for Recycling

To promote recycling activities, October is designated Recycling Promotion Month, when “idea contests” and other awareness campaigns are implemented.

- Measures for New Energy

Many types of equipment related to new energy have already been developed commercially, but are still expensive. For further cost reductions, initial demand is stimulated through commendation systems for superior products and application examples, as well as through seminars, symposiums, and other

awareness campaign activities.

- **Awareness Campaign for Nuclear Power**
With giving priority to safety, nuclear power is promoted by actively disclosing information to the public to ensure greater transparency and reflect public opinions and by providing correct and easy-to-understand information through all types of media. In addition, guidebooks for elementary, junior and senior high school students or teachers are supplied, and symposiums and seminars are held to strengthen basically “PR activity” to obtain the consent of citizens for nuclear power policies.
- **Awareness Campaign for National Greenery and Urban Greenery**
Funds for greenery campaigns are collected on the basis of the Law for the Green Feather Fund Movement Via Use of the Green Feather Fund Movement. Other examples of promotions designed to promote greenery include National Arbour Day (celebrated every spring), the Green Town Campaign (April through June every year), and City Greening Month (every October).
In addition, the National Trust Movement is being expanded through symposiums and other events.
- **Awareness Campaign for Transport Sector Environmental Issues**
Environmental measures for the transport sector are promoted throughout Japan by implementing specific measures and improving awareness of global environmental issues through the creation of pamphlets concerning global warming issues, energy conservation measures such as Eco-drive, and environmental issues for the transport sector such as air pollution problems, and their distribution to local government, industrial circles concerned, and the general public.
- **Awareness Campaign for Fuel-Efficient Vehicles**
Fuel-efficient vehicles have been promoted by preparing and distributing the ‘automobile fuel efficiency list’ showing fuel efficiency and carbon dioxide emissions from vehicles, and providing the latest information through the Internet, etc.
- **Provision of Information on the Current Status and Future Projections of Global Warming**
Japan has been encouraging the general public to become more aware of the latest information on climate change with publications describing the current status and future estimates of climate change, such as ‘Climate Change Monitoring Report’, ‘Global Warming Projections’ and ‘Report on Recent Climate Change in the World’.
Japanese editions of the Technological Summary (TS) and Summary for Policymakers (SPM) of the Third Assessment Report (TAR) of the Intergovernmental Panel on Climate Change (IPCC) have also been prepared. They will be released in print and via Internet.
- **Promotion of Public Involvement**
In order to promote the mitigation of global warming, it is important to emphasize measures related to our daily lifestyles, and encourage all members of the general public to implement them. For example, an environmental account book has been promoted to take records on changes in domestic energy use, such as electricity and gas, etc.. Since 2001, ‘10 measures that can be done at home’ has been proposed. In this awareness promotion, measures to reduce emissions of greenhouse gases that can be implemented domestically, such as reduction of electricity use by domestic electrical products in stand-by mode, and curtailing the habit of leaving stationary vehicle engines idling have been suggested through the distribution of pamphlets, etc.

8.4 Support for Environment NGOs

8.4.1 Outline

The vital activity and healthy development of environmental NGOs and other private groups are indispensable for success in mitigating global warming. Such groups can also play important roles as leaders or advisors in efforts to get the general public involved. However, many groups do not have the financial resources needed to operate adequately and have depended on assistance from the national and local governments. Japan is committed to strengthening financial support for environmental NGOs and

other private groups while preserving the original intent of their activities.

8.4.2 Specific Measures

- **Global environment funds under the Japan Environment Cooperation**
The 'Japan Fund for the Global Environment' has been set up under the Japan Environment Cooperation with contributions from the government and the private sector, and every year subsidies and other support has been provided for greenery, recycling, and nature conservation-related activities undertaken by environmental NGOs both within and outside Japan. The Fund made donations 759 million Yen to 227 projects in fiscal 2001. The Ministry of Public Management, Home Affairs, Post and Telecommunications has also been allocating donations from special postcard sales to environmental conservation-related projects carried out by private groups, as well as providing support.
- **Funds for the Conservation of the Local Environment by Local Government**
Local governments also support the environmental conservation activities by NGOs and other groups through their respective funds for the conservation of the local environment.
- **Measures to be taken by the 'Global Environment Information Centre'**
The Global Environment Information Centre was established as a joint project between the United Nations University and the Environment Agency in October 1996. The Centre compiles the results of surveys and researches to build up mechanisms that will allow opinions of NGOs to be reflected in the Framework Convention on Climate Change. It also promotes NGOs' participation in the implementation of Agenda 21 through, inter alia, facilitation of international symposiums that focus on the roles of NGOs in arresting global warming; and information service on the global warming problem with a wide range of materials from Japan and abroad.
- **Environmental Counselor Registration System**
Environmental counselors who have professional knowledge and sufficient experience are selected and appointed to provide advice on environmental conservation activities of private groups including and entrepreneurs. The list of counselors is open to public. Activities of private groups are supported by expanding opportunities for environmental counselors to work and by providing training to such counselors.
- **Support for Private Afforestation Projects**
The Forestry Agency has been supporting private afforestation projects via the Japan International Forestry Promotion & Cooperation Center. The following have been implementing through this project.
 - 1) Support for afforestation projects implemented by NGOs
 - 2) Strengthening of cooperation with NGOs
 - 3) Training of afforestation engineers
- **Provision of Opportunities for Forest-related Activities**
National forest also provides forestry volunteer groups, etc. with a place to establish and improve forest.
- **Support for Global Environmental Conservation Using "Postcard Contributions" and Other Programs (as previously mentioned)**