Assessment and Review of the Climate Change Policy Programme

Interim Report

August 2004

Central Environment Council

Ministry of the Environment, Japan

Contents

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As of Aug 6, 2004

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Meeting Schedule: Assessment and Review of the Climate Change Policy Programme

January 30
The 12th Subcommittee Meeting (Review of scientific knowledge)

February 25
The 13th Subcommittee Meeting (Procedure of assessment and review, Assessment of transport sector)

March 10
The 14th Subcommittee Meeting (Assessment of commercial and industrial sectors)

March 22
The 15th Subcommittee Meeting (Promotion of activities by residential sector and every social actor to prevent global warming, Assessment of carbon dioxide from non-energy source, methane, nitrous oxide and Kyoto Mechanisms)

April 2
The 16th Subcommittee Meeting (Hearings of concerned organizations [Keidanren, Tokyo Metropolitan Government, Kiko Network], Assessment of energy supply sector)

April 7
The 17th Subcommittee Meeting (Hearings of concerned ministries and agencies [Ministry of Economy, Trade and Industry, Ministry of Land, Infrastructure, and Transport, Ministry of Agriculture, Forestry and Fisheries], Assessment of sinks and the three CFC alternatives measures)

April 16
The 18th Subcommittee Meeting (Tentative estimation of greenhouse gas emissions in 2010, Review of energy supply sector)

June 4
The 19th Subcommittee Meeting (Review of transport, commercial, and residential sectors)

June 19
The 20th Subcommittee Meeting (Review of industrial sector, Kyoto Mechanisms, and the three CFC alternatives measures)

July 15
The 21th Subcommittee Meeting (Promotion of activities by social actors to prevent global warming, Strengthening the research and development of innovative environmental and energy technologies, Review of carbon dioxide from non-energy source, methane, nitrous oxide and sinks measures, Tentative estimation of greenhouse gas emissions in 2010, [BAU and Measure Enhancement Scenarios], Summarizing the point of issue for interim report)

July 29
The 22th Subcommittee Meeting (Interim report [preliminary draft])

August 6
The 23th Subcommittee Meeting (Interim report [final draft])

Introduction

Last summer, contrary to the continuing low temperatures and shortage of sunlight in Japan, Europe experienced unusually high temperatures, resulting in heat stress-related deaths and forest fires. This year too, many countries around the world, including Japan, are faced with abnormal weather, such as heat waves and heavy rain. The increase in the occurrence of abnormal weather in recent years has led to the outbreak of forest fires on a large scale in Europe, Siberia, Asia, and the U.S.A. It has also seriously affected agriculture and stock farming. It is predicted that in the future, as global warming worsens, such kinds of abnormal weather will bring frequent and massive damages. The frequent occurrence of abnormal weather in recent years has already deepened the concerns of citizens about the effects of global warming.

The Kyoto Protocol is the first step taken by the international community to work towards realizing the ultimate objective of the United Nations Framework Convention on Climate Change (hereinafter referred to as “UNFCCC” or “Convention”) that was adopted to tackle climate change-related problems.

The Climate Change Policy Programme (hereinafter referred to as “Programme”) was formulated in 1998 following the adoption of the Kyoto Protocol. It was revised in March 2002, prior to Japan’s ratification of the Kyoto Protocol.

In order to fulfill the 6% reduction commitment of the Kyoto Protocol in the first commitment period etween 2008 and 2012, while taking into consideration changes in the socio-economic situation and conditions related to the development and diffusion of technology, the Programme adopted a step-by-step approach. The first step refers to the three years between 2002 and 2004, the second step refers to the three years between 2005 and 2007, and the third step refers to the three years between 2008 and 2012 (the first commitment period of the Protocol). The Programme is scheduled for assessment and review in 2004 and also in 2007. As three years have passed since the Programme was last revised, 2004 is the year in which assessment and review will be carried out in order to pave the way for the second step of the Programme.

In January 2004, the Central Environment Council started deliberation of the assessment and review of the Programme. The Council has held twelve meetings to assess the progress of policies and measures implemented by each sectors; to conduct hearings of concerned ministries, agencies, and organizations; and to review policies and measures for each sector. Following the deliberations, the Central Environment Council put together an interim report to provide a basic direction for the assessment and review of the Programme.

The Central Environment Council calls for the government to step up assessment and review of the Programme and utilize this interim report to make steady progress towards fulfillment of the 6% reduction commitment of the Kyoto Protocol.

Global warming has tremendous deleterious effect on the earth’s overall environment. Mankind staking its fate must make every effort to achieve the ultimate objective of UNFCCC by creating a socio-economic system that causes no global warming. In Japan, every social actor must not relegate this responsibility to others, but actively take the initiative to prevent global warming. Businesses, public entities, and citizens must treat global warming as their own problem and take actions to further implement various measures. To this end, all ministries and agencies of the government must work together, utilize all policy instruments, and appeal to all actors of the society to take concrete actions to prevent global warming.

I. Basic Understanding of the Global Warming Prevention Measures and Efforts of Japan

1. Scientific Knowledge of Global Warming

(Various effects of global warming)

- According to the IPCC[1] Third Assessment Report, the world's mean temperature rose 0.6± 0.2 ℃ and the average sea level rose 10–20 cm within the hundred years of the 20th century. The atmospheric concentration of carbon dioxide increased drastically from approximately 280 ppm before the Industrial Revolution to approximately 370 ppm today. The report pointed out that global warming in the last fifty years is most likely caused by anthropogenic activities and that global warming is a real and imminent problem.

- According to the report, the effects of global warming are becoming more obvious. The glaciers are receding; the areas of snow coverage are declining; the ecosystems are changing, and the frequency of heavy rain or drought is increasing in certain areas. As global warming worsens in the future, it is predicted that the global mean surface temperature will rise 1.4–5.8 ℃ in the period between 1990 and 2100. Consequently, the average sea level will rise 9–88 cm. It is also predicted that the risk of various adverse effects on humans and on the environment, including abnormal weather such as floods and heat waves, increase in droughts, spread of infectious diseases such as malaria, extinction of some plants and animals, decrease in grain production, and damage to water resources, will increase in proportion to the rise in temperature.

(Need for the stabilization of greenhouse gas concentrations and drastic emission reductions)

- To prevent serious effects caused by such climate changes, the UNFCCC, which entered into force in 1994, stipulates its ultimate objective as "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." It also stipulates that such "a level" should be achieved within a time-frame sufficient to (1) allow ecosystems to adapt naturally to climate change, to (2) ensure that food production is not threatened and to (3) enable economic development to proceed in a sustainable manner."

- "Stabilization of greenhouse gas concentrations" means to balance the amounts of greenhouse gases emitted and the amounts absorbed so that the amounts of greenhouse gases in the earth's atmosphere remain constant. Currently, these gases emitted into the atmosphere are double the amounts absorbed by the oceans and forests, resulting in a continuous rise in the atmospheric concentrations of these greenhouse gases. To stabilize the concentrations of greenhouse gases, the current emissions of greenhouse gases must be drastically reduced so that the amounts of emission and absorption are equal.

- The stabilization level for concentrations of greenhouse gases is determined by the accumulated amounts of greenhouse gases that have been emitted until they become stabilized. The lower the desired stabilization level of gas concentrations is, the earlier the emissions must be reduced. For example, IPCC put forward a scenario in which, if it is determined that the concentration of carbon dioxide is to be stabilized at 550 ppm, a level of concentration that is double the level existing before the Industrial

[1] A United Nations entity established in 1998 jointly by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP). It aims at gathering the latest knowledge of natural science and social science on climate change to provide a scientific base for measures to prevent global warming. It put together the First Assessment Report in 1990 and the Second Assessment Report in 1995.

Revolution, carbon emissions must be on a downward trend by around 2030.

- It has been pointed out that the weather will remain unstable for a long time, even after the atmospheric concentrations of greenhouse gases stabilize. This is because there is a time lag before the atmospheric temperature stabilizes and the rise of sea level from thermal expansion and melting of ice stops. From this viewpoint as well, it is necessary to stabilize the atmospheric concentrations of greenhouse gases as soon as possible.

(Importance of technologies and the need for their early introduction to facilitate social reform)

- The IPCC Third Assessment Report pointed out that drastic reduction is achievable with the introduction of existing technological options. It is necessary to continue the research and development of new technologies as well as to put the existing applicable technologies to wider use in society.

- Besides population, energy mix, and industrial structure, the emissions of greenhouse gases are influenced by various kinds of infrastructure such as transport systems and urban structures. It takes a huge investment and a long period of time to make a transition to the kinds of infrastructure that emit less greenhouse gases and that can enable individual measures for preventing global warming to take full effect . For this reason, it is necessary to have a long-term perspective and take early measures to reform the infrastructure.

- Furthermore, even after a technology is developed, it takes certain amount of time for it to be put to wide use. In order for a country to quickly introduce and commercialize a technology that has been developed, it must have in place the necessary institutional conditions, including various subsidization programs, taxation systems, and rates. Additionally, in order to bring about a global decline in greenhouse gases, it is necessary to find an international mechanism that will enable various countries to introduce global warming prevention technologies at lower cost.

2. UNFCCC and Kyoto Protocol

(The Kyoto Protocol that has been agreed upon with consideration to the various conditions of countries in the world)

- International discussion on global warming started in the 1980s. The UNFCCC was adopted in 1992 and Japan endorsed the Convention upon the Diet's approval in May 1993.

- The aim of UNFCCC is to stabilize the concentrations of greenhouse gases. All the countries in the world, including developing countries, must implement measures to realize the objective of stabilizing the concentrations of greenhouse gases. In the process of negotiating the Convention, there were intensive discussions between the developed and developing countries with regard to measures to be taken to achieve that objective. Consequently, it was agreed that the countries would be divided into three groups and each group would implement different levels of measures, based on the principle of "common but differentiated responsibilities." This agreement was based on the recognition that per capita emissions are closely related to the state of social and economic development, that per capita emissions in developing countries are still relatively low compared to the developed countries, that the largest share of historical and current global emissions of greenhouse gases has originated in developed countries, and that measures taken by countries to address global warming may differ according to their specific circumstances and capacities. Thus, the three groups are the developed countries (Annex-I OECD countries and countries with economies in transition (former socialist countries)), other developing countries (countries not included in Annex-I), and developed countries among the Annex-I countries that provide technological support and financial resources (Annex-II OECD countries). A non-binding target was set up for the developed countries to return them to their 1990 levels of carbon dioxide emissions by the end of the 1990s.

- It was realized, however, that there was a need to strengthen measures, due to the lack of adequate measures stipulated in the Convention to accomplish its objective. In the 1st Conference of the Parties to the UNFCCC (COP1) held in Berlin in 1995, negotiation on legally binding numerical targets for developed countries was initiated. It was agreed in the "Berlin Mandate" to come to a consensus on the numerical targets by the 3rd Conference of the Parties to the UNFCCC (COP3). Based on this negotiation framework, the Kyoto Protocol was adopted in the Kyoto Conference on Climate Change (3rd Conference of the Parties to the UNFCCC, COP3) in 1997. It prescribed specific and legally binding numerical targets for the developed countries. In this way, the Kyoto Protocol brought together a consensus after long years of international negotiations.

- The Kyoto Protocol is the only treaty that is named after a Japanese city. Every actor of the Japanese society welcomed its adoption as a symbol of the accomplishment of Japan's environmental diplomacy.

(The contents of the Kyoto Protocol and its ratification by Japan)

- The Kyoto Protocol targets six key greenhouse gases, including carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6). It aims at reducing the collective emissions of these gases by developed countries by at least 5% compared to the 1990 level in the first commitment period from 2008 to 2012 and at setting up legally binding numerical targets for each country. It was agreed that carbon sinks can also be included in the calculation

for meeting these targets. The Kyoto Mechanisms[2] an international system to promote highly cost-effective measures for meeting the targets, were adopted.

- In March 2001, the newly inaugurated Bush Administration in the U.S. announced that the U.S. would not support the Kyoto Protocol. One of the reasons given by the U.S. was the fatal flaw in the Kyoto Protocol of not setting any numerical targets for the developing countries. This assertion was a setback for international initiatives based upon various agreements that had been hammered out in negotiations, in which the U.S. was also one of the participating members. These agreements included the UNFCCC principle of "common but differentiated responsibilities" and the agreement in the Berlin Mandate to negotiate measures only among the developed countries and to "not introduce any new commitment" for developing countries. In April 2001, in addition to seeking U.S. endorsement of the Kyoto Protocol once again, Japan adopted the Kyoto Protocol after the Diet unanimously approved a resolution for its adoption.

- With regard to the commitment of legally binding numerical targets by each country under the Kyoto Protocol, the US and EU countries called for an across-the-board reduction commitment by developed countries while Japan suggested a differentiated reduction commitment. In the end, the differentiated reduction commitment, which took into account the individual circumstances of each country, was adopted. Japan continued the negotiation on methods of implementing the Kyoto Protocol even after COP3. The negotiation continued after the U.S. had announced its retreat from the Kyoto Protocol. Although each country had its own agendas, tireless efforts were made to try to facilitate the Kyoto Protocol's entry into force. The negotiation came to a consensus, taking Japan's proposal into consideration, and the Marrakesh Accord was reached in 2001. Upon receiving the unanimous approval of the Diet, Japan ratified the Kyoto Protocol in June 2002.

- Judging from the development and contents concerning the negotiations of the Kyoto Protocol as described above, it cannot be said that it was unfair or disadvantageous to any one party. In international negotiations, it is extremely rare to embrace fully the conditions of one country. The direction and the roadmap for the international community shall be determined by unremitting compromises and agreements.

(Efforts to facilitate the early entry into force of the Kyoto Protocol)

- The Kyoto Protocol will enter into force 90 days after the following two conditions have been fulfilled: (1) The Protocol is ratified by at least 55 Parties to the Convention; and (2) The total 1990 carbon emissions from the Annex-I countries[3] that ratified the Protocol shall represent at least 55% of the total carbon emissions of all Annex-I countries. As of August 2004, 123 countries and the EU have ratified the Protocol. With ratification by either the U.S. or Russia, the Kyoto Protocol will enter into force.

- Although the Kyoto Protocol has not entered into force as of August 2004, as the country that has played host to the Kyoto Conference on Climate Change and a Party to the Protocol, Japan will continue to work

[2] It refers to the "Clean Development Mechanism" (CDM), which enables developed countries to receive credit for financing emissions-reduction projects in developing countries; "Joint Implementation" (JI), which enables developed countries to acquire "emission reduction units" by financing certain kinds of projects in other developed countries or countries with economies in transition; and an international "emissions trading" regime.

[3] Countries that are required to meet the legally binding numerical commitment in the emissions of greenhouse gases under the Kyoto Protocol (applicable to developed countries and countries with economies in transition)

towards its entry into force as soon as possible by appealing to countries that have not ratified the Kyoto Protocol to do so.

3. Japan's Initiatives in Preventing Global Warming

(Progress of global warming prevention measures in Japan)

- The "Action Program to Arrest Global Warming" in 1991 marked the beginning of Japan's initiatives in global warming prevention. The Action Program also represented the basic concept held by Japan when it attended the 2nd World Climate Conference in 1991.

- Following the adoption of the Kyoto Protocol in 1997, the Global Warming Prevention Headquarters set up the Climate Change Policy Programme in 1998. The Climate Change Policy Law was enacted in 1998 to provide a full-scale legislative scheme for promoting global warming prevention measures. Through international negotiations, the Marrakesh Accord was hammered out. Since then, ratification of the Kyoto Protocol has gained momentum in various countries around the world.

(Initiatives for meeting the reduction commitment of the Kyoto Protocol)

- In preparation for the ratification of the Kyoto Protocol, Japan revised the Programme in March 2002. The Climate Change Policy Law was also revised, incorporating contents such as formulation of a plan to achieve the target of the Kyoto Protocol so as to ensure implementation of the Kyoto Protocol in Japan. After the establishment of these domestic schemes, Japan ratified the Kyoto Protocol in June 2002.

- Japan ratified the Kyoto Protocol and expressed to the international community its intention to honor the 6% reduction commitment of the Kyoto Protocol. Although the Kyoto Protocol has not entered into force at this time, the national and local governments, businesses, and citizens should take concrete actions in line with Japan's strong commitment to fulfill the commitment of the Kyoto Protocol. In particular, as the Global Warming Prevention Headquarters has decided on the Programme to achieve the 6% reduction commitment, the government must steadily implement measures in accordance with the Programme to prevent global warming after this assessment and review by the Central Environment Council.

II Assessment of the Programme

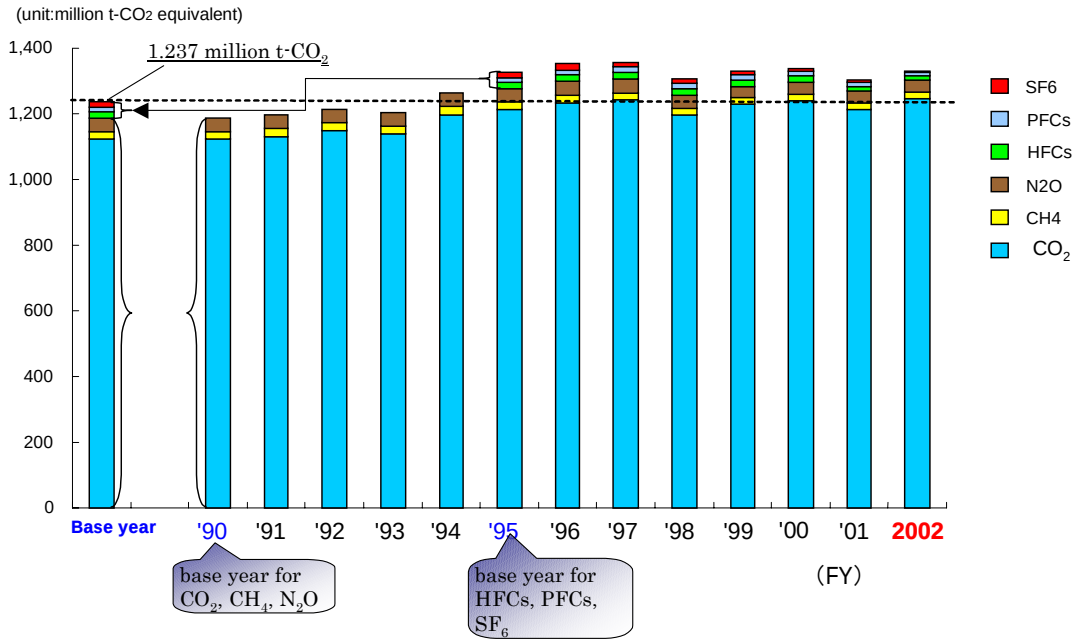
1. Current State of Greenhouse Gas Emissions

(1) Changes in Emissions from 1990 to 2002

(Amounts of emissions by category)

- Japan's greenhouse gas emissions in FY 2002 totaled 1,331 million t-CO2, 7.6% more than the total emissions of the base year (see Fig. 1).

(Fig. 1: Changes in the total amounts of greenhouse gas emissions in Japan)



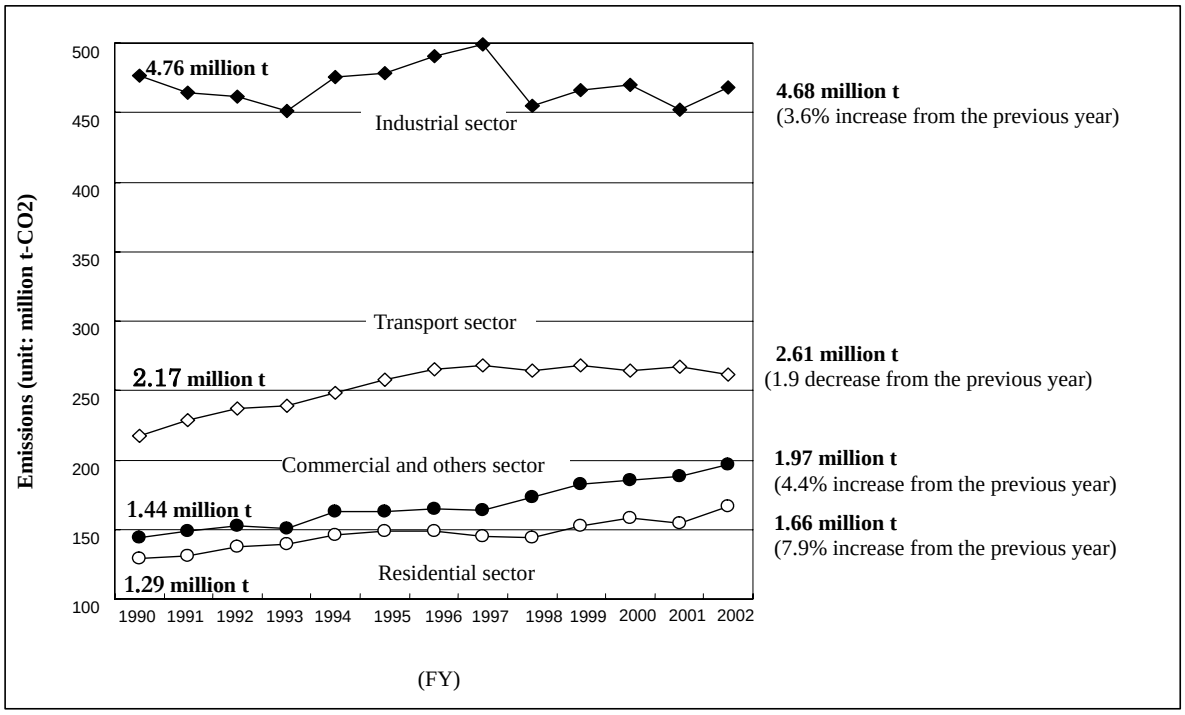
- Looking at the changes in the emissions of individual greenhouse gases from the base year to 2002, one realizes that the increase in carbon dioxide emissions, which accounted for over 90% of the total greenhouse gas emissions in Japan, was the greatest. Emissions of the other five gases were below the base-year levels.

- A comparison of emissions in FY 2002 to the targeted levels of greenhouse gas emissions stipulated in the Programme showed that "carbon dioxide emissions from energy use" exceeded the targeted level by a great margin. The emissions of "carbon dioxide from non-energy use, methane, and nitrous oxide" and the "three CFC alternatives" were below the targeted levels. The Programme also set up targets for the categories of "innovative technological development" and "promotion of global warming prevention activities by every social actor" as part of efforts to mitigate global warming. In terms of their relationship to the statistical data, their effects are mostly calculated as part of the carbon dioxide emissions from energy use.

(Emissions by sector)

- The following figure shows the changes in carbon dioxide emissions from energy use by sector between 1990 and 2002 (see Fig. 2):

(Fig. 2: Changes in carbon dioxide emissions from energy use, by sector)



(2) International Comparison of Energy Consumption by Sector

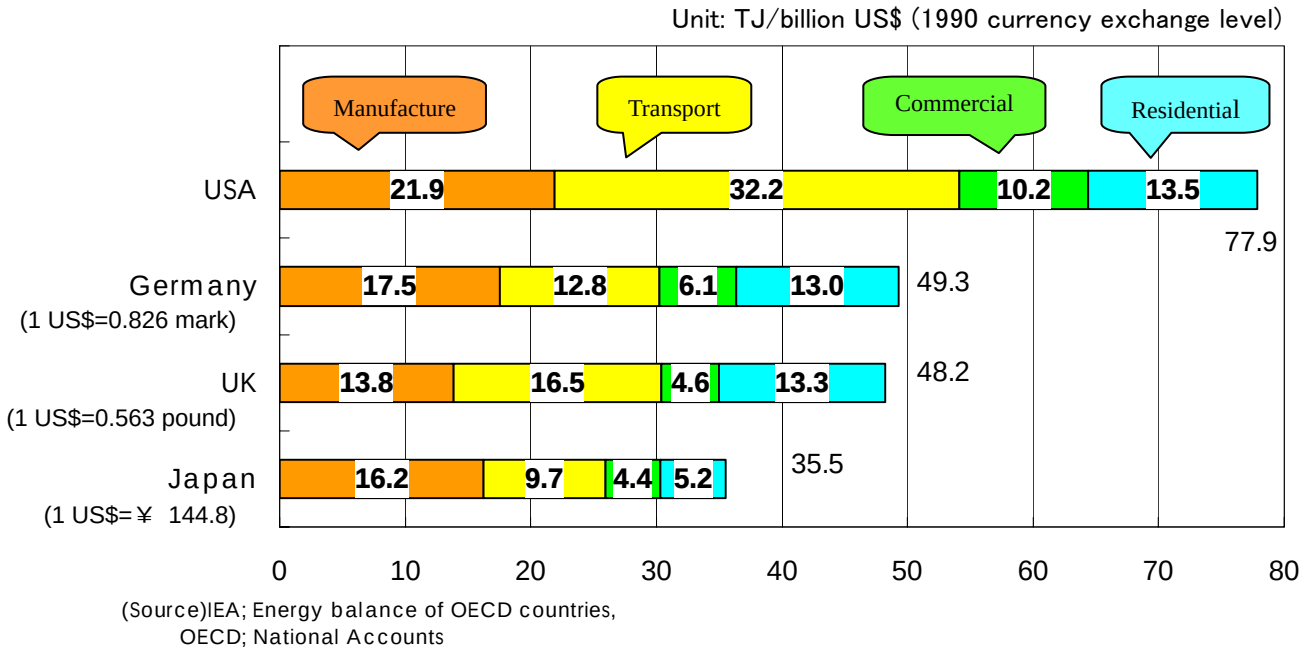
(International comparison of energy consumption per GDP)

- Carbon dioxide emissions from energy use account for approximately 90% of greenhouse gas emissions in Japan. For the purpose of inventory, the emission amount is calculated for each of the following sectors: industry, transport, commercial and others, and residential. In the Programme, emission amount in the base year, target level, and emission amount in a specific fiscal year are calculated for each sector. Although not in terms of carbon emissions from energy use, an international comparison of energy consumption per GDP by sector shows that Japan's energy consumption in the residential sector is low when compared with other major countries (see Fig. 3, 4, 5, and 6). This is also demonstrated in an absolute-quantity comparison of energy consumption per household (see Fig. 7).

(Review of energy efficiency by country)

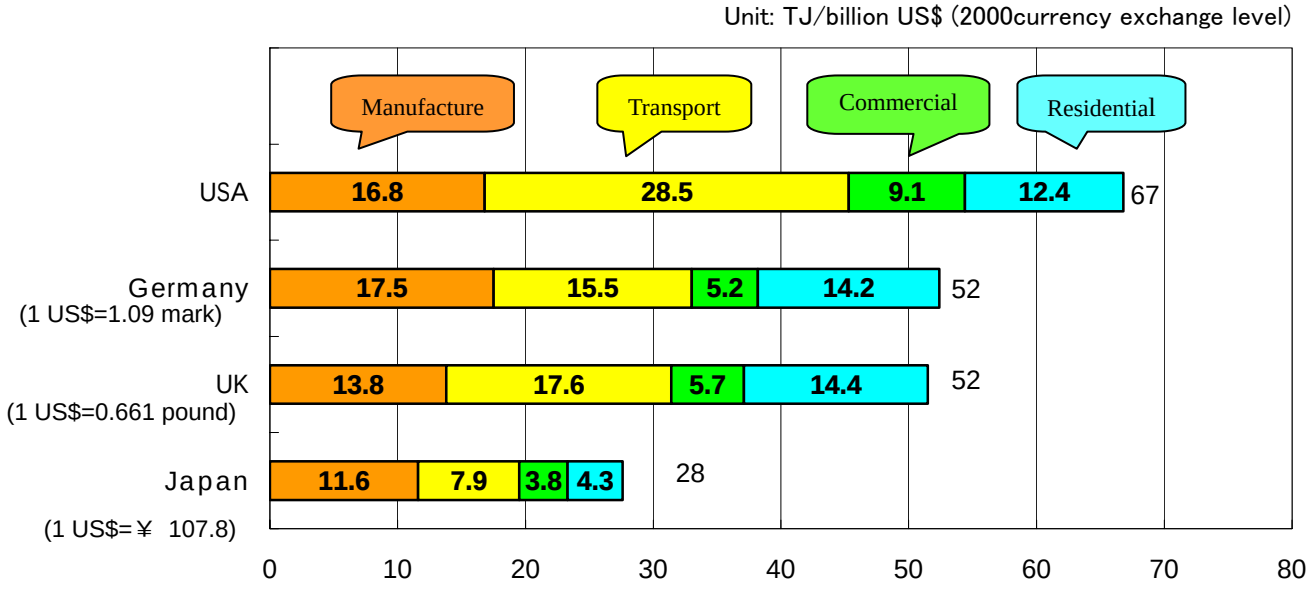
- It is true that Japan has achieved high energy efficiency in general. However, a detailed review must be conducted to find out specifically what technology in what field, or what lifestyle has contributed to such a high level of energy efficiency. To determine how energy efficient the Japanese industries are, it is best to compare energy consumption per production for each product. In such a comparison, differences in the ways of procuring raw materials and energy, as well as the composition of products, must be considered.

(Fig. 3: Energy consumption per GDP in 1990, by sector (using the 1990 currency exchange level))



(Source)IEA; Energy balance of OECD countries,
OECD; National Accounts

(Fig. 4: Energy consumption per GDP in 2000, by sector (using the 2000 currency exchange level))



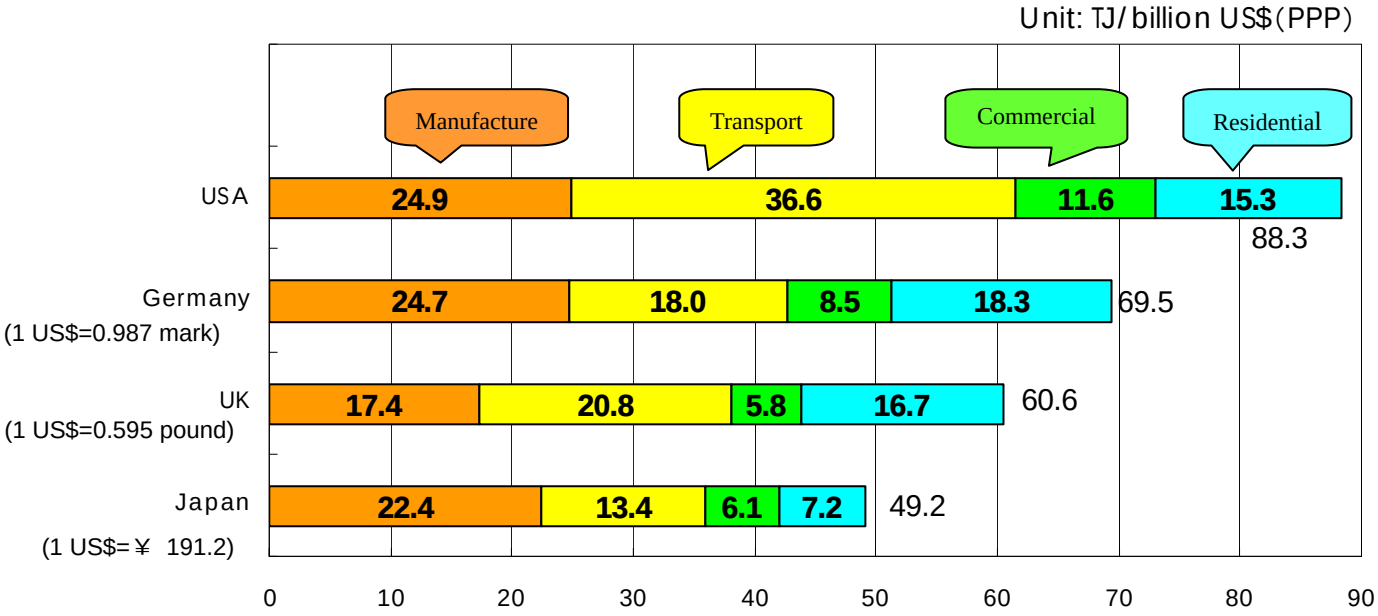
(Source)IEA; Energy balance of OECD countries,

(Note)

※ Because the currency exchange level is affected by the international demand and supply of financial products, speculation, and fluctuations in interest rates, it cannot be an absolute measurement that reflects the relative values of goods and services of different countries. Country comparison based on dollar-parity GDP is only one of the yardsticks for the international comparison of energy efficiency and its changes over time.

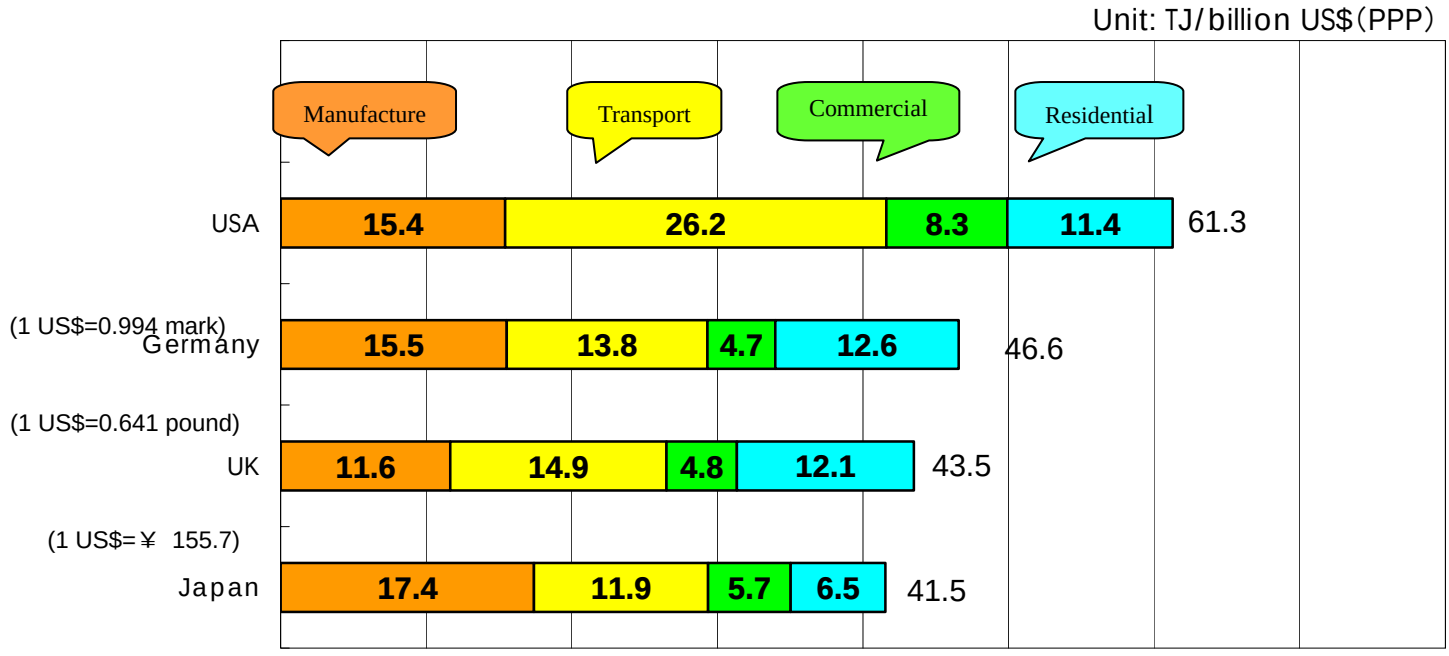
It is also important to remember that since energy consumption is influenced by various factors such as industrial structure, national land area, household area, and weather, energy efficiency is not the only factor that affects the overall or by-sector energy consumption of a country.

(Fig 5: Energy consumption per GDP in 1990, by sector (using the 1990 purchasing power parity))



(Source) IEA; Energy balance of OECD countries,
OECD; National Accounts

(Fig. 6: Energy consumption per GDP in 2000, by sector (using the 2000 purchasing power parity))



(Source) IEA; Energy balance of OECD countries,

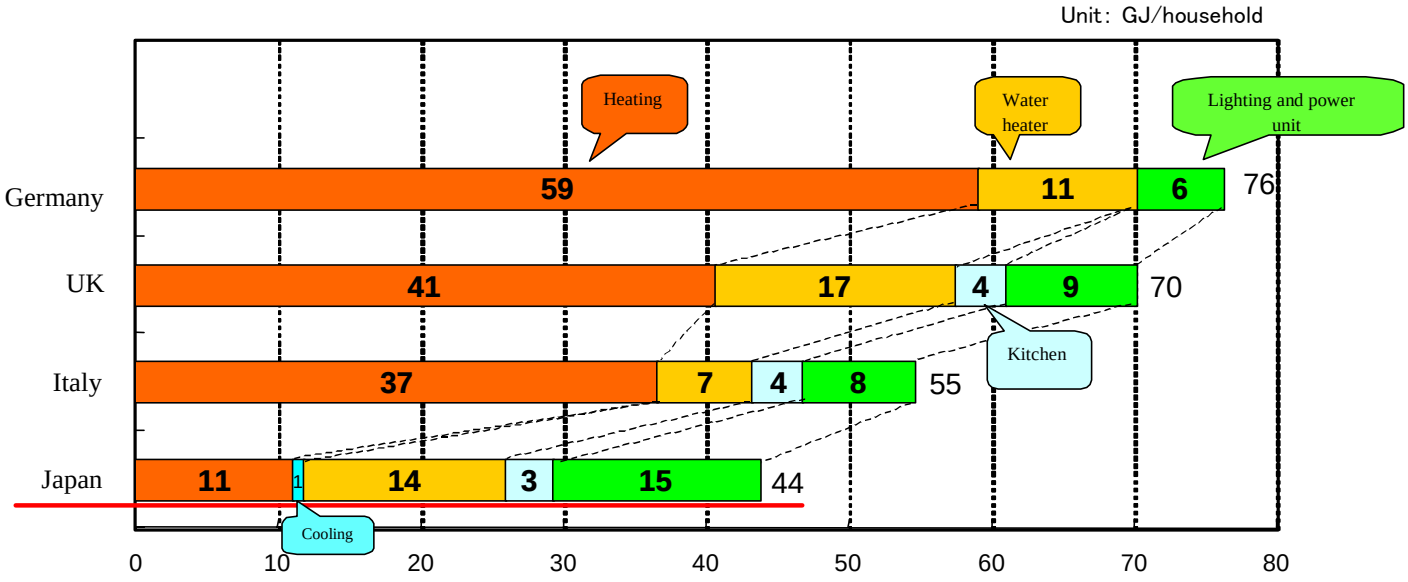
(Note)

※ The purchasing power parity used here is from the OECD National Accounts for OECD Member Countries that uses market price. In an international comparison based on purchasing power parity, a standard not affected by the international demand and supply for financial products, speculation, or

fluctuations in interest rates, it is necessary to take into account the effect of a tendency for the GDP of countries with internationally competitive tradable commodities to be assessed low. Furthermore, when assessing sectors incurring strong influence from tradable commodities, it is necessary to consider that these sectors are using the currency exchange rate as the standard.

It is also important to remember that since energy consumption is influenced by various factors such as industrial structure, national land area, household area, and weather, energy efficiency is not the only factor that affects the overall or by-sector energy consumption of a country.

(Fig. 7: Energy consumption per household in 1997)

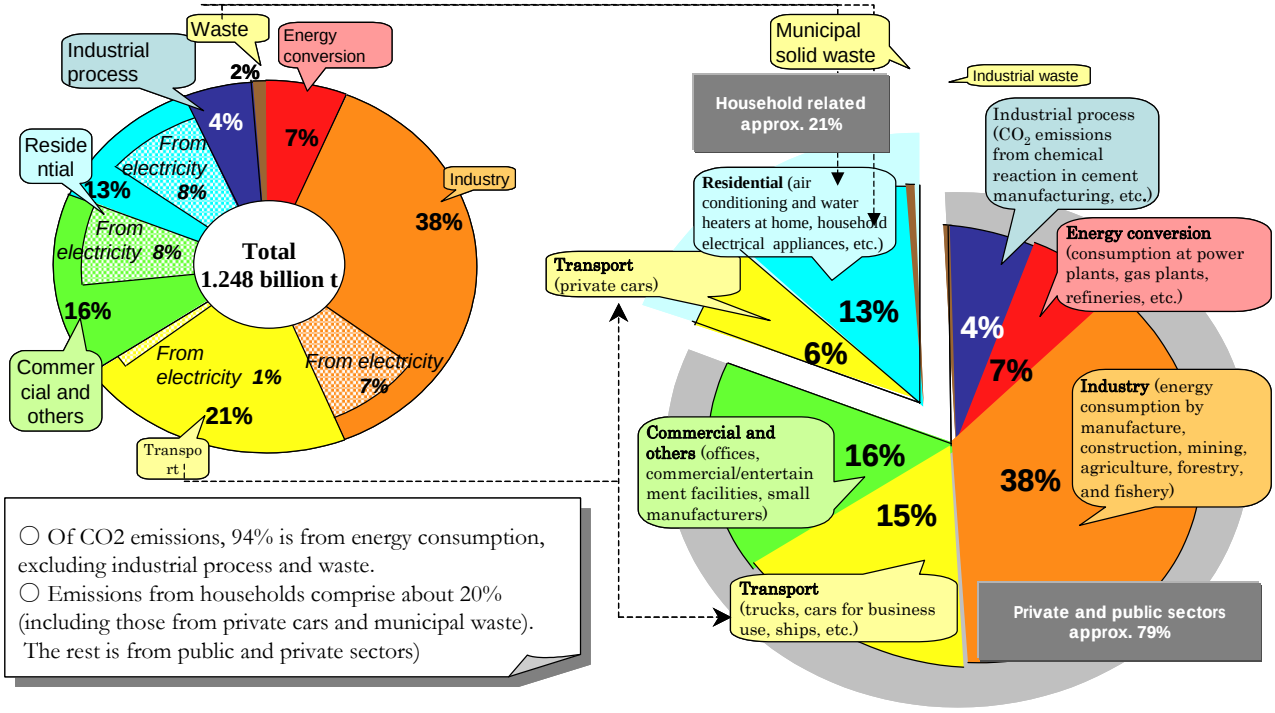


<Source> Prepared from IEA "Energy balance of OECD countries" ; UNFCC "Country Report"; EDMC "Handbook of Energy & Economic Statistics in Japan."

(3) Emissions by Sector

- Among the greenhouse gases emitted in Japan, the sources of carbon dioxide emissions can be divided into “residential” and “business/public sector.” The residential sector accounts for approximately 21% of the total and the business/public sector for approximately 79% (see Fig. 8).

(Fig. 8: Carbon dioxide emissions in FY 2002, by sector)



(4) Analysis of Various Factors Affecting Emissions (In the Case of Carbon Dioxide Emission from Energy Use)

(Active mass)

- Changes in the amounts of carbon dioxide emitted from 1990 to the present are affected by many factors, including the trend in economic development, changes in the production of various industries, changes in transport demand, increase in floor space of businesses, growth in population and number of households, improvement in living standards, etc.

- The trend in industrial activities is closely related to economic growth. The trends in energy consumption depend greatly on business types. Compared to the service industry, the material industry is generally more energy-intensive. As Japan is undergoing a long-term structural change from the manufacturing industry, including the material industry, to the service industry, the rate of growth in energy consumption will continue to show a long-term decline.

(Energy consumption per active mass)

- As measures for controlling the demand for energy, upgrading the efficiency of production at production sites and the efficiency of equipment that consumes energy, such as automobile and household electrical appliances, can help reduce energy consumption.

(Carbon dioxide emissions per energy consumption)

- Even when the same amount of energy is consumed, the amount of carbon dioxide emission differs depending on the energy source. In the case of electricity, for example, emissions of carbon dioxide per energy consumption (carbon dioxide emission intensity) differ depending on the energy mix. With the rise in electricity demand since 1990, and as more nuclear power plants, and power plants fired by coal and liquefied natural gas (LNG) are built, carbon dioxide emission intensity changes every year. Since the Programme stipulates that carbon dioxide emissions from electricity consumption shall be assessed for each sector, as the energy mix changes and carbon dioxide emission intensity changes as a result, there will be a tremendous effect on the amounts of carbon dioxide emitted by each sector.

(Factors affecting the amount of carbon dioxide emissions from energy use)

- Considering the above factors, the increases and decreases in the amount of carbon dioxide emissions from energy use shall be analyzed from criterion such as (1) active mass; (2) energy consumption per active mass (energy consumption intensity); and (3) carbon dioxide emissions per energy consumption (carbon dioxide emission intensity). Such detailed analysis would be necessary when reviewing various measures.

2. Assessment of the Progress of the Policies and Measures in the Programme

(1) Measures for Reducing Carbon Dioxide Emissions from Energy Use

1) Energy Supply Sector

- The current Programme sets targets for carbon dioxide emissions from energy use for each sector. This concerns only the so-called “electricity after distribution.” This means that the Programme does not make clear to what level the carbon dioxide emission intensity should be improved for energy suppliers and to what level the energy consumption intensity should be improved for energy users. It lacks a clear division of emission reduction responsibilities between energy suppliers and energy users.

- The Programme promotes “use of new energies,” “fuel switch,” and “nuclear energy” as measures for the energy supply sector. However, given the big gap between the current condition and the Programme’s goal for new energy measures, the uncertain outlook of fuel switch and the possible downward adjustment in the construction of new nuclear power plants, achievement of the Programme’s targets is difficult.

  - New energies: Based on the “Special Measures Law Concerning the Use of New Energy by Electric Utilities (Renewable Portfolio Standard (RPS) Law),” which mandates the use of new energy sources by electricity providers, 12.2 billion kWh (approximately 1.13 million kl)/year is expected to be covered by new energies in FY 2010. However, there is still a gap between the target set by the Programme and the amount of electricity generated by solar energy and wind power. Furthermore, given the current situation, it will be difficult to achieve the relatively high targets set by the Programme for solar energy and waste heat. At present, the chance of meeting the overall target for new energies is quite low.

  - Fuel Converting: Due to deregulation, the number of wholesale electricity providers has increased. Coal-fired power generation with high carbon emissions per power generated is expected to exceed 50% of the total electricity generated wholesale electricity providers, thus deterring transition to the direction set out by the Programme. Under such circumstances, achievement of the target will be difficult.

  - Construction of new nuclear power plants has been delayed more than was expected when the Programme was formulated. If electricity demand were as the Programme projected, nuclear power generation would not be sufficient, resulting in additional carbon emissions of approximately 20–30 million tons. In the latest electricity supply plan, however, the growth in future electricity demand is expected to be lower than the Programme’s original estimation. Therefore, it is estimated that carbon emissions in 2010 will probably not increase.

  - The electricity industry is currently carrying out voluntary action plans to curb the emission intensity approximately 20% from the FY 1990 level. The emission intensity envisioned by the Long-term Energy Supply and Demand Outlook, upon which the Programme originally based its calculations, represented a 28% improvement from the 1990 level.

2) Industrial Sector

- The industrial sector has pursued policies and measures aiming at a 7% reduction of emissions from the base year. Emissions from the industrial sector have been in decline, and compared to other sectors, deviation from the targeted level is small. Assessment of the reduction brought about by individual

measures is as follows:

- Of the industrial sector-related reduction mandated by the Programme, 96% is to be achieved through “voluntary action plans” and “measures at factories based on the Law concerning the Rational Use of Energy.” Because it is difficult to assess separately the reduction amounts realized by these two measures, they are categorized as one. Reduction achieved by voluntary action plans refers mainly to the Keidanren Voluntary Action Plan. Although the Keidanren’s Plan can be credited for certain results, it is not certain that the industrial sector as a whole can achieve its targets, because the relationship between the efforts and targets for individual industries and the overall targets of the Keidanren Voluntary Action Plan is not clear.

- Introduction of high performance industrial furnaces: Despite the fact that their use has become more widespread, it is difficult to accurately track their introduction to small and medium-sized businesses or forecast their use. The outlook for their use in 2010 is uncertain.

- Technological development and diffusion of results: Reducing the production cost of high performance boilers, and improving the technology and lowering the cost for the commercialization of high performance lasers are issues remaining to be solved. Under such circumstances, it is difficult to judge if the goals can be achieved.

3) Transport Sector

- The transport sector has been pursuing policies and measures aimed at keeping emissions at the same level as in 1995 (+17% compared to emissions from the same sector in 1990).

- Among measures carried out by the transport sector, measures for motor vehicle structure and the conversion of private trucks to commercial trucks earned high marks for their results.

- Measures such as facilitating traffic flow, modal shift, upgrading distribution efficiency, and promoting the use of public transport are effective, but their nature makes it difficult to accurately evaluate their effects. Although these measures are expected to be effective, due to the inaccuracy and difficulty in assessment, only part of the reduction effect is incorporated at this time. In the future, if it becomes possible to assess the effects more accurately, assessment of these measures will be revised.

- It is necessary to set forth such assessment conditions at the outset. Against the backdrop of increasing ownership of private vehicles and distance traveled, carbon emissions are expected to continue to rise, making it somewhat difficult to achieve the targeted goal.

- Top Runner Standard for automobile fuel efficiency based on the Law concerning the Rational Use of Energy: Because over 90% of the target set for 2010 is expected to be achieved as early as 2005, the measure can be considered highly effective.

- Motor transportation demand measures: Since there is only data showing the national average, individual measures cannot be assessed accurately. Furthermore, quantitative data to evaluate the effectiveness of measures such as reduction in road construction and promotion of teleworking are hard to obtain. It is necessary to strengthen policies and measures to secure the effectiveness of measures taken and to set up a system for gathering the necessary data for assessment.

- Modal shift: There are some concrete examples showing the shift of freight transport from motor

vehicles to railroads. It is necessary to strengthen policies and measures to secure the effectiveness of measures taken and to set up a system for gathering the necessary data for assessment.

- Upgrading distribution efficiency: Conversion of private trucks to commercial trucks has improved transport efficiency and is highly effective. While distribution efficiency has improved, there is the concern that carbon emissions from freight transport using motor vehicles will rise as the economy recovers in the future and as the distribution volume increases.

- Promoting the use of public transport: Continued efforts have been made in constructing and improving public transport means. It is not possible, however, to assess the measure's effectiveness at this time because of the lack of data to evaluate how much motor transport has been shifted to public transport. It is necessary to strengthen policies and measures to secure the effectiveness of measures taken and to set up a system for gathering the necessary data for assessment.

4) Commercial and Others Sector

- The Programme pursues policies and measures aimed at reducing emissions in the overall residential/commercial sector a total of 2% from the level of the base year. The commercial and others sector, however, has shown the largest increase in carbon dioxide emissions from energy use. As change in the industrial structure and other factors are expected to expand the floor space of offices and commercial facilities as well as increase the number of workers in the future, it will be difficult to achieve the targeted goal.

  - Measure to improve the efficiency of equipment: With the introduction of Top Runner Standards for OA equipment and household electrical appliances in line with the Law concerning the Rational Use of Energy, the standards are expected to be achieved smoothly by the target years.

  - Popularization of high performance lighting (using light emitting diode (LED)): The lighting is expected to become popular in several years and a certain reduction in emissions is expected.

  - Measure to improve energy conservation of buildings: Due to the lack of data at present, it is not clear if achievement of the Programme's goal is possible.

  - Strengthening of Building and Energy Management System (BEMS): BEMS is gaining popularity in newly constructed large buildings, making emission reduction highly possible. To achieve the level targeted by the Programme, it is necessary to step up the use of BEMS. More efforts need to be devoted to the energy management of buildings, including promotion of energy service businesses.

5) Residential Sector

- The Programme pursues policies and measures aimed at reducing emissions in the overall residential/commercial sector a total of 2% from the level of the base year. The residential sector, however, has shown the second largest increase in carbon dioxide emissions from energy use following the commercial and others sector. The number of households and ownership of household electrical appliances are on the rise. There is also a preference for large size appliances. Japan, where the demand for air-conditioning and heating was traditionally lower than in western countries, will see more demand for air-conditioning and heating as lifestyle and housing structure change and the number of households with an aging population increases. Under these circumstances, it will be difficult to achieve the targeted goal.

- Measure to improve the efficiency of equipment: With the introduction of Top Runner Standards for OA equipment and household electrical appliances in line with the Law concerning the Rational Use of Energy, the standards are expected to be achieved smoothly by the target years.

- High performance water heater: Although more units have been sold in recent years, more efforts need to be made to popularize the product in order to achieve the Programme's goal.

- Measure to improve energy conservation of residential housing: Due to the lack of data on residential housing in general, it is not clear if achievement of the Programme goal is possible. It is also necessary to review measures for residential housing in general, including measures to encourage renovation of existing housing.

- Home Energy Management System (HEMS): HEMS is still at the technological development stage. As no product has been developed yet, it is not certain whether the Programme's goal can be achieved.

(2) Measures for Controlling the Emissions of Carbon Dioxide from Non-energy Use, Methane, and Nitrous Oxide

- In the "carbon dioxide from non-energy use, methane, and nitrous oxide" category, despite the fact that some measures proved to be of insufficient effectiveness, it is certain that in 2010 the goal for curbing 0.5% of total emissions from the base year level can be achieved, due to the activity level being lower than expected.

- Carbon dioxide from non-energy use: Carbon dioxide emissions from industrial processes decrease with the decline in cement production, while emissions increase with rise in waste incineration. In total, carbon dioxide emissions rose slightly compared to the 1990 level.

- Methane: With less coal production and a reduction in the areas covered by water paddies, the amount of emissions from fuel leakage and water paddies has decreased.

- Nitrous oxide (N2O): With the installation of N2O decomposition equipment in the adipic acid manufacturing process, a decrease in areas for farming , and a decrease in the number of domestic livestock, emissions of nitrous oxide have seen a drastic decrease. Together with other measures related to incineration, the overall emissions of nitrous oxide are in decline.

(3) Strengthening of the Research and Development of Innovative Environmental and Energy Technologies and Promotion of Global Warming Prevention Activities by Every Social Actor

(Strengthening of the research and development of innovative environmental and energy technologies)

- "Strengthening of the research and development of innovative environmental and energy technologies" includes the following technologies: innovative energy conversion technologies such as energy storage technology and technology for reducing loss in power transmission and distribution, basic technology to substantially increase the energy efficiency of products such as electronic and transport equipment, and innovative process system technology to realize substantial energy conservation for energy-intensive

industries.

- Since these technologies would have become conventional technologies that are made into products and introduced into market at the time of their introduction, it would be difficult to differentiate them as “innovative environmental and energy technologies” from other global warming prevention technologies that have already been put to practical use in the industrial, commercial, residential, and energy conversion sectors.

- The Innovative Global Warming Prevention Technology Working Group under the Research and Development Subcommittee of the Industrial Technology Sectional Committee of the Industrial Structure Council assessed that innovative global warming prevention technologies would bring about a reduction effect of 7.49 million t-CO2 case of average emissions factor for all power sources of carbon dioxide in 2010. In view of the difficulty in putting innovative carbon dioxide sequestration technology into practical use by 2010, the Working Group reassigned it as an issue of global warming prevention technology to be tackled by 2030. The Central Environment Council, however, has not had the opportunity to examine the contents of these technologies in detail.

(Promotion of global warming prevention activities by every social actor）

- The Programme encourages every social actor to take actions to prevent global warming. The actions include measures undertaken by the public (residential/commercial sector, transport sector), measures taken by business operators (residential/commercial (offices) sector, transport sector), and measures by the national and local governments (residential/commercial sector, transport sector, cross-sectoral measures). These policies and measures are considered important global warming prevention measures from the viewpoint of facilitating implementation of these measures through changes in public awareness, people’s lifestyle, and work habits.

- During the first step, the following measures are taken: dissemination of information using national and local CM campaigns, hosting of seminars and symposia at Center for Promoting Activities to Prevent Global Warming in 23 prefectures nationwide, use of voluntary advisors to enhance awareness for climate friendly lifestyles (approximately 3000 advisors), distribution of learning materials (DVD) to the nation’s middle and high schools, promotion of a lights-out campaign, commendations, and the use of eco-labels for household electrical appliances.

- These measures lead to the reduction of fuel and electricity use at homes and offices when, for example, coupled with the installation of insulation materials or the purchase of energy-saving household electrical appliances. Therefore, it is difficult to separate the reduction effects of these measures from the energy-saving effect achieved by the measure to improve the efficiency of equipment, when conducting a quantitative assessment[4].

- Though it is difficult to conduct a quantitative assessment of the direct reduction brought forth by these measures, because they appeal directly to public awareness, these measures provide a foundation for various citizens’ movements and are important for the government. They serve as the motivating power for discovering other global warming prevention measures through a wide range of lifestyle and work

[4] There was the opinion that the government did not try hard enough to obtain sufficient data for each measure, making a quantitative assessment impossible. Nevertheless, efforts should be made to try to conduct a quantitative assessment.

habit reforms, including changes in purchasing behavior and investment activities.

- Therefore ensure these measures' continuity and to enforce them using the PDCA (Plan, Do, Check, and Action) cycle, it is necessary to actively undertake a quantitative assessment of these measures. This can be achieved through opinion polls, continued implementation of the annual global warming prevention evaluation model project, which targets several hundred households, and through measures to continuously and accurately track changes in public awareness and behavioral patterns based on in-depth studies and evaluation results.

(4) Measures to Control Emissions of the Three CFC Alternatives

- With the entry into force of the Montreal Protocol, which regulates the use of CFCs (chlorofluorocarbon (CFC) and hydrochlorofluorocarbon (HCFC)), emissions of the CFC alternative, HFC, was expected to increase substantially. Therefore, the Programme set a target to control its emission at approximately 73 million t-CO2. This amount represents an increase of approximately 47% when compared to the standard level of the three CFC alternatives in 1995 (49.74 million t-CO2) and an increase of 2% in the total greenhouse gas emissions.

- The latest data (2003) show that emissions of the three CFC alternatives were 25.8 million t-CO2, almost half the emissions in 1995 (base year for the three CFC alternatives). The decline was due to progress made by the voluntary action plans of the industries which included the recovery of HFC 23, a by-product from the manufacturing of HCFC, and the recovery of SF6 used as an electrical insulating gas. It is also the result of HFC recovery mandated by the law. Many measures are investments solely aimed at preventing global warming, and their effectiveness is highly regarded.

- Due to the regulation of the Montreal Protocol to replace CFC and HCFC, HFC emissions from refrigeration and air-conditioning equipment and insulation materials are expected to increase in the future. Also, an increase in the production of magnesium is expected to increase the use of SF6. Despite the fact that their use may contribute to an increase in emissions, under the premise that the ongoing measures would continue to be implemented, achievement of the existing goal of the Programme is highly possible.

(5) Measures concerning Sinks

- Measures concerning forest sinks are implemented with the goal of securing maximum sink capacity （13 million t-C（47.67 million t-CO2, approximately 3.9% of the total emissions of the base year)）through management of forests stipulated in Article 3.3 and 3.4 of the Kyoto Protocol.

- This entails, specifically, sound forest management; promotion of proper management and conservation of protection forests; promotion of the use of timber and wood biomass; forest creation with the participation of citizens; and strengthening of the reporting and reviewing systems related to sinks.

- Attaining the maximum capacity of allocated sinks is premised on fulfilling the forest management requirements in a total of approximately 17.5 million ha of forests, including all plantations (about 11.6 million ha) and part of the natural forests (about 5.9 million ha consisting of conservation forests, natural parks, etc.). The results of forest management in the five years between 1998 and 2002 show that if the current level of forest management continues until 2010, about 70% (approximately 8.3 million ha) of all plantation areas are expected to fulfill the requirements of forest management. If part of the natural forests—the assumed 5.9 million ha—fulfills the forest management requirements, the total will be 14.2

million ha. In such a case, the forecast for sinks in FY 2010 under the requirements of Kyoto Protocol will be approximately 37.76 million t-CO2 (an approximate 3.1% improvement.) This will fall below the maximum 47.67 million t-CO2 (an approximate 3.9% improvement) level of allocated sinks that was to be realized through forest management.

- Besides undertaking measures to secure carbon sinks through the greening of urban areas, methods to track and calculate the total of sinks in line with the IPCC Good Practice Guidelines are being reviewed.

(6) Utilization of Kyoto Mechanisms

- The Programme stipulates that, in principle, the Kyoto Mechanisms shall be supplemental to domestic measures and only in such cases shall their use be considered. Although the amount has not been stated in the current Programme, the Kyoto Mechanisms are expected to make up the 1.6% (approximately 20 million t-CO2) difference between the total of the targets of domestic measures and the 6% reduction goal.

- As of today, the Japanese government has approved nine projects for Clean Development Mechanism (CDM) and Joint Implementation (JI). Credits[5] to be gained from these projects are estimated to be approximately 6.8 million t-CO2. These projects need to undergo review by the CDM Executive Board[6] in the future.

- In order to use credits obtained from the Kyoto Mechanisms to fulfill Japan's commitment to the Kyoto Protocol, the government must address the following issues: (1) Motivate businesses to launch CDM/JI projects and (2) Set up systems to facilitate the transfer of credits from businesses to the government. Unfortunately, these issues have not been fully addressed. Under the current policies and measures, it is difficult to assume that enough credits will be obtained to fill the 1.6% gap that is necessary to meet the target of Kyoto Protocol.

(7) Conclusion

- A "target level for introduction"[7] and an "estimated emission reduction level"[8] are set up for each measure in the Programme. However, it is difficult to assess the progress of various measures by comparing the progress and the "estimated emission reduction levels" for the following reasons: the Programme has not suggested any methods for calculation; the data required for performing quantitative assessment have not been collected; and there are measures that may have different effects on emission reduction depending on the presence of other measures.

- While there are measures that employ regulatory means and are certain to bring about reduction, a wide range of measures undertaken by the different sectors, especially by the transport sector, the commercial

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[5] Credits such as CER (in the case of CDM) and ERU (in the case of JI) are issued for emissions reduction through CDM/JI projects. Japan can use these credits to fulfill the Protocol's reduction commitment.
[6] An entity under the United Nations Framework Conventions on Climate Change (COP). It is the core organization for operation of the CDM system. It sets rules for CDM, registers projects, and issues credits (CER).
[7] A target of how many kl of crude oil equivalent is reduced or how many percentage of efficiency is improved
[8] A target of how many 10,000 t-CO2 of greenhouse gases are reduced

and others sector, and the residential sector, have slim chances of showing effectiveness. This is due to insufficient business volume resulting from budgetary constraints or preferential tax measures; the measure's low possibility of success in reduction; the lack of clear responsibility-sharing and sufficient coordination between concerned parties, etc.

- In terms of the formulation of action plans by the national and local governments, it cannot be said that adequate policies have been implemented.

- In order to ensure fulfillment of the 6% reduction target, making efforts to ensure accountability to the citizens, and transparency, the government must introduce supplementary policies to strengthen probability of weak measures~~,~~ and adopt additional new measures.

3. Outlook of Greenhouse Gas Emissions in 2010 and Deficiency in Reduction

(1) Change in socio-economic active mass

-The amount of greenhouse gas emissions is affected to a great extent by socio-economic active mass including such factors as population and industrial production. For this reason, when evaluating the possibility of fulfilling the Kyoto Protocol's 6% reduction commitment with the current Programme, it is necessary to re-evaluate the forecast for the socio-economic conditions of FY 2010 that was made at the time of Programme formulation to see whether any adjustments must be made to the forecast based on the changes in the socio-economic conditions that have taken place since then.

- However, since the Long-term Energy Supply and Demand Outlook, which was referred to when the outlook for carbon dioxide emissions from energy use was drawn up for the current Programme, has adopted a model that feeds the details of socio-economic indicators endogenously from the population and energy prices, the Outlook does not shed light on, for example, the production outlook for the material manufacturing industry.

- Therefore, rather than directly comparing the trend of various indicators to the values that existed at the time the Programme formulation, we decided to forecast the future by looking at the predicted changes in socio-economic active mass in FY 2010 and basing that on the latest data that can be obtained at present.

- The following highlights the directions of change in socio-economic active mass predicted for FY 2010:

  - It is believed that the median estimated figure for population (as of January 2002) compiled by the National Institute of Population and Social Security Research and the estimated household figure for the number of households (as of October 2003) compiled by the same institute are the most appropriate data. Due to the influence of an increasingly aging population and fewer numbers of children, the population in FY 2010 is anticipated to drop slightly from the last estimation (as of January 1997). Japan's population will peak in 2006. On the other hand, compared to the previous estimation (as of October 1998), an upward adjustment has been made to the number of households, which is expected to peak in 2015.

  - Based on the "Structural Reform and the Economic and Fiscal Mid-term Outlook" (January 19, 2004 Cabinet decision), the GDP is premised on an economic growth of 2% in coming years. However, concerning an upward adjustment to economic growth, it is necessary to pay attention to an increase in emissions in the future because of increases in the production volume of the manufacturing industry, expansion in distribution, and a rise in commercial activities.

  - The production trends of typical energy-intensive industries such as the manufacturing of iron and steel, chemicals, pulp and paper, and cement and ceramic products constitute an important factor in carbon dioxide emissions from energy use. Here, we used the production outlook of crude steel, ethylene, paper and paperboard, and cement, as estimated by the Demand and Supply Subcommittee of the Advisory Committee for Natural Resources and Energy in June 2004.

  - To forecast the traffic demand, information prepared by the "Committee for Reviewing Methods of Forecasting Future Traffic Volume" (2003) of the Ministry of Land, Infrastructure, and Transport was used as reference. Compared to the outlook that was estimated in the past, in the "12th Five-year Plan for Road Development" (1998) for example, the traffic demand volume currently shows decline, especially in the demand for freight.

- To estimate the electricity demand, the electricity portions of the energy demands of the industrial, transport, commercial and others, and residential sectors estimated using the above-mentioned various indicators were used.

(2) Reduction Effect from the Implementation of Measures

- Based on the evaluation made in the section, "2. Assessment of the Progress of the Policies and Measures in the Programme," the amounts of reduction realized from the implementation of policies and measures are assessed with somewhat stringent criteria. The Programme's measures can be classified into the following categories:

(i) Measures that can achieve reduction of the targeted amount
(ii) Measures that can achieve certain reduction but fall short of the targeted amount
(iii) Measures that can be said to have qualitative reduction when implemented, but are difficult to assess in terms of a quantitative reduction effect due to the lack of data
(iv) Measures that may bring reduction when implemented fully, but it is highly uncertain whether policies and measures currently in implementation would bring reduction

- Therefore, in order to ensure fulfillment of the Kyoto Protocol's 6% reduction target, the (i) and (ii) measures, which can be assessed quantitatively, shall be implemented to accumulate the amounts of greenhouse gases reduced to meet the reduction amount mandated for 2010. Then, efforts shall be made to develop necessary data for the (iii) and (iv) policies and measures so that they can be assessed quantitatively. At the same time, to further ensure the achievement of the reduction target, policies and measures shall be implemented continuously.

(3) Outlook for Greenhouse Gas Emissions in 2010

- Based on the above (1) and (2) and the latest estimated volume of socio-economic active mass that can be obtained at this time, and taking into account only those measures in the Programme that are likely to bring about reduction, the outlook of emissions in 2010 (hereinafter referred to as "Existing measure Scenario") is forecasted as follows in Tables 1 and 2. These tables show that carbon dioxide emissions from energy use in 2010 are expected to exceed the aggregate emissions of the base year by 7.1%. Adding the emissions of carbon dioxide from both energy and non-energy use, methane, and nitrous oxide together, the amount is expected to exceed the aggregate emissions of the base year by 6.2–6.7%.

- This shows that implementation of the Programme's policies and measures alone may not fulfill the Kyoto Protocol's 6% reduction commitment and that adoption of additional policies and measures are necessary to ensure steady achievement of the 6% reduction commitment.

Table1: FY2010 tentative greenhouse gas emissions as estimated by the Ministry of the Environment [Existing measure Scenario]

Greenhouse Gas	Base Year		BAU Scenario (2010)			Programme Target	
	Million t-CO2		Million t-CO2	% from total emission in base year		Million t-CO2	% from total emission in base year
① CO2 emission from energy use	1048.33		1136.68	＋7.1%		1023.59	-2%
CO2 from non-energy source, CH4, N20	138.88		127.28～134.14	-0.9%～-0.4%		132.69	-0.5%
② CO2 from non-energy source	73.94		75.60	＋0.1%			
③ CH4	24.74		17.77～20.71	-0.6%～-0.3%			
④ N2O	40.19		33.90～37.83	-0.5%～-0.2%			
⑤ HFC ⑥ PFC ⑦ SF6	20.23 12.59 16.92		Close examination is underway	Close examination is underway		74.48	＋２%

(Notes)

*A close examination is underway for HFCs, PFCs and SF6 emissions (the rationality and validity of the parameters needed for estimation are currently being checked.)

*Measures other than those listed above are CO2 sink enhancement and utilization of the Kyoto Mechanisms.

*Figures in Programme Target column represent values obtained by reclassifying the reductions achieved through the measures for “strengthening of the research and development of innovative environmental and energy technologies”, and “promotion of global warming prevention activities by every social actor” to each greenhouse gas. See Figs. 9 and 10 on p.43 for the concept behind the reclassification.

*After the compilation of an interim summary, the Central Environment Council intends to continue to review additional policies and measures during the time remaining until the revision of the Programme, with a view to securing additional emission reductions in greenhouse gases identified as ①～⑦ in the Table, and further enhancing carbon sinks. Thus, figures for Existing measure Scenario shown above represent tentative estimates at present released by the Ministry of the Environment. Because other councils have arrived at different projection numbers, it is necessary to carefully examine the rationale for each of the projections and make adjustments so that those projections may be ultimately reconciled.

Table2: FY2010 tentative CO2 emissions from energy use as estimated by the Ministry of the Environment [Existing measure Scenario]

Sector	Base Year		Existing measure Scenario (FY 2010)			Programme Target (% from the base year)	
	Million t-CO2		Million t-CO2	% from the base year		Before distribution	After distribution
CO2 emission from energy use	1048.33		1136.68				
Industrial	476.08		446.74	-6.2%		- 7 %	-8.0%
Transport	217.21		260.20	+19.8%		+17%	+16.0%
Residencial/ Commercial	273.00		356.18	+30.5%		- 2 %	
Residential	129.15		158.50	+22.7%			-12.2%
Commercial and others	143.85		197.69	+37.4%			-6.2%

(Notes)

*Figures in Programme's Target column represent values obtained by reclassifying the reductions achieved through the measures for "strengthening of the research and development of innovative environmental and energy technologies", and "promotion of global warming prevention activities by every social actor" to each sector. See Figs. 9 and 10 on p.43 for the concept behind the reclassification.

*After the compilation of an interim summary, the Central Environment Council intends to continue to review additional measures and policies during the time remaining until the revision of the Programme. Figures for Existing measure Scenario shown above represent tentative estimates at present released by the Ministry of the Environment. Because other councils have arrived at different projection numbers, it is necessary to carefully examine the rationale for each of the projections and make adjustments so that those projections may be ultimately reconciled.

(4) Deficiency of Reduction in 2010

- According to (3) above, excluding the emissions of the three CFC alternatives currently under investigation, there is a 12–13% gap between the estimated emissions in 2010 under the BAU case (6.2–6.7% increase from the aggregate emissions of the base year) and the 6% reduction target of the Kyoto Protocol. If measures concerning sinks continue to be implemented, absorption of about 3.1% can be expected. This means that under the BAU case, the reduction amount will fall short in 2010 by about 9–10%.

- In reviewing reduction measures for the future, it is necessary to implement not only measures to reduce carbon dioxide emissions from energy use but also adopt other measures to reduce other greenhouse gas emissions, implement measures concerning sinks, and utilize the Kyoto Mechanisms (international mechanisms) to ensure the overall achievement of Kyoto Protocol's 6% reduction commitment. From this perspective, it is necessary to conduct a comprehensive review of the Programme in 2004.

III. Review of the Programme

1. Important Points in the Review of the Programme

(1) Basic Ideas in the Programme Review

1) Implementation of the Programme as an Effort of an Environmentally Advanced Country

- As a country that has ratified the Kyoto Protocol and that shoulders the international responsibility for the environment, Japan shall devote full effort to fulfill the 6% reduction commitment of greenhouse gas emissions during the period from 2008 to 2012, no matter whether the Kyoto Protocol enters into force or not. Even after 2012 further efforts shall be made to realize the ultimate objective of the United Nations Framework Convention on Climate Change.

- As the country that had played host to the Kyoto Conference on Climate Change, where the Kyoto Protocol was adopted, Japan should steadily fulfill the 6% reduction commitment in order to utilize Japan's capacity to play a leading role in international initiatives to protect the future of mankind.

- Taking a progressive approach on global warming prevention measures will facilitate the development of environmental technologies and strengthen Japan's international competitiveness. It is important to seek new growth through it, and lead to maintaining and expanding employment.

- Therefore, global warming prevention measures shall not be treated as an operational cost for businesses. Rather, they shall be thought of as a challenge to create a sound cycle of the environment and economy and to create a 21st-century socio-economic system that includes a fundamental change in the conventional values of mass production, mass consumption, and mass disposal, as well as a reform of public awareness. It is necessary to actively undertake these measures.

2) Enhancing the Awareness of Every Social Actor by Enforcing Information Disclosure and Publicity

- Today, with four years left before the Kyoto Protocol's first commitment period of 2008–2012, the latest data on greenhouse gas emissions taken in FY 2002 exceeded the base year level by 7.6%, showing a big gap from the Kyoto Protocol's 6% reduction commitment. Although citizens are quite concerned about global warming and the environment, their concern has not been translated into broad base participation. Under such circumstances, it is important to offer information on the increasingly severe global warming problems and the difficult situation with regard to the implementation of measures, to disseminate information through public relations activities, to change the awareness of citizens, and to call for action at home and in the workplace.

- A wide range of initiatives is being carried out at factories, businesses, and labor unions, such as environmental education for employees and union members, and at their homes, such as the environmental household bookkeeping campaign to enhance energy-saving awareness. It is important to disseminate these practices to wider areas and to the public in general.

3) Ensuring the Transparency of Assessment and Review

- In order to make the step-by-step approach adopted in the Programme effective, not only the party parties that establish the so-called PDCA cycle and formulate and implement the policy but also the parties targeted by the policy and that actually engaged in the reduction of greenhouse gases, should be able to

verify the PDCA cycle. To this end, it is important to increase transparency in the calculation of reductions realized by the policies and measures taken, and in the assessment of the effectiveness of policies and measures, so that the parties can participate in the PDCA cycle through the whole process of assessment.

- To ensure an accurate assessment of the efforts made by various parties in reducing the emissions of greenhouse gases, efforts should be made to increase transparency regarding the activities and effectiveness of each party in relation to the amount and form of emissions.

4) Increasing the Chance of Achieving the 6% Target

- First, the assessment and review of the Programme in 2004 seeks to heighten the chance of realizing the 6% reduction target in the first commitment period.

- Global warming prevention measures are characterized by a time lag between the time when a measure is implemented and the time when the effect surfaces. Therefore, when the next assessment and review of the Programme comes due in 2007, if the measures have shown results, the Programme can be handled by making slight adjustments immediately before entering into the first commitment period. If not, however, strict measures that can bring out results within a short period of time must be taken.

- Therefore, in the 2004 assessment and review, it is important to further ensure the chance of realizing the 6% reduction.

- For this reason, in the 2004 assessment, policies and measures must be classified into tangible ones and intangible ones when evaluating their effectiveness in reducing greenhouse gas emissions. Only the reduction amounts that would be brought about by the tangible measures should be included in the calculation.

- Some of the policies and measures classified as intangible, including those that do not have data for calculation, those that lack concrete methods of calculating their effectiveness, and those that cannot have their effectiveness judged quantitatively but are imperative as a basis for other measures, such as the activities to disseminate information or enhance awareness. The effectiveness of these policies and measures in curbing greenhouse gases cannot be expressed in numerical figures at this time but they play an important role in promoting measures to prevent global warming.
  These policies and measures in the Programme shall continue to be implemented. It is appropriate, however, not to include them in the calculation of the reduction amounts of policies and measures in terms of fulfilling the numerical target.

- The government formulates the Programme's various policies and measures, including voluntary initiatives, regulatory means, economic instruments, and informational approaches. These policies and measures must be the ones that lead to the actual reduction of greenhouse gases emitted by government agencies, businesses, and citizens or they must enhance the chance of reduction.

- In the review of policies and measures, the volumes of socio-economic activities, which serve as the premise for future forecasts, should be updated with the latest data in realistic figures. Based on the latest data, as mandated by the current Programme, a comprehensive review of individual targets for greenhouse gases and targets under other classifications, of the target level and estimated emission reduction level of each measure in Japan, and policies for promoting the implementation of measures should be conducted, whenever necessary, to ensure a steady achievement of Kyoto Protocol's 6% reduction commitment.

- Global warming prevention measures should not only be implemented in the first commitment period of the Kyoto Protocol but should also continue in subsequent years. For this reason, the specific policies and measures to be included in the Programme must be those that can be integrated in the overall medium-to-long term strategy.

(2) Global Warming Prevention Measures in Other Countries

- Since the adoption of the Kyoto Protocol in 1997, not only Japan but also other countries have introduced various measures to curb greenhouse gas emissions. When introducing additional policies and measures, Japan shall use the policies and measures introduced by other countries as references, taking into consideration Japan's situation.

- For carbon dioxide emissions from energy use, the following measures have been taken:

  - In terms of measures for the energy supply sector, the "Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market" took effect in October 2001 in the EU. The Member States were required to set up a 2010 target for the consumption of electricity produced from renewable sources in relation to the overall electricity consumption. The target values should be those that would augment the share of electricity produced from renewable sources in the EU from current 14% to 22%. The directive prescribed a reference value for each country and the government of each Member State would set up a target, taking into account the reference. To increase the use of renewable energy, Germany, for example, adopted a fixed price purchasing scheme for solar energy and other renewable energy sources[9].

  - In terms of measures for the industrial sector, a GHG emission calculation/reporting system, a domestic emissions trading scheme, carbon taxation (climate change levy) and other agreements have been introduced in various other countries. The GHG emission accounting and reporting system has already become mandatory in the EU, the U.K., the Netherlands, and Canada. The U.S. uses a voluntary reporting system. Agreements have already been introduced by the U.K., the Netherlands, the U.S., and Germany. Furthermore, the EU will launch the emissions trading scheme throughout the region beginning in 2005, and Canada will introduce an emissions trading system for businesses with large volumes of emissions beginning in 2008. In the U.S., an emissions trading scheme has already been launched at the state and private levels. Taxation measures that correspond to taxes for global warming measures have been introduced in various European countries, including the U.K., the Netherlands, and Germany.

  - In terms of measures for the transport sector, international initiatives in introducing bio fuel for vehicle use have gained momentum. Brazil and the U.S. have adopted policies to use bioethanol as a substitute for fossil fuels as part of an agricultural policy and an energy policy. An EU directive for the introduction of bio fuel for vehicle use has been put into force recently. China has also started the use of bioethanol. In particular, an EU directive, aimed at preventing global warming and reducing dependency on oil, requires the governments of Member States to set a target for the

[9] In 1997, the EU issued the "Energy for the future—renewable sources of energy: White Paper for a Community Strategy and Action Plan" to double the percentage of natural energy in the primary energy from 6% to 12%. In compliance with the 2001 EU directive, Germany set a target of 12.5% for electricity to be achieved by 2010, and furthermore, a 20% target for 2020. In compliance with the 2001 EU directive, the U.K. set a target of 10.4% for 2010, and furthermore, a 15% target for 2015.

introduction of bio fuel.[10] The standard target for each country (ratio to gasoline and light oil) is 2% by the end of 2005 and 5.75% by the end of 2010.

- As measures for the residential/commercial sector, the "Directive on the Energy Performance of Buildings" entered into force in the EU in January 2002. The Member States are required to set up domestic systems by 2006, including (i) introduction of a minimum energy performance standard for new residential housing and buildings; (ii) introduction of a minimum energy performance standard in the refurbishment of large-scale residential housing and buildings; and (iii) introduction of a certification system for the energy performance of residential housing and buildings. Many countries, including Germany, the U.K., and France, have already taken the necessary measures.

- As measures for the three CFC alternatives, a bill to regulate CFC-related greenhouse gases is being reviewed in the EU. It proposed banning the use of SF6 in the manufacturing of magnesium that exceeds a certain volume beginning in 2007. Except when the use of HFC is needed to satisfy safety requirements, it proposed that the sale of foam insulating materials containing CFC gas be banned one year after the regulation takes effect and the sale of aerosol products containing CFC gas be banned three years after the regulation takes effect. In Denmark, a tax is levied on the three CFC alternatives in proportion to the global warming potential (GWP) of each gas.

(3) Dissemination of Global Warming Prevention Technology from a Medium-to-long Term Perspective

(Initiatives for the formation of a Low carbon economy)

- The problem of global warming must be addressed beyond the Kyoto Protocol's first commitment period and with a medium-to-long term perspective. Eventually, the atmospheric concentrations of greenhouse gases must be cut drastically so that the greenhouse gases in the atmosphere can be at a level that can keep the climate change risk stable. It is necessary to create a Low carbon economy.

- To this end, it is necessary to take measures to create a sound cycle of the environment and the economy, reform the socio-economic system, disseminate technology to preserve social infrastructure (stock measures), as well as develop, commercialize, introduce, and disseminate new technologies. It will take time for these measures to take effect. For example, for measures to renew the existing residential housing and buildings, immediate action must be taken to make the necessary preparations. By doing so, the effect can be maintained for a medium-to-long term following the end of the first commitment period. Furthermore, it is necessary to give thought to the development and maintenance of social capital, infrastructure, cities, and regions under population decline, such as making changes to urban structure, including long-lasting infrastructure, and to transport systems that link the urban and rural areas.

- From a medium-to-long term perspective of building a Low carbon economy, it is necessary to consider measures that can reduce emissions not only between 2008 and 2012 but also for a medium-to-long term when assessing and reviewing the Programme.

(Four pillars of Low carbon technology)

[10] Bio fuel here refers to bioethanol, bio methanol, bio gas, bio DME, bio ETBE, bio MTBE, synthetic bio fuel, bio hydrogen, and vegetable oil.

- The dependency on fossil fuel must ultimately be curbed in order to realize a Low carbon economy. To this end, it is important to continue to pursue the following four pillars of technology: (i) improve energy efficiency; (ii) full utilization of energy, including waste heat, etc.; (iii) shift to fossil fuel that has smaller carbon dioxide emission intensity, such as natural gas; and (iv) expand the use of renewable energies. It is important to start technological development and dissemination of technology immediately and build a system to integrate the technologies of the four pillars. At the same time time, it is necessary to take into consideration that as many measures will be implemented in each local region, it is important that regional characteristics be utilized in energy-saving measures, and that many of the renewable energy sources exist in local areas. Therefore, the approach of creating models of advanced initiatives and systems in local areas, and then diffusing them throughout the country is important.

- Besides these technologies that form four pillars, nuclear power generation, which does not emit carbon dioxide in the course of power generation, is another important pillar from the viewpoint of Low carbon economy. It shall continue to be pursued, with safety being ensured.

(i) Improve energy efficiency

To save energy, it is necessary to continue to improve the energy-saving functions of equipment such as household electrical appliances and motor vehicles, use high performance insulation materials in the construction of new residential housing and buildings, popularize the use of multi-layered glass and window sashes for insulation when refurbishing old buildings, popularize the use of equipment using high performance heat pump technology and fuel cells, and introduce an energy management system that controls energy conservation, as well as inter-process linkage technologies between different industries.

(ii) Full utilization of energy, including waste heat, etc.

In order not to waste any energy resources used in Japan and employ them efficiently, it is necessary to utilize waste heat, introduce high performance cogeneration systems, and install communal heating and air-conditioning facilities. As matters stand, despite the fact that waste heat shows potential, it has not been utilized because of a mismatch in supply and demand. Cogeneration, which is originally designed to employ heat and electricity efficiently, has not been fully utilized. Thus, measures must be taken to match up the supply and demand of waste heat, accommodate heat on a regional unit basis in order to utilize waste heat efficiently, set up cogeneration on a local district or regional unit basis in order to utilize heat and electricity in a balanced manner, and install communal heating and air-conditioning facilities.

(iii) Expansion of the use of natural gas[11] which has a smaller carbon dioxide emission intensity

With regard to expanding the use of natural gas, a fossil fuel that has a smaller carbon dioxide emission intensity, if the infrastructure for supply of natural gas is developed which can be keeping the price of natural gas low and the reliability of supply high and the use of natural gas expands, power generation will be more efficient, making introduction of cogeneration systems, such as fuel

[11] In the Basic Energy Plan as well, natural gas is considered an important energy source. It says, “Natural gas is found in many areas besides the Middle East. It is a clean energy because it exerts less of a burden on the environment when compared to other fossil fuels. From the perspective of both steady supply and environmental conservation, it is an important energy. For this reason, efforts will be made to promote and accelerate the shift to natural gas, taking into account the balance with other energy sources such as oil, coal, and nuclear power, etc.”

cells, and a dispersed energy system using mainly renewable energy sources easier. Infrastructure such as the main pipelines required for expanding the use of natural gas can lay the groundwork for a hydrogen economy in the future. For a medium-to-long term plan, the government as a whole shall conduct in-depth discussions as to what measures shall be taken to make the transition to natural gas.

(iv) Substantial expansion of the use of renewable energy

The basic guideline for introducing renewable energy is to maximize the use of biomass, solar energy, and wind power while giving the environment proper consideration. To this end, it is necessary to take measures to maximize potentials by developing cost-cutting technology and regional models and introducing a dispersed energy system using mainly renewable energies.

Hydrogen has attracted attention as a core secondary energy source for the future, together with electricity. Using fuel cells, it enables the efficient use of heat and electricity. From the viewpoint of creating low carbon economy, it is important to maximize the introduction of hydrogen generated by the renewable energy source in an early stage of the efforts targeted at transition to a hydrogen economy.

- Besides the above, carbon sequestration technology and clean coal technology, which is closely related to the use of coal, can be considered as interim technologies for fossil fuels. Japan is actively working towards the commercialization of these innovative technologies and participates in international cooperation in their development.

- Waste recycling technology which can contribute to global warming prevention measures, is an important technology supporting both the transition to Low carbon economy and the formation of a sound material-cycle economy. It is necessary to take a medium-to-long term approach to the development and introduction of this technology.

(Drawing a roadmap for the development and introduction of technology)

- To translate the above-mentioned directions into concrete actions, it is important to take the following measures. For the short term, measures should be taken to develop, commercialize, and introduce technology such as cost-cutting technology and energy-saving technology. Efforts should be made to promote continuous technological advancement and diffusion of promising technologies such as heat pumps and hybrid vehicles. From a medium-to-long term perspective, measures should be taken to develop, commercialize, and introduce vital technologies such as fuel cells, use of hydrogen, biomass, and dispersed energy systems.

- It is effective to draw up a roadmap to show what procedures should be taken to develop, introduce, and disseminate technology for hydrogen energy, which is considered a vital technology of the future for the society as a whole, and for renewable energy, which is a source of supply for hydrogen and also the key to low carbon economy.

- To translate the development, commercialization, and introduction of technology into concrete actions, it is necessary to support not only the development and introduction of technology, but also development of business models and community models, so that human resources in local communities and the private sector can be utilized to pursue sustainable systems and businesses.

2. Targets of the Programme

(1) Establishing Targets for Clarifying Greenhouse Gas Reduction Efforts of Each Actor

(Establishment of targets by various classifications of actors, such as by business enterprises and households, by industries, and by business types)

- Targets for carbon dioxide emissions from energy sources have been established according to inventory classification, i.e. industrial sector, transport sector, and residential/commercial sector.

- In reality, from the perspective of implementing actions for reducing greenhouse gases, a business enterprise may own a factory classified under the industrial sector, a headquarters building classified under the commercial and others sector, as well as motor vehicles classified under the transport sector. It may also be emitting not only carbon dioxide from energy sources, but also greenhouse gases such as CFC alternatives. Government agencies are also responsible for emissions spanning various inventory sectors. The situation is the same for households as well.

- From this perspective, in addition to reduction targets of greenhouse gases based on inventory, it would be effective to set targets for reducing greenhouse gases for each actor, such as business enterprises, government agencies, households, and other industry and business categories, in order to encourage actions leading to emission reduction. Thus, targets should be established for each actor.

(Methods to assess initiatives taken by each actor and the resulting greenhouse gas emission reduction)

- Carbon dioxide emission from energy use, which accounts for approximately 90% of emissions of greenhouse gases in Japan, is classified into several sectors: industrial, transport, commercial and others, residential, and energy conversion. Basically, carbon dioxide emission from energy use can be calculated as follows: “volume of activities” x “energy consumption per activity volume” (energy consumption intensity) x “carbon dioxide emission per energy consumption” (carbon dioxide emission intensity). Therefore, efforts to reduce greenhouse gases can come as efforts to improve any one of these factors, and it would be appropriate to prepare the Programme in a form so as to enable analysis of changes in any of these factors.

    - Firstly, “carbon dioxide emission intensity” can be lowered by utilization of renewable energies and by selection of fossil fuels with less emission, such as natural gas. For electric power, as it is not possible to control carbon dioxide emission intensity by consumers, when evaluating the efforts of consumers, it is necessary to adopt a method that do not take emission intensity into consideration.

    - Secondly, it can be said that efforts by various emitting actors and manufacturers are most easily manifested in the “energy consumption intensity”. To enable evaluation of increased efficiency of equipment, insulation of buildings, and changes in lifestyle through this indicator, it is necessary to obtain more detailed data.

    - Thirdly, “volume of activities” is indicated by such indicators as production volume, distribution volume, floor area, number of households, and traffic volume. While the number of households can be regarded as an external factor, in general, most other indicators such as floor area and traffic volume can largely be improved by policies.

(2) Upgrading the Targets of Greenhouse Gas Type

(Upgrading the classification of greenhouse gas type)

- In the current Programme, basically, targets are established according to inventory classification of six types of greenhouse gases, enabling comparison of standard levels, target levels, and emissions in specified fiscal years at a glance.

- However, while carbon dioxide is divided into two different categories, carbon dioxide emission from energy use and carbon dioxide from non-energy sources, carbon dioxide from non-energy sources is grouped together with methane and nitrous oxide, and HFC, PFC, and SF6 are also put together in one group.

- Since carbon dioxide from non-energy sources, methane, and nitrous oxide differ in sources, parties concerned, and measures, there is no common factor that holds them together. Also for HFC, PFC, and SF6, there is no single measure that effectively applies to all of these gases, nor is there any complementary relationship between measures. In other words, independent policies and measures are required for each gas, and performing individual assessment would make it possible to practice the PDCA cycle with more transparency.

- In addition, as a matter of course, these six types of gases will be treated independently in terms of inventory as well.

- For this reason, to conduct proper assessment of measures concerning these gases, it is advisable to reorganize the classification so that the progress of measures can be evaluated according to each type of gas.

(Integration of classification by measures into classification by greenhouse gases)

- Based on the assessment of measures and policies in the Programme, standard levels, target levels and emissions in specified fiscal years should be listed for each of the six gases, so that the progress made by each measure can easily be grasped.

- At present, the reduction measures of “Strengthening of the Research and Development of Innovative Environmental and Energy Technologies” and “Promotion of Global Warming Prevention Activities by Every Social Actor” are together allotted 2% of the committed target, that is reduction of 25 million t-CO2. These measures reduce emissions of carbon dioxide from energy use.

- Therefore, in inventory, this reduction is calculated as part of emissions of carbon dioxide from energy use, and it is appropriate to position them within the classification of six types of greenhouse gases.

- As there is no “emission” accompanying “strengthening of the research and development of innovative environmental and energy technologies” and “promotion of global warming prevention activities by every social actor,” reduced emissions from these two measures must be subtracted from emissions calculated for each of six greenhouse gases. There is the peculiarity that the effectiveness of these measures cannot be evaluated unless changes in emissions resulting from these measures are quantitatively separated from the emissions of the six gases. If not separated, then the problem of double counting will occur.

- The “strengthening of the research and development of innovative environmental and energy

technologies" can be understood as emission control technology that can curb carbon dioxide emission from energy use more than the amount estimated at the time of Programme formulation in 1998. However, if such technology is to be introduced by 2010, it would have then already become ordinary technology for commercialization and market introduction. Thus, at the time of introduction, it would be difficult to differentiate the technology in question from other global warming prevention technologies adopted by the industrial, commercial, residential, and energy conversion sectors, and evaluate it as "innovative environmental and energy technology."

- "Promotion of global warming prevention activities by every social actor" can be understood as measures to curb carbon dioxide emission from energy use that should be promoted mainly by public awareness activities, through provision of information, publicity activities, education by the government, and as actions realized through special efforts by every social actor. In reality, however, measures classified under "promotion of global warming prevention activities by every social actor" such as changes in lifestyle and work style, are combined with measures classified under "carbon dioxide emission from energy use" such as increased efficiency of energy-saving home electrical appliances and insulation measures for housing. Both types of measures, as a whole, bring about a reduction effect of emissions classified under "carbon dioxide emission from energy use." Measures for changing lifestyles and work styles are positioned as important measures for decreasing power consumption and energy consumption intensity per floor area in households, and must continue to be promoted by the government. However, while conducting quantitative evaluation of this measure independently, without taking into consideration other measures and premises, there is a high possibility of encountering the problems of double counting, or excess/short counting.

- As such, "strengthening of the research and development of innovative environmental and energy technologies" and "promotion of global warming prevention activities by every social actor" should be re-classified so that their effectiveness can be assessed as standard levels and emission levels of each of the six gases. This does not imply any change in their significance as measures for "strengthening of the research and development of innovative environmental and energy technologies" and "promotion of global warming prevention activities by every social actor."

- Therefore, measures under "strengthening of the research and development of innovative environmental and energy technologies" should be reorganized so that they can be evaluated within emission control measures for each greenhouse gas. When a reduction effect can be certainly expected, it would be effective to either list the "target level for introduction" for each innovative technology in the Programme, or separately list the "estimated emission reduction level" for each innovative technology as reference values in the Programme.

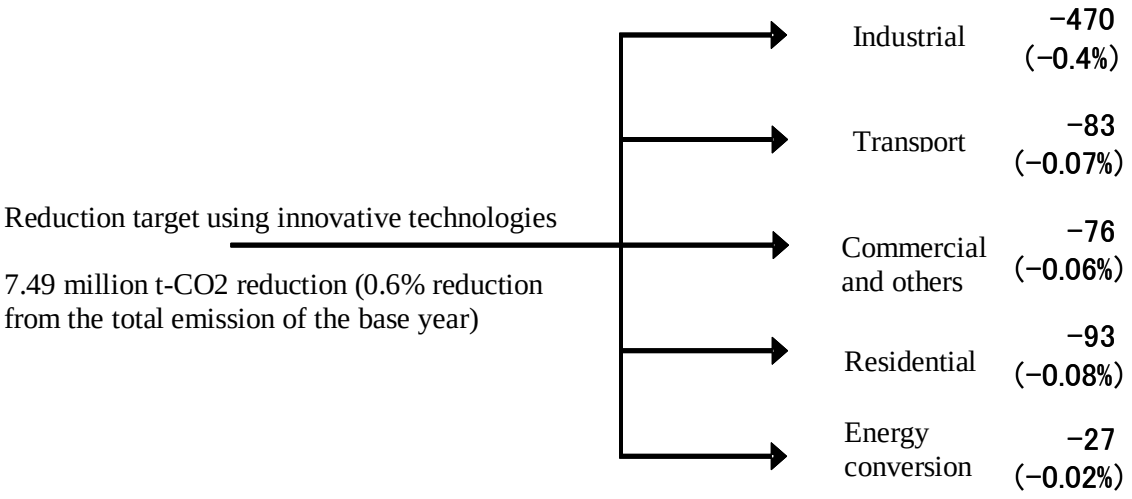
- As "promotion of global warming prevention activities by every social actor" functions as the driving force for actualizing energy-saving and alternative energy measures, and produce results in conjunction with measures other than public awareness activities, it is appropriate that they be reorganized and covered under carbon dioxide emission control measures of the various sectors in the Programme. Considering the aforementioned points and the fact that evaluation of measures such as changes in lifestyle and work style will be confined to qualitative evaluation at this point, it would be appropriate to include just the measures and not specific "estimated emission reduction levels" shown in figures (t-CO2) in the Programme. However, in regards to the "target level for introduction," level that shows, for example, the percentage of households which should introduce that measure, it is important that they continue to be listed in the Programme, as they have been and will continue to be implemented.

- "Implementation of measures for emissions of greenhouse gases related to administrative projects of the

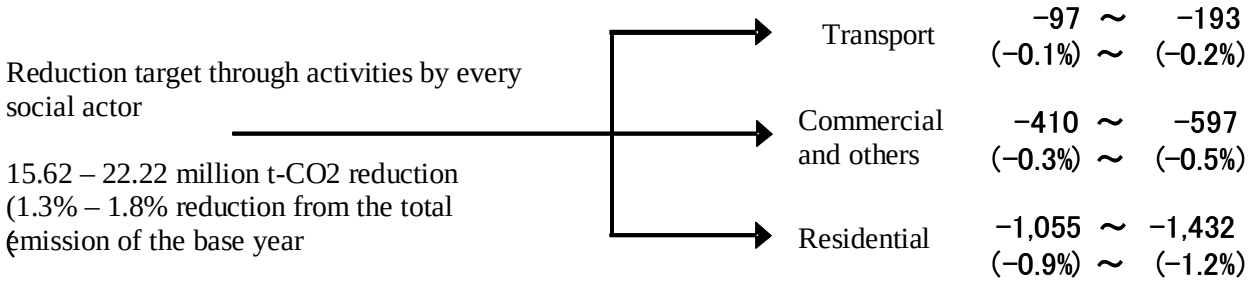
state and local governments" is one specific action listed under the "actions by state and local governments." It would be appropriate to position this action within the "targets by actor" separate from "targets by greenhouse gas type in the inventory."

- By careful examination of the measures listed in the Programme, it is possible to distribute the amount of emission reduction related to innovative technology R&D and activities by every social actor to the different sectors' reduction in CO2 emission from energy use, Fig. 9 and 10.

(Fig. 9: Emission reduction through "strengthening of the research and development of innovative environmental and energy technologies," by sector)



(Fig. 10: Emission reduction through "promotion of global warming prevention activities by every social actor," by sector)



(Notes)
*Emission reductions to be achieved by each sector through "Strengthening of the research and development of innovative environmental and energy technologies" was determined by Global Warming Prevention Technology Follow-up Working Group of Subcommittee on Research and Development, Industrial Technology Committee, Industrial Structure Council. This is shown as one example of emission reduction calculation.

*The Fig. 9 and 10 show emission reductions to be achieved by each sector through "strengthening of the research and development of innovative environmental and energy technologies" and "promotion of global warming prevention activities by every social actor." Reduction targets are shown in "million t-CO2," and the target amount to the total emission of the base year in "%." On the other hand, Table 2 (p.32) and Table 4 (p. 74) show the amount of emission reduction target of each sector to the emission from that sector

in the base year. For example, for the industrial sector, in the above figure the reduction target is –0.4% from the total emission in the base year, while in Table 2 and 4, the reduction target to the emission in the base year is –1.0% (difference between -8% before dividing the emission among sectors and –7% after dividing the emission among sectors). They basically mean the same reduction amount.

(3) Changes in Volume of Socio-Economic Activities and Establishment of Targets by Greenhouse Gas

- The objective of the assessment and review of the Programme in 2004 is to prepare measures and policies for the achievement of the 6% emissions reduction commitment of Japan and to enhance their transparency and potential for realization.

- Through this assessment based on greenhouse gas type, it became evident that the increase in emissions of carbon dioxide from energy use is more significant in the transport and residential/ commercial sectors than others. While discrepancy with targets is also notably great for these sectors compared with other sectors, it is not entirely due to lack of efforts, but due to substantial increase in socio-economic activities, such as traffic volume, floor area, and number of households. Moreover, our country is undergoing various socio-economic structural changes. For example, the commercial sector is affected by changes in the industrial structure, as represented by the shift to tertiary industry, and the increase in the residential sector is attributed to an increasing heating demand in our aging society. As to the industrial sector, it should be noted that there are fluctuations due to varying production volume.

- The increased certainty of achieving targets in the category of carbon dioxide from non-energy sources, methane, and nitrous oxide is due to decreases in the production volumes of mining, agriculture, and livestock farming.

- The volume of socio-economic activities may be controlled by various polices, such as a policy to encourage a shift to public transportation in order to decrease traffic volume. However, even with such policies, there may be trends that greatly affect the volume of socio-economic activities. Thus, taking into account such trends, it would be appropriate to review the target levels as well. It should also be noted that if great discrepancies between target levels and actual emissions are left standing, there is the danger of greatly impairing the possibility of realizing the Programme, as well as hurting the reliability of the Programme itself.

- The distinctive feature of the three CFC alternatives is that, while other gases have few measures for directly controlling emissions, the three CFC alternatives have related technology for directly controlling emissions, including technology for development of alternative products, and recovery and destruction. Taking such features into account, it is commendable that a great reduction has been achieved toward the target value through the united efforts of the public and private sectors.

３. Cross-sectoral Measures and Policies

(1) Policy-mix

- Although measures that cover different categories and sectors as well as those that promote each measure in different sectors in a cross-cutting way would bring some results on their own, the combination of some measures in an effective way would supplement shortcomings of each individual measure and make it possible to achieve the policy objectives of creating a sound cycle of environment and economy at the same time. We should consider a scheme of appropriate policy mix suitable for our country by examining those taken in other countries, such as Britain.

(2) Establishing a System of Gathering and Sorting out Data and a Highly-transparent System of Assessing and Reviewing Data

- The Central Environment Council has conducted assessment and reviews of measures and policies as much as possible by examining the basis of calculation and data on the amount of greenhouse gas emission reductions obtained through measures and policies. It was found that the evaluation of data at the planning stage and also at the checking stage under the PDCA cycle lack transparency, which makes it difficult for the third party to conduct a fair assessment. For example, there are many data that have not been collected or classified even though they are essential to developing measures against global warming, such as stock data on electronic appliances at home and data on different types of insulation systems at houses and other buildings.

- In order to be able to assess and review the policy programs more appropriately in 2007 by making use of the experience gained in 2004, the Council strongly urges the government to acquire a set of data indispensable for creating and carrying out measures against global warming as well as to take steps to create assessment methods and to improve their transparency.

- In particular, statistical data on environmental information that can be gathered is rarely legally available, even though the data is necessary for assessing and reviewing global warming measures. In spite of the recognition that collecting such data is necessary, the current situation is insufficiency. In addition to asking people to provide data regarding individual sectors or categories, it is necessary to clarify the rights and responsibilities of both information seeker and provider and to consider a legal framework that clarifies the levels of social necessity concerning environmental information.

(3) Expanding and Strengthening Public Awareness Activities and Information Provision Concerning Global Warming Prevention Measures

(Importance of public awareness activities and information provision)

- Obtaining understanding from businesses and individuals in addition to public agencies is fundamental to promoting global warming prevention measures. Such activities concerning public awareness, including environmental education, are often made light of, as they do not directly lead to curbing greenhouse gas emissions. However, in order to carry out global warming prevention measures effectively, the government must exercise its leadership, with enough budgetary backing, in disseminating information and encouraging individuals to take actions. As global warming prevention measures cannot be accomplished without actions taken by each person, it is necessary to carry out drastic public awareness activities.

- As the Japanese people have a high environmental awareness, it is necessary to encourage them to take actions voluntarily by providing appropriate information through various means.

- When doing so, in addition to providing the public with latest scientific knowledge on global warming in an understandable way, it is also important to provide information that helps the public take specific actions to reduce greenhouse gas emissions, such as information on what to buy and what to do. One idea is to make reduction targets for the household sector that are understandable from the viewpoint of housekeeping, using kWh, m3, liter and other easy-to-understand units.

(Strengthening of public awareness activities and information provision)

- As it is important to involve as many people as possible in carrying out global warming prevention measures, it is necessary to further strengthen the roles, as described in the Climate Change Policy Law, of the Japan Center for Climate Change Actions (JCCCA), the Local Center for Promoting Activity to Arrest Global Warming, the Local Council for Global Warming Measures as well as voluntary advisors who promote awareness raising for climate friendly lifestyles.

- In addition, it is important for the government to carry out measures to promote activities that help people acquire necessary information between and among non-governmental sectors, by such means as assisting cooperation between businesses and consumers on further understanding anti-climate change products and technologies of businesses, between grassroots groups working to prevent global warming, as well as by helping businesses disseminate information on their products.

(Strengthening of public awareness activities through environmental education)

- At the Johannesburg Summit, Japan proposed the "UN Decade of Education for Sustainable Development,'' to begin in 2005, and worked for its adoption at the 57th U.N. General Assembly. At home, the government actively promotes environmental education and enacted the "Law to Promote Environmental Awareness and Environmental Education to Protect the Environment." In order to carry out public awareness activities through education effectively, it is necessary to establish a system of producing and delivering educational materials on global warming as well as dispatching teachers and other experts to classrooms.

(Collection of assessment data on public awareness activities and information provision)

- It is necessary to conduct research regularly to determine the outcome of public awareness activities and information provision. This can be accomplished by making use of public opinion polls and other types of surveys, answering such questions as the level of interest in climate change issues by region, occupation and gender as well as changes in individual lifestyles.

(4) Mandatory Greenhouse Gas Accounting and Reporting System

(The usefulness of common rules for private and public sectors)

- Private and public sectors accounted for about 80 percent of Japan's total carbon dioxide emissions from the energy-supply sector, industrial sector, commercial and others sector, transport sector, and household sector in FY 2001. The public sector is required by the Climate Change Policy Law to draw up action programs to reduce their greenhouse gas emissions from clerical works and projects, and to announce the

figures to the public.
On the other hand, there is no legal obligation for businesses to calculate and announce the amounts of greenhouse gases emitted from their business activities. The Keidanren calls for doubling in three years the number of environmental reports issued by businesses and encourages its member companies to announce their emissions of greenhouse gases. The move is welcome, but a survey by the MOE has found that the number of companies that made such announcements of their figures to the public stood at only 20 percent of the total as of fiscal 2002.

- In order to achieve reduction targets of carbon dioxide emissions from energy use, it is necessary for businesses that contribute largely to the emissions to make active efforts to cut emissions in industrial, commercial and others, and transport sectors. It is indispensable as the basis for establishing the PDCA cycle that each company knows the emission amounts of greenhouse gases produced both directly and indirectly from their operations in taking steps to cut emissions.

- Thus, establishing common rules that apply both to private and public sectors in their calculation of their greenhouse gas emissions is important. Moreover, the initiatives by administrative agencies to publicize the date of emissions from offices, factories and public entities in a consistent manner would give incentive to individual companies to carry out measures to cut emissions.

(Points to remember when establishing a Mandatory Greenhouse Gas Accounting and Reporting System)

- In order to promote global warming prevention measures appropriately, it is effective to introduce a system in which businesses that are larger than a certain size calculate the greenhouse gas emissions on their own and report to administrative bodies, which would then make the figures public in a consistent manner. The system also needs to take into account the conditions surrounding industries and to ease the burden on each company. It is also appropriate to include not only CO2 but other greenhouse gases when calculating emissions, if possible.

- As for distribution businesses in the transport sector, it is necessary to consider ways to appropriately calculate emissions from delivery operators and consignors separately. It is also important to announce the emissions from those belonging to the public sector in the same consistent manner.

- In designing the Greenhouse gas accounting and reporting, it is necessary to coordinate similar systems among government ministries and between central and local governments in order to avoid repetition and to address the shortcomings of each system. For instance, the Law concerning the Rational Use of Energy requires businesses to report the yearly amount of energy consumption by designated factories.

- Regarding this system of announcing the emission amounts, while some members of the council had opinions that it is unnecessary to announce the date of emissions from each of their sites because those who operate nationwide often adjust production volume among factories depending on the condition of equipment, other members said it is necessary to do so because emission-cutting measures are carried out at each business site individually. They said that some incentives to encourage individual business sites to cut emissions should be provided and that emissions should thus be announced for each site.

- Within this system, it is necessary to protect business secrets as they correspond to competition with other companies. There are already precedents for this seen in the Law Concerning Reporting, etc. of Releases to the Environment of Specific Chemical Substances and Promoting Improvements In Their Management and the Public Information Disclosure Law. It is appropriate to create a system that can ensure the protection of business secrets as these examples.

- Information disclosure is one of the most essential activities of businesses that thrive in the 21st century. From this point of corporate social responsibility (CSR[12]), openness, fairness, and honesty are the keys of this time. Through these activities, it is hoped that a relationship of mutual trust will be established between businesses and society, consumers, and citizens[13].

(5) Improving Environmental Voluntary Action Plans and Securing their Transparency

(Improvement of environmental voluntary action plans)

- Currently, under the initiative of Keidanren, an environmental voluntary action plan is made and carried out by each sector. The move has made companies introduce their own unique activities and has produced certain positive results. In order to improve the action plans and make them more effective, they should be made and implemented in the commercial and transport sectors, which are expected to see a sharp rise in emissions, through such efforts as reducing emissions from corporate headquarters and sales offices as well as raising efficiency in delivery operations as consignors.
  Keidanren is trying to encourage businesses in the transport, commercial and others sectors to draw up and implement voluntary action plans. These sectors are behind in such efforts compared to the industrial and energy sectors. Manufacturing companies are also involved in transport and commercial and others sectors. Cross-sectoral emission reduction efforts are being acknowledged. Considering the fact that carbon dioxide emissions are increasing in the transport and commercial and others sectors, it is quite meaningful to formulate environmental voluntary action plans for these sectors.

(Making agreements with the government and securing transparency of voluntary action plans)

- Keidanren's environmental voluntary action plans are said to be the business sector's commitment to society as corporate citizens. In order to secure their transparency and effectiveness, Keidanren has been making efforts to have the plans reviewed by concerned councils and further evaluated by a third-party committee.

- In regard to transparency, it is necessary to promote further disclosure of basic data used in calculation and to make use of "organizations capable of conducting objective and appropriate assessment" to assure the "consistency between figures put forward by businesses and national statistics, between targets of the entire plans and targets of each sector as well as the validity of each target," as recommended in a report prepared in 2003 on environmental voluntary action plans by the Keidanren Third Party Committee.

- In order to improve effectiveness, the Committee calls for more accountability and feasibility of achieving goals. To this end, the action plans should be considered an agreement between businesses and the

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[12] Corporate social responsibility: Its idea is that businesses are social entities and they should seek not only their own profit and economic rationality but also the benefit of interest of those concerned. It is also a way of thinking that businesses also hold responsibility for social aspects, including complying to legal issues, and protecting the environment, human rights and consumers.

[13] Some members of the council raised opinions that voluntary announcement by businesses as seen in environmental reports should be encouraged rather than mandatory reporting and announcement from administrative bodies because the figures themselves, when made public while its objectives of reporting and announcement are unclear, might draw too much attention and business efforts to reduce emissions may not be properly evaluated.

government. It is also necessary to consider coordination among corporate responsibility, environmental reports and environmental accounting.

- The Committee's report also states, "voluntary agreements seen in some European countries can be an example when considering the future of voluntary action plans and that the agreement to be considered in Japan would not, as we understand, involve legally binding and punitive measures. If the agreement is designed in a way in which transparency and reliability of data are secured by inspection carried out by the government or highly independent bodies, and measures under the agreement are identified as the pillars of business efforts and no additional measures are imposed as long as the targets are met, it would contribute to raising the incentives for participating businesses."

- On the other hand, some members of the Council expressed their opinions that making agreements with the government is not necessary. The Programme states that environmental voluntary action plans are one of the Programme's core programs that seek to create a sound cycle of the environment and economy. These plans make it possible for businesses to choose the most appropriate ways on their own, through creativity and voluntary participation. The members also regard Keidanren's action plans as a commitment made by businesses to the society, which includes the government.

(A system that evaluates reduction efforts of businesses in a fair manner)

- Keidanren's environmental voluntary action plans have produced some positive results. However, efforts made by each company or each sector are not seen clearly from outside because of an overall evaluation system.

- It would probably be possible to evaluate individual efforts of a company or a sector and overall efforts by businesses as a whole at the same time. As there are many companies which have already made great efforts and produced good results and Keidanren has made it clear that it would never block efforts of individual companies or a sector, but would instead encourage their efforts, it is important to prepare for the introduction of a system that makes assessment of individual companies possible.

- It is also important to have a system in which companies that have made efforts are also recognized by consumers. The government should encourage and support such innovative efforts and activities. Moreover, it should also be considered that when each business sector or individual company makes an agreement with the government and further promotes their efforts, it will be given larger incentives.

(6) Domestic Emissions Trading Scheme

(Domestic emissions trading scheme)

- Emission trading is one of the major economic instruments. This is an economically effective scheme that uses a market mechanism and minimizes the overall cost of reducing greenhouse gas emissions. If this trading is not allowed, it would result in higher costs of cutting emissions as a whole because it fails to equalize the marginal cost of reducing emissions.

- Domestic emissions trading schemes will be introduced in the EU in January 2005. Norway, Switzerland and Canada are also planning to introduce similar systems. Discussions on linking these with various domestic systems have also started. By linking it with the Kyoto Mechanisms and emission trading schemes of other countries such as those in the EU, the price of allowance would be reduced and stabilized, thus making it more cost effective in attaining emission reductions.

- Emission trading is a system that utilizes a market mechanism. It is a flexible system because if emissions increase, more allowance can be purchased to deal with that situation.

- In Japan, Keidanren's environmental voluntary action plans oblige each industrial sector to achieve certain reduction targets. It is not possible for all companies and sectors to unanimously contribute in achieving the targets, but rather, some companies contribute more and others less. Keidanren's plans have no monetary trading scheme. If an emissions trading scheme is introduced, a market mechanism would be created for the trading of allowances.
- Emissions trading schemes have been introduced in EU countries[14]. Canada and other countries are planning to introduce a similar system that aims to achieve targets based on emission intensity. If Japan introduces a scheme that links with the Kyoto Mechanisms and the schemes of the EU and Canada, and that allows the use of credits and allowances of foreign markets, it would level out the marginal abatement cost with the EU and Canada.

(Points to remember when designing a domestic emissions trading scheme)

- By allocating emissions from industrial processes and fuel not used for power generation as direct emissions, and those from electricity as indirect emissions (final user of that electricity is responsible for the emission), the industrial sector, industrial processes, and commercial and others sector can be encouraged to work towards emission reduction.

- If mandatory emissions trading is introduced, further discussions will be needed on such subjects as the type of institution, ways to distribute allowances, and measures against noncompliance. The scheme should be designed so as to match the situations in Japan. When developing the scheme, studies will be necessary to ensure fairness among industrial sectors and among companies. It is important, however, to keep the administrative costs necessary for these studies low. It is also important in the future to link the domestic emission trading scheme with the Kyoto Mechanisms and emission trading schemes of countries in the EU and elsewhere.

(Voluntary emissions trading scheme)

- Voluntary emissions trading scheme is a system that gives some incentives to participants who make a voluntary emission reduction commitment and that enables them to trade emissions to achieve the targets. Britain introduced such a voluntary system with incentives before the introduction of the EU emissions trading scheme in order to accumulate experiences and reduce greenhouse gas emissions.

- It is appropriate for Japan to introduce a voluntary emissions trading scheme during the second step so t hat it can build experience and realize additional reductions. When doing so, greenhouse gases to be covered should not only be limited to carbon dioxide but should also include the three CFC alternatives, whose reduction has a high cost performance. Inclusion of these three gases will become an incentive to further reduce their emissions.

- This kind of voluntary domestic emissions trading scheme can be seen as a social experiment, creating a

[14] Some members of the council were against the introduction of EU's emissions trading scheme as it has restrictive and controlled economy natures. On the other hand, some said that by introducing the system that follows free economy utilizing market mechanism rather than being controlled by regulations, the cost of reducing emissions would be minimized.

new business model in which innovative efforts to tackle climate change generate additional values. While encouraging such innovative efforts by companies and stabilizing and expanding the voluntary scheme, studies must be carried out to solve additional issues (for example, who should be the main actor, what is the cost performance, etc.) and necessary conditions must be put into place.

- Some members of the council expressed concern that this voluntary scheme may be contradictory to environmental voluntary action plans promoted by the industrial sector as a whole, while others said that the scheme cannot be contradictory as it encourages additional efforts of businesses by giving them incentives.

(7) Tax System to Combat Global Warming

- Expert Committee on Tax System to Combat Global Warming (under) Central Environment Council proposed a concrete proposal of the system in August 2003. It calls for introduction of a taxation system that imposes a moderate ¥3,000 per carbon ton as tax and utilizes the tax revenues for global warming prevention measures.

- The introduction of tax system to combat global warming is said to bring the following three effects: (1) price-incentive effect, by which an increase in the price of fossil fuels could promote energy-saving, selection of more energy efficient products, and development of new technologies(by industries); (2) tax revenues could be used to adopt a wide range of global warming measures; (3)announcement effect, by which introducing the tax system could raise public awareness .

- Economic instruments may be used to realize measures which are in the Programme but are considered to have low feasibility.
  This tax system requires broader entities that emit greenhouse gases, including general households and automobile users, to reduce emissions equally. It also minimizes the reduction cost of emissions in the whole society, as compared to regulatory measures which require higher cost.
  Among various economic instruments, subsidies and tax breaks can cost the society immensely as a whole. This tax system would make it possible to utilize its revenue to adopt such measures.
  Thus, despite various challenges voiced against introducing another economic measure, the tax system to combat global warming with its above three effects can be considered an effective measure.

- Some members expressed concern over the effectiveness of introduction of this taxation system, as it may cause Japanese corporations to lose competitiveness in the global market and to lose some financial resources necessary for technological development. It is important to conduct further deliberations on the system, including such issues as its effectiveness and the comparison and possible combination with other measures.

- The tax system to combat global warming has been under deliberation at the Central Environment Council's Comprehensive Policy Planning Committee set up by both its General Policy Planning Committee and Global Environmental Committee. Further discussions at the committee, taking due consideration of the above mentioned issues, are expected.

(8) Introduction of Daylight-saving Time

- From the viewpoint of global warming prevention measures, introducing daylight-saving time could reduce CO2 emissions through the use of less electricity for lighting in the evening and air-conditioning in the morning.

- The introduction of daylight-saving time could bring benefits other than those for global warming prevention. Introduction of daylight-saving time, together with other measures such as the one that promotes volunteer activities, tourism and the cultural industry as well as those that reduce working hours and promote longer vacations, is expected to bring about changes in people's lifestyle, contributing to global warming prevention at the same time. When considering its introduction, it is necessary to take into account a change in lifestyle and working rules that aim at more free time for workers, addressing commonly held concerns that the Japanese people work too many hours. It is also necessary to make the system flexible so as to be applicable to different local situations.

- To this end, the government should make efforts to generate public discussion and a consensus on the system by conducting surveys, distributing pamphlets, having information exchanges with different sectors and reviewing experiments carried out in some areas.

(9) Strengthening of Observation and Monitoring Systems and Promotion of Research

- As for observation and monitoring activities concerning global warming prevention measures, it is necessary to strengthen comprehensive observation systems in order to understand climate change and its effects. This should be achieved by following the points described in the Framework Document for a 10-year Implementation Plan for establishing the Earth Observation System, which was adopted in the Earth Observation Summit II held in Tokyo in April 2004, and also an interim report, Future Measures for Earth Observation issued in March 2004 by the Council for Science and Technology Policy.

- Concerning research on global warming, it is necessary to promote research strategically and intensively and with international cooperation on such topics as finding the mechanisms of climate change, understanding and predicting global warming trends, evaluating the effects global warming has on the environment, society and economy, measures for greenhouse gas reductions and for dealing with climate change.

- When calculating the amount of greenhouse gas emissions and absorption, it is necessary to grasp more accurately the actual emissions by sectors. To examine the evaluation methods for the effectiveness of global warming prevention measures, it is also important to gather statistics that are used to measure the volume of activities and to promote studies on energy intensity and CO2 emission intensity calculations.

4. Strengthening of Measures and Policies by Gas Type

Note: Of measures by gas type listed in this section, current measures are indicated by " + " and additional measures by " * ".

(1) Strengthening of Measures and Policies for Carbon Dioxide Emission from Energy Use

1) Strengthening of Measures and Policies on the Energy Supply Side

(Importance of measures on the energy supply side)

- Among global warming prevention measures, those related to energy supply occupy an extremely important position due to their variety of substantial reduction effects. It is essential to promote the use of renewable energies, surplus energy such as waste heat, and natural gas with relatively little carbon dioxide emission compared to other fossil fuels. Also, nuclear power with being secured safety will continue to serve as the key source of energy in Japan, and as a source of energy with little emission of carbon dioxide, it is necessary to promote its use.

- Taking into account that such measures concerning energy supply require time for construction of infrastructure and that the problem of introduction cost remains to be solved, to achieve the targets of the Climate Change Policy Programme, maximum efforts must be made toward the first commitment period of the Kyoto Protocol to the UNFCCC. Moreover, it is necessary to promote these measures steadily in the medium-to-long term, as well.

(Expanding the Use of Renewable Energies and Surplus Energy)

- As for renewable energy sources that do not impair the earth's carbon cycle, such as solar power generation, wind power generation, biomass energy, waste power generation, and surplus energy such as waste heat, various measures are being implemented with the aim of accounting for approximately 3% of primary energy generated by the year 2010. However, some of the measures for promoting the use of solar and biomass heat are not proceeding smoothly. If the current situation continues, it is uncertain whether the 3% target can be attained as a whole. For this reason, to ensure target achievement, strengthening of the following measures and policies are necessary.

- As for solar power generation, it is necessary to promote its introduction through combined efforts of manufacturers, solar system users such as individual households and businesses, and electric power companies. To this end, it is advisable to adopt the following measures.
  - * Support manufacturers undertaking technology development by encouraging cost reductions to facilitate introduction by a greater number of people and working to create supply routes.
  - * Promotion of efforts with far-reaching effect, centering on the public sector.
  - * Promotion of public awareness activities by making use of information from PV users such as individual households and business sites.
  - * Expanding the initiatives by the national and local governments, use of Green Power Certification System and cooperation with the Green Power Fund.
  - + Proper implementation of the Renewable Portfolio Standard (RPS) Law and continuation of the existing surplus power purchasing menu by electric power companies.

- As for wind power generation, it is advisable to adopt the following measure.
  - + In addition to proper implementation of the RPS law, strengthening of measures for system

Interconnection to enable the easing of restrictions on introducing wind power generation.

- In regards to the use of solar heat, as solar water heaters that were installed in large quantities in the past are now reaching their time for renewal and are not in active use, drastic strengthening of measures is necessary to promote their use. In addition to water heaters, solar heat is utilized in solar systems employing a heat medium, and solar walls are used for home heating and passive solar house construction, together composing a field with diverse possibilities. For this reason, it is advisable to adopt the following measures.
    + Expanding the use of existing systems by devising a support system for spreading solar systems and by promoting green procurement in the public sector.
    * Promoting technology development for realizing the low costs necessary to enable expanding utilization of solar heat.

- As for biomass energy, taking into account the “Biomass Nippon Comprehensive Strategy,” it is advisable to take the following measures.
    * In addition to proper implementation of the RPS Law concerning biomass power generation, expanding the use of biomass heat, and further implementing plans for promoting biomass utilization, including energy recovery from food waste and domestic livestock excreta, while conforming to the basic principles stipulated in the Fundamental Law for Establishing a Sound Material-Cycle Society.
    * Development of a regional model useful for expanding the use of and cultivating a market for biomass energy, such as through development of technology and systems for realizing a cost reduction of biomass energy, and introduction of a dispersed energy system for enabling effective use of biomass potentials.

- As for energy recovery from wastes, considering the present state of use of heat from waste, disparity with the target is great. Thus, while conforming to the basic principles stipulated in the Fundamental Law for Establishing a Sound Material-Cycle Society, it is necessary to take the following measures for further promoting energy recovery.
    * Promotion of measures for energy recovery from plastics.
    * Promotion of recovery and use of heat from waste treatment facilities, and promotion of recovery of methane and utilization of energy from waste landfills.

- Renewable energy and surplus energy, such as factory waste heat, are energies found locally, and it is necessary to promote their use according to regional characteristics and supply and demand in order to ensure their introduction and expansion. To this end, it is advisable to take the following measures.
    * Promotion of the development of a regional model and a system according to the characteristics of each region, making use of the ingenuity of the private sector.
    * Adoption of an approach of establishing regional bases as areas in which the concentrated introduction of renewable energy and surplus energy is promoted according to regional characteristics, and by spreading such bases throughout the country, achieving the targets of the Climate Change Policy Programme.

- As drastic measures for promoting the use of renewable energy in the future, it is necessary to examine raising the target level of natural energy introduction, introducing a fixed price purchasing system for natural energy, and establishing system access rules and the system itself for expanding wind power generation.

  When examining such measures, it is necessary to take into consideration that electric power companies have already taken the initiative of establishing the Green Power Fund and Green Power Certification

System, and are voluntarily contributing to the promotion of new energy by financially assisting power generation facilities and purchasing surplus energy.

(Efforts by the Electric Power Industry)

- In the electric power sector, which accounts for a large portion of emission of carbon dioxide from energy use and an increasing percentage of the consumption of secondary energy, it is extremely important to continue reducing emission of carbon dioxide per 1kWh of electric power generation (emission factor). According to the Long-Term Energy Supply and Demand Outlook of July 2001, a 20% improvement of emission factor is expected during the period from 2000 to 2010, and the current Climate Change Policy Programme is based on the premise of attaining this level (at power generation end 73.6g-C/kWh[15]). When calculated based on a period from 1990 to 2010, this level corresponds to an approximate 28% improvement.
  Meanwhile, the voluntary action plan of the electricity industry states that "efforts shall be made to reduce end-user carbon dioxide emission intensity in fiscal 2010 by approximately 20% from the fiscal 1990 results."

- To achieve such a level of the emission factor, it is necessary to shift the electric power generation mix to those sources with little emission of carbon dioxide. While building of nuclear power generation facilities is becoming increasingly difficult considering the socio-economic conditions, the following measures can serve to further improve the emission factor: expanding the use of nuclear power generation on the condition that safety is secured, increasing the capacity factor of natural gas power stations, and further raising the efficiency of electric power generation of thermal power stations. To this end, it is necessary to improve the emission factor as much as possible by combining the following measures
  In addition to efforts to improve the emission factor, electric power companies intends to make their best to achieve the targets set in the voluntary action plan by utilizing additional measures: increasing the capacity factor of nuclear power generation facilities, improving power generation efficiency and adjusting operational methods at thermal power stations, and utilization of the Kyoto Mechanisms.

  * As for expanding the use of nuclear power, on the condition that safety is secured, it is possible to raise the capacity factor of existing power stations (1% increase results in approximately 1% improvement of emission factor) through scientific and rational operation management, such as shortening of periodic inspection time. However, it is necessary to take into account to what extent improvement of output and capacity factor is possible, considering such aspects as technology, facility management, time required for formalities, and securing the understanding of local communities.

  * As for raising the capacity factor of natural gas power facilities, if the capacity factors of existing power stations and those currently planned are raised, the emission factor will also be improved. However, in reality, it is necessary to take into account to what extent improvement of capacity factor of natural gas power facilities is possible, considering the stability and economical aspects of the electric power supply.

  * As for raising the efficiency of power generation of thermal power stations, when increasing and replacing buildings of a power station, measures are taken to introduce high-efficiency facilities,

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[15] In the Long-Term Energy Supply and Demand Outlook of July 2001, it is noted that "as figures in this Outlook have been estimated based on set conditions, they should be taken with some latitude."

such as LNG combined-cycle electric power generation. As such efforts to raise the efficiency of power generation facilities have been conventionally practiced, it is necessary to determine whether there is room left for further improvement.

- Fully taking into account the voluntary activities of the electricity industry, it is advisable to aim at securing the greatest possible effect for achieving the level of emission factor on which the current Climate Change Policy Programme is based, by examining measures for maximum improvement of the emission factor, combined with promotion of energy conservation measures in the industrial sector, commercial and others sector, and residential sector.

2) Strengthening of Measures and Policies in the Industrial Sector

(Importance of measures in the industrial sector)

- As the industrial sector accounts for a little less than 40% of carbon dioxide emission from energy use, it takes up an important position in regard to overall measures for fighting global warming.

- While it is desirable that business enterprises take the initiative in promoting reduction measures by building upon the foundation of aforementioned cross-sectoral measures and policies, from the standpoint of actualizing the reduction potentials toward achieving the targets of carbon dioxide emission from energy use and ensuring the effectiveness of measures through voluntary actions, it is advisable to take the following measures.

(Emission estimates based on voluntary action plans of each industry)

- Under the voluntary action plan of the Keidanren, voluntary action plans are set by each industry for implementing emission reduction activities . Almost all industries have indicated that target achievement is possible or that efforts will be directed toward target achievement. (March 10, Joint Follow-up subcommittee of the Industrial Structure Council and Advisory Committee on National Resources and Energy for the Voluntary Action Plan of Keidanren)

- Based on the targets of voluntary action plans and environmental reports of each industry, the emission of carbon dioxide from energy use associated with the industrial sector was forecasted for the year 2010 by the Ministry of the Environment, and though it is a provisional value, the estimate is reduction of 12.4%[16].

- In view of achieving the target of carbon dioxide emission from energy use, along with actualization of reduction potentials in the industrial sector, it is necessary to raise the certainty of the measures. Because treating the entire industry as one body makes it difficult to see the efforts of individual enterprises and industry, it is important to evaluate such individual efforts in a fair manner.
From such a standpoint, it is advisable to position the targets of each industry, a group which more closely represents enterprises that actually emit greenhouse gases and make reduction efforts, as targets to be

[16] At the Central Environment Council, it was decided that close inspection of emission of greenhouse gases be continued even after the interim report until revision of the Climate Change Policy Programme, and the above estimates are provisional values announced by the Ministry of the Environment at the present point. As other council meetings have come up with different estimates, it is necessary to carefully examine the grounds for each estimate and make adjustments at the end.

attained by the industrial sector, and to list the specific targets of each industry in the Climate Change Policy Programme.[17]

3) Strengthening of Measures and Policies in the Transport Sector

(Importance of measures in the transport sector)

- Measures in the transport sector, which accounts for approximately 20% of emission of carbon dioxide from energy use, will be focused on motor vehicles, which account for the majority of carbon dioxide emission in this sector. In particular, it is necessary to examine the strengthening of measures and policies, keeping in mind that most of the increase in carbon dioxide emission in this sector is attributable to private vehicles.

- In promoting the measures in the transport sector, it is important to place priority on strengthening national and local government measures, while coordinating with urban and community planning and measures aimed at inducing people to use public transportation.

(Measures for transportation demand)

- Measures for transportation demand, smooth transportation flow, modal shift and increased efficiency of distribution, and promoting the use of public transportation systems are recognized as measures with a certain amount of reduction effect. However, there are presently limits to available data and measurement and evaluation methods, making uncertainty and difficulty unavoidable when quantitatively evaluating such effects. For this reason, it is necessary to take steps, including data collection, to realize quantitative evaluation of actual effects. Also, it is necessary to examine the strengthening of policies to enable the effect of measures to be fully demonstrated.
  In addition to this, regarding measures for modal shift from vehicles to railway and ships, and measures that span over multiple entities such as consigners and haulage operators, to seek room for further measures and linking them to reduction of greenhouse gases, adoption of the following policy can be considered.

  * For promoting the use of public transportation systems, conduct a model project coordinated by entities such as public transportation systems, motor vehicle users, government and NPOs in order to grasp the effectiveness of various actions and the extent of sustainable effect that can be obtained, thereby linking it to strengthening of measures and policies.
    Moreover, in view of building a compact city with little emission of carbon dioxide, promote construction of pedestrian walkways, bicycle trails, bus lanes, and Light Rail Transit (LRT) to prompt walking, riding bicycles, and using public transportation systems, as alternatives to private motor vehicles.

  * As for modal shift and improvement of distribution efficiency, referring to leading examples such as the express container train developed with the aim of realizing high-speed transport of small-quantity products combination freight, consigners and haulage operators will coordinate to conduct a model project aimed at grasping the effect of introducing a next-generation domestic

[17] There were also opinions that even if targets are set by industry, it is not possible to witness the efforts of each enterprise, and that because targets by industry are already disclosed, it is meaningless to list them in the Climate Change Policy Programme.

vessel, and linking it to the strengthening of measures and policies.

(Measures for Motor Vehicle Structure)

- Solid results can be expected by the improvement of fuel efficiency of motor vehicles.

  * As it is deemed possible to achieve the Top Runner Standards based on the Law concerning the Rational Use of Energy targeted for 2010 ahead of schedule by 2005, it is necessary to start examining the targets for the next phase.

  * It is fully expected that green taxation, which applies to vehicles meeting the requirement of exceeding the current fuel standard value by more than 5%, will not only encourage users to select vehicles with higher fuel efficiency, but also prompt auto manufacturers to improve fuel efficiency. In the future, taking into account the assessment of results of the current green taxation, it is advisable to examine new policies, such as incorporating a system that will contribute to improve fuel efficiency in the automobile tax system, to ensure further expansion of vehicles with superior fuel efficiency by 2010.

- The hybrid vehicle system is a promising automobile technology that will make possible substantial improvements in fuel efficiency and will have applications in fuel cell vehicles as well.

  + Increasing vehicle categories of hybrid cars is important in the short term as well as in the medium-to-long term. Judging from the magnitude of sales expansion activities by auto manufacturers and the interest of users, it can be fully expected that hybrid cars will continue to spread.

  * It is necessary to support technological development of rechargeable batteries for the hybrid system, reduce cost, ensure high performance, and promote the expansion of vehicle categories by auto manufacturers.

- From the standpoint of using vehicles with less carbon dioxide emission, the use of idling stop devices and low rolling resistance tires are highly reliable ways of reducing emissions of carbon dioxide. For vehicles which can accommodate such device or tires, it would be suitable to consider their installation as standard equipment. To this end, it is advisable to adopt the following measures.
  * Spreading the use of idling stop device equipped vehicles.
  * Promotion of environmentally conscious driving by spreading the use of vehicles equipped with fuel efficiency meters.
  * Promotion of car sharing projects using low-emission vehicles, such as hybrid cars.
  * Spreading the use of vehicles equipped with low rolling resistance tires.

(Measures for Automotive Fuel)

- Regarding measures for automotive fuel, it is advisable that actions be taken to introduce 3% bioethanol blended gasoline (E3) as an effective stock measure for the 60 million existing gasoline vehicles, and to promote the use of ultra-low sulfur light oil and ultra-low sulfur gasoline that will enable raising the fuel efficiency of diesel vehicles and gasoline vehicles, respectively.

  * Blended fuel, such as E3, containing bio-derived components that can be used to fuel existing vehicles without particularly increasing environmental load in terms of exhaust gas properties, is a

promising measure for reducing emissions of carbon dioxide from the entire stock of 60 million existing vehicles. While recognizing such problems as economical efficiency and securing stable supplies of bioethanol, a consensus should be formed regarding its introduction with businesses involved in petroleum distribution and automobile users who will be paying for the increase in cost. Based on such a consensus, it is advisable to start with ethanol manufactured from domestic biomass resources and gradually spread its use throughout the nation, aiming at a nationwide supply by around 2012.

* Ultra-low sulfur light oil and raising the fuel efficiency of diesel vehicles can become measures leading to reduction of emissions of carbon dioxide, only if they are realized through the united efforts of suppliers of fuel and vehicles. Thus, close cooperation between businesses involved in petroleum distribution and auto manufacturers is important. For this reason, it is advisable that the public sector take the initiative in introducing diesel vehicles fueled by ultra-low sulfur light oil in garbage trucks and city buses, and support cooperation between petroleum suppliers and auto manufacturers so as to accelerate the simultaneous introduction of ultra-low sulfur fuel and corresponding vehicles.

* In regards to bio-diesel fuel, activities are already starting at the community level, and as its use is expected to expand in the future, supporting and making efficient use of such forward-looking efforts should be considered.

(Considerations in using vehicles)

- The way vehicles are used by citizens greatly affects the emission of greenhouse gases. Practices listed in the Climate Change Policy Programme are as follows: “refrain from using vehicles,” “stop idling while parked,” “raise the temperature of car air-conditioning by 1℃,” “do not fill up the tank,” “do not start or accelerate suddenly,” “do not carry unnecessary loads,” “practice planned driving,” and “keep tire air pressure at a proper level.”

- Accumulated savings in fuel through conscious stoppage of idling and planned driving will result in a great reduction effect for the nation as a whole. To this end, it is necessary to carry out full and continued efforts to educate and provide information to the public on these considerations when using vehicles. Coupled with measures concerning transportation demand and motor vehicle structure, these efforts will contribute to ensuring a reduction of emissions in the transport sector.

4) Strengthening of Measures and Policies in the Commercial and Others Sector

(Importance of measures in the commercial and others sector)

- As the commercial and others sector presently accounts for the greatest increase in emissions of carbon dioxide from energy use, maximum implementation of feasible measures is required. Thus, in addition to existing measures and policies, it is necessary to devise additional measures and to strengthen policies. In doing so, as businesses extend over diverse fields and vary in scale, it is advisable to adopt cross-sectoral measures and policies that effectively cover wide-ranging targets.
  It is also necessary to plan carefully thought out measures by business categories, such as wholesale and retail, hotels and inns, restaurants, and office buildings. Furthermore, as government and related organizations, schools and hospitals, and public facilities such as welfare facilities are also included in this sector, it is important that these facilities take the initiative in implementing actions.

(Improving energy efficiency of buildings)

[Policy for promoting measures for improving energy efficiency of buildings]

- In regards to improving the energy efficiency of buildings, firstly, it is necessary to grasp and collect currently missing data on the energy efficiency of individual buildings so as to ensure the reduction effect of measures. Moreover, to facilitate implementation of measures for improving energy efficiency of buildings, it is advisable to adopt the following policies.
    * Examination of regulatory measures, such as making it obligatory for newly constructed buildings to secure a certain level of energy efficiency.
    * Introduction of a plan for providing information on energy efficiency, such as energy saving effects on buildings already in use, and comprehensive environmental performance to users and builders in an easy-to-understand manner.
    * Expansion of incentive measures, such as tax incentives for buildings with high energy saving features.

[Strengthening of energy management of buildings]

- Energy management projects targeted at office buildings include such projects as the Building Energy Management System (BEMS), which employs IT for optimal operation of lighting and air-conditioning of office buildings, the Energy Service Company (ESCO) projects, and proper monitoring of energy consumption, which serves as the basis for implementing energy conservation measures for all buildings. It is necessary to promote dissemination of these projects through existing support plans and their active introduction by the public sector.
  In this case, it is important for the government and concerned businesses to prepare in cooperation a concrete plan, indicating specific targets, time schedule, measures, and division of roles.

- With multi-tenant buildings, in some cases, incentives to promote energy conservation of buildings do not appeal to owners and tenants. However, as reduction of energy consumption essentially benefits both owners and tenants, it is essential to promote concerted efforts between owners and tenants. To realize this, it is suggested that local governments take the initiative in establishing local councils made up of multi-tenant buildings in the community for sharing information on successful examples and carrying out activities for the dissemination of BEMS.

(Improving energy efficiency of equipment)

[Improving efficiency of OA equipment and high-efficiency commercial air-conditioning equipment with heat pumps]

- For commercial-use equipment such as OA equipment and high-efficiency commercial air-conditioning equipment using heat pumps, in addition to current efforts being made to improve efficiency by introducing Top Runner Standards based on the Law concerning the Rational Use of Energy, it is advisable to adopt the following policies.
    * Examination of increasing the range of target equipment covered by the Top Runner Standards and strengthening target values, for ensuring the further improvement of efficiency of individual equipment.
    * Establishing closer target dates, so as to ensure faster dissemination of equipment meeting the standards.

[Expanding dissemination of LED lighting]

- To realize utilization of light-emitting diode (LED) lighting, featuring power-saving and long-life properties, as indoor and outdoor lighting in place of fluorescent lamps, it is advisable to adopt the following measures.
    * Support of technology development for realizing high output and low cost.
    * Creation of initial demand through active introduction in the public sector, according to the expanded applications of LED lighting.

[Expanding and dissemination of high-efficiency water heaters]

- As for high-efficiency water heaters, including carbon dioxide refrigerant heat pump water heaters, latent heat recovery type water heaters, and gas water heaters, it is necessary to continue efforts to spread their use by leasing them from equipment manufacturers, electric power companies and gas companies, and strengthening other measures for promoting their introduction.

(Expanding introduction of commercial co-generation systems)

- As for co-generation systems, it is necessary to promote introduction of such systems, including small-scale commercial-use systems, whose energy-saving effect is secured by efficient use according to demand of heat and electricity. Thus, in addition to supporting the introduction of micro gas turbines, small gas engines, and fuel cells, it is advisable to assist the development of fuel cells and technology aimed at realizing high efficiency in all of these systems.

(Promoting utilization of bioethanol in commercial boilers)

- As ethanol (bioethanol) produced from carbon neutral biomass can be blended with fuel such as heavy oil and kerosene, and used in commercial boilers, to promote its utilization, it is advisable to adopt the following policies.
    * Support such as subsidy systems for installing equipment required for burning bioethanol.
    * Support in development and practical application of technology for realizing low production costs of bioethanol, thus lowering the price to the consumer.

(Measures for energy intensive businesses such as convenience stores)

- mall and medium-sized stores that consume large amounts of energy, such as convenience stores and family restaurants, which are not subjects to the Law concerning the Rational Use of Energy, should also be directed toward cutting down the amount of energy they use. To this end, it is advisable to adopt measures supporting the introduction of a model project taking advantage of the characteristics of chain store business.

(Changes in work styles)

- Work style is greatly related to emissions of greenhouse gases. Efforts to be taken listed in the Climate Change Policy Programme are as follows: “raise air conditioner setting to 28℃,” “lower heater settings to 20℃,” “turn off lights during lunch break,” “eliminate unnecessary copying,” and “turn off personal computers during lunch break.”

- The accumulation of savings in electricity, heat, water, and paper in factories and business establishments

results in a great reduction effect for the nation as a whole. Therefore, it is essential to carry out full and continuous public awareness activities and provide information about changing work styles. Combined with the aforementioned measures, such efforts will ensure reduction of emissions in the commercial sector.

5) Strengthening of Measures and Policies in the Residential Sector

(Importance of measures in the residential sector)

- Following the commercial sector, the residential sector is noted for its increasing percentage of emissions of carbon dioxide from energy use. As measures in the residential sector involve not only households, but also diverse parties such as national and local governments, enterprises (e.g. energy conversion, housing, manufacturing, and retail businesses), consumer organizations, NPOs, and labor unions, it is necessary on multiple levels to clearly define the responsibility of each party and promote reduction measures effectively with their cooperation.

- Greater actions by citizens are required for reducing emissions from households. It is important that the nation takes the lead in providing information, carrying out publicity activities, and promoting environmental education so as to bring out active efforts and creative ideas from households and communities, and to make good use of these resources.

(Improving energy efficiency of housing)

[Policy for promoting measures for improving energy efficiency of housing]

- In regards to energy efficiency of housing, measures are necessary for the thorough improvement of the energy efficiency features of newly constructed housing, taking into account that efficiency data on overall housing is lacking to begin with, and that energy efficiency is closely related to the use of cooling/heating equipment. Moreover, to facilitate steady promotion of measures for improving the energy efficiency of housing, it is advisable to adopt the following policies.
    * Examination of regulatory measures, such as making it obligatory to secure a certain level of energy efficiency features for newly constructed housing, and strengthening efforts by builders of collective housing.
    * Introduction of a system for providing information on the energy efficiency features of housing, such as the energy reduction effects of housing in use, and comprehensive environmental performance data to consumers in an easy-to-understand manner.
    * Expansion of incentive measures, such as low-interest loans and tax incentives for highly energy-efficient housing.
    * Promotion of development and dissemination of leading technology related to housing with superior environmental performance.

- Measures are also required for promoting energy efficiency of existing housing through remodeling. To this end, it is advisable to adopt the following policies.
    * Examination of strengthening efforts by builders of collective housing, and introduction of a plan for providing information on energy efficiency of homes after remodeling, such as the reduction of energy costs, to consumers in an easy-to-understand manner.
    * Expansion of incentive measures, such as low-interest loans and tax incentives for remodeling into highly energy-efficient housing.

- Moreover, to ensure the diffusion of measures for housing, it is essential that housing manufacturers, builders, architects, and consumers carry out coordinated activities. In such activities, it is important to devise a system leading to the preference for housing that can reduce emissions of greenhouse gases, comparable to the reaction of consumers to hybrid cars.

[Management of home energy demand]

- The Home Energy Management System (HEMS) is a project for reducing energy use through the optimal management of energy demand at home. To realize its commercialization and prompt and smooth introduction in the market, it is advisable to adopt the following policies.
    + Support in cost reducing technology development.
    * Assisting the development of a new business model for introducing HEMS as a part of existing services, such as energy supply services.
    * Introduction of a system for ensuring dissemination of HEMS, including support and promotion of undertakings by energy suppliers such as electric power companies who can effectively provide energy-saving services to customers using HEMS as a part of their energy supply services.
      Effective plans for promoting a simple system that only displays the amount and rate of energy used, aimed at raising the cost consciousness of consumers and thereby prompting energy-saving activities.
    * Promotion of projects that prompt energy-saving actions with greater certainty of reducing energy consumption. For example, through concerted efforts of the national government, local governments, energy suppliers such as electric power companies, and consumers, specific targets are set for reduction of energy consumption per household.

- As even a simple system equipped only with a real-time display of amount and rate of energy used is effective in raising cost consciousness and prompting energy-saving actions, it is necessary to examine promotion plans similar to those of HEMS.

(Improving energy efficiency of equipment)

[Improved efficiency of home electrical appliances]

- The efficiency of home electric appliances and gas and petroleum equipment used at home has been improved by introducing the Top Runner Standards based on the Law Concerning the Rational Use of Energy. In the future, it is advisable to adopt the following policies.
    * Expansion of the range of target equipment and the strengthening of target standard values to ensure the further improvement of efficiency of individual equipment.
    * Establishing closer target dates, so as to ensure faster dissemination of equipment meeting the standards.

[Steady reduction of standby power consumption]

- To reduce standby power consumption, energy wasted while home electrical appliances are not in active use, it is advisable to adopt the following policies.
    * Incorporation of standby power consumption in the Top Runner Standards.
    * Measures for further ensuring reduction of standby power consumption, such as setting limits to standby power consumption when manufacturers develop new home electrical appliances.
    * Spreading the use of taps that enable turning the power off without unplugging.

[Promoting purchase of energy-saving home electrical appliances]

- To promote active replacement of old equipment and the purchase of home electrical appliances meeting the Top Runner Standards and those with superior energy efficiency in categories other than those specified by the Law concerning the Rational Use of Energy, it is advisable to adopt the following policies.
    * Provision of product information concerning energy efficiency of equipment to consumers, through the national and local governments and various organizations promoting climate change actions, such as the Japan Center for Climate Change Actions.
    * Examination of economical incentives for purchasing products with high energy efficiency exceeding a specified level.
    * Introduction of a system, including obligatory measures, for indicating information on the carbon dioxide reduction effect on the product by manufacturers.
    * Introduction of a system for prompting in-shop explanation and shop front display of information on carbon dioxide reduction effect of equipment sold by retail stores larger than a certain scale.
    * Implementation of a model project through the cooperation of home electrical appliance manufacturers, distributors, and consumers, aimed at determining the effect of promoting purchase by providing product information on carbon dioxide reduction effect and energy efficiency, and linking it to strengthening of measures and policies.
    * Support of technology development for realizing lower costs of energy-saving products and even greater energy efficiency.
    * Support of the development of a new business model which provides a product leasing service to enable consumers to utilize products with the latest energy-saving functions at all times.

[Expansion and dissemination of high efficiency water heaters]

- As for high efficiency water heaters, such as carbon dioxide refrigerant heat pump water heaters and latent heat recovery type water heaters, it is essential to continue efforts toward expanding their dissemination. In order to create large-quantity demand and accelerate dissemination, it is necessary to promote introduction of high efficiency water heaters by leasing them through equipment manufacturers, electric power companies, and gas companies, and by working with related industries, such as housing manufacturers, condominium distributors, and builders to encourage their standard installation in newly constructed homes.

[Fuel cells for household use]

- In the medium-to-long term, dissemination of fuel cells for household use will make possible a substantial reduction of emissions of carbon dioxide from home. Thus, in addition to technology development, it is important to start the introduction of this technology, so as to enable prompt dissemination and expansion in the market.

[Voltage adjustment system]

- Based on the present Electricity Enterprises Act, voltage should be supplied within the range of 101±6V. It is necessary to examine the voltage adjustment system, which can adjust voltage down to 100V, as a measure for saving energy.

[Changes in lifestyle]

- The lifestyles of citizens greatly affect emissions of greenhouse gases. Efforts to be implemented listed in the Climate Change Policy Programme are as follows: “raise cooler setting to 28℃,” “lower heater setting to 20℃,” “spend time with family members in the same room to cut heating and lighting by 20%,” “cut TV time by 1 hour a day,” “cut use of shower by all family members by 1 minute a day,” “use refrigerator efficiently,” “use leftover bath water for laundry,” “do not use warming feature of electric pots,” “carry your own shopping bag and select minimally packaged vegetables,” “spread eco-cooking,” and “save water in the washroom.”

- The accumulation of electricity, heat, and water saved in the daily life of every citizen and efforts to select and purchase equipment with high energy efficiency can amount to a large reduction effect for the country as a whole. For this reason, it is necessary to carry out full and continuous public awareness activities and provide information on changing our lifestyle. Combined with aforementioned measures, these undertakings will ensure the reduction of emissions in the household sector.
- As pertains to the concrete actions for practicing an environmentally conscious lifestyle, which are listed in the Climate Change Policy Programme, they should be reviewed and expanded so as to facilitate certain results. For example, establishing conservation targets for energy consumption will make achievements more visible.

(2) Enhancement of Measures and Policies for Carbon Dioxide from Non-energy Sources, Methane and Nitrous Oxide

- While it is more than probable that the goal of a 0.5% emission reduction from the base year will be met for the “carbon dioxide from non-energy sources, methane and nitrous oxide” category, further reductions may be possible by stepping up the following measures and policy initiatives:

1) Promotion of the Greater Use of Blended Cement

- The manufacturing of blended cement involves mixing blast furnace slag and fly ash. A cutback in consumption of clinker yields a reduction of the amount of carbon dioxide emitted from limestone during clinker production. Currently, about 60% of blast furnace slag is used to make blended cement. Increasing this proportion will achieve additional reductions in emissions.

2) Increase in the Incineration Temperature at Sewage Sludge Incineration Facilities

- Studies conducted to date on sewerage administration have revealed that raising the incineration temperature (the measures to control the incineration temperature of the fluidized-bed furnace at 850℃ or higher) contributes to substantial reductions in nitrous oxide emission. To institute these higher-temperature burning measures in the future, it is deemed appropriate to implement measures such as rigorous control of incineration temperatures at sewage sludge incineration facilities.

3) Waste Reduction

- As for landfill and incineration of waste, waste recycling measures have been instituted based on the Fundamental Plan formulated under the Fundamental Law for Establishing a Sound Material-Cycle Society, which came into effect in March 2003. As a result, carbon dioxide emitted by waste burning and methane released by landfilled organic waste are expected to decrease.

(3) Enhancement of Measures and Policies for Three CFC Alternatives

- Three CFC alternative gases have a high global warming potential (GWP). Thus, reducing their emission generally proves highly effective. Moreover, emissions of the three CFC alternatives have been declining steadily thanks to the voluntary action plans of related industries. Assuming that the measures implemented in the past remain in place, there is a high probability that the target set by the current Programme (curbing emission increases to about 2% over the base year level) will be attained. Meanwhile, measures to reduce CFCs, HCFCs and other ozone-depleting substances were implemented in accordance with the Montreal Protocol, with a resultant increase in emissions of HFCs, a CFC alternative, whose effect is expected to persist beyond the first commitment period. There are also several other factors contributing to increases in emissions, such as growth in SF6 use as a result of the increased production of magnesium. It thus becomes necessary to step up measures and policies as suggested below.
  While measures and policies concerning three CFC alternatives, for which there is a high probability of attaining the Programme target, are enhanced by the overhaul of the Programme at this time, aid programs should be offered to sectors having difficulty in achieving the goal set by the current Programme. It is also necessary to continue to investigate the actual state of usage and emissions of these gases.

1) Development of Alternative Substances

(SF6-free magnesium)

- Characterized by a small specific gravity yet high strength, magnesium boasts excellent properties as a metallic material. For this reason, demand for this metal is expected to surge in the future. Because magnesium oxidizes and burns when dissolved and molded in air, it must be dissolved in the presence of protective gases such as SF6. Thus, emissions of SF6 are expected to rise.
- The following measures therefore should be implemented to arrest the increase of SF6 emissions in the wake of the sharp rise in demand for magnesium.
  * Develop and popularize magnesium alloy technology that does not employ SF6.

(Acceleration of the shift to HFC aerosol alternatives)

- HFC-using aerosols, which are used in automatic teller machines to blow away dust, are also finding their way to home personal computers in the form of air dusters. The increasingly wide range of uses for this gas has become a cause for concern over future increases in emissions of this compound.
  Trade organizations have been pushing forward with a shift to HFC-152a, whose greenhouse effect is about one-tenth of that of the conventionally utilized HFC-134a. In April 2004, products using HFC-152a were added to the list of green products designated by the Green Purchasing Promotion Law. The following measures should be implemented in the future to ensure the shift to HFC-free substitutes, except in cases where the use of HFC-134a is absolutely necessary.
  * As an alternative, development and popularization of electrically operated products that employ compressed air.

2) Promotion of the Use of Products Employing Alternative Substances

(Acceleration of the shift to CFC-free foaming agents and insulation)

- As efforts to improve the energy efficiency of residential housing accelerate in the future, the demand for insulation is expected to rise sharply. In particular, at the end of 2003 to 2004, a restriction was imposed

on the production and import of major HCFC (HCFC-141b), a gas that has conventionally been used as a foaming agent, with a view to protecting the ozone layer. As a result, there will be many shifts to HFC, an alternative foaming agent for insulating materials, which will cause more HFC to be released into the air. Because of its foaming property, HFC, once used, causes emissions to continue over many years beyond the first commitment period. It should be noted that the longer the delay in shifting to CFC-free substitutes, the greater the impact on emissions will be beyond the first commitment period. Under the circumstances, the following measures should be implemented.

* Bundling the initiatives for greater use of CFC-free insulation with programs to promote more energy efficient buildings and homes. Consider instituting measures such as imposing regulatory control and explicitly stipulating the use of CFC-free insulation as one of the conditions required to receive a loan, tax benefit or subsidy.
* Aggressively promoting the use of CFC-free alternatives in public construction works that use insulation.
* Replacing all insulating materials on the list of the Green Purchasing Promotion Law to CFC-free insulators.

3) Efforts to Recover CFCs based on Law

(Improving recovery of CFCs from refrigeration and air-conditioning devices)

- Effective in April 2001, recovery of CFCs used as a coolant in home-use refrigerators and air-conditioners was made mandatory under the Home Appliance Recycling Law. This was followed by the Fluorocarbons Recovery and Destruction Law, which mandated recovery of CFCs from commercial refrigerating and air-conditioning devices starting in April 2002, and from automobile air-conditioners starting in October 2002. Consequently, the overall CFC recovery rate has improved compared with the period before the laws were enforced.
  However, the amount of CFCs recovered from these devices, especially from commercial refrigerating and air-conditioning devices, is expected to be only about 30-40% of the estimated amount of CFCs that remained in devices at the time of disposal.
  Thus, the following measures should be implemented to raise the recovery rate of CFCs as well as to reduce HFC emissions.
  * Review measures to improve the CFC recovery rate, such as a radical overhaul of the system for recovering CFCs from commercial refrigerating and air-conditioning devices.

(4) Enhancement of Sink-related Measures and Policies

(Achieve absorption of close to the upper limit (13 million ton-CO_2 (about 3.9% of the total emissions volume of the base year)) using the sinks through forest management plan)

- Given the current level of forest improvement efforts, absorption by sinks will most likely fall far below the upper limit. It thus becomes necessary to intensify related measures, so that the goal stated in the Forests and Forestry Basic Plan—full utilization of multifaceted functions of forests—and the supply and utilization target for forest products may be attained as planned.

  * On the environmentally sound forest development front, efforts should focus on eradicating forests that are overdue for thinning. The efforts entail: promoting efficient thinning operations undertaken collectively by forest owners; engineering a shift toward forests with a longer cutting cycle or multistoried forests; and encouraging greater use of thinned wood. Also promoted are

measures to systematically eliminate the land allowed to be left denuded and programs that foster and secure leaders through the green job creation initiative.

* Proper management and maintenance of protection forests are pursued through systematic and aggressive implementation of measures including: designation of the protection forest in a well planned and sound manner in accordance with the Nationwide Forest Plan; expansion of natural parks and nature conservation areas, and more rigorous maintenance and management of these areas; promotion of forest conservation work in mountain regions with a high disaster risk and denuded forests in the hinterland.

* As for initiatives to promote citizens' participation in forest development, a number of programs are instituted, with a view toward nurturing higher public awareness about the society-wide support of forest improvements. These include: making a broader range of actors involved in forest development activities; improving skills of forest volunteers and upgrading safety systems; expanding the scope of the green worker program that aims to protect flora and fauna, including forest, in national parks; further enhancing education in the conservation of forest environment; encouraging corporations to participate in forest development efforts by making use of the "corporation forest" scheme (e.g. profit-sharing scheme for the national forest).

* Usage of lumber and woody biomass is encouraged to help promote sustainable forest management and reduce fossil-fuel use both inside and outside Japan. Specific measures include: utilization of locally harvested lumber through closely coordinated distribution, processing and housing supply from upstream all the way through the downstream; use of low-grade lumber and woody biomass; consumer-focused programs such as expanding the user base, which will stimulate actual demand for locally harvested lumber; upgrading of production and distribution systems through computerization, to make them capable of meeting consumer needs; and promoting the use of thinned wood under the Green Purchasing Promotion Law

- Continue to work toward systematic enhancement of reporting and validation systems for forest sinks in line with the IPCC Good Practice Guidelines.

(Promotion of urban greening)

- Based on the Green Policy Guidelines and the Green Basic Plan drawn up by municipalities, steady efforts will be made toward improvement of urban parks, and greening of roads, rivers, erosion control facilities, harbors and other public facilities. Also actively implemented are programs to create additional green space in urban areas, enlisting different actors and approaches. They include programs such as the urban greening and the conservation of privately owned green areas, involving diverse actors ranging from citizens and corporations to NPOs, the greenery area scheme, and multilevel park systems.

- Continue to conduct a review, with an eye toward establishing a system for reporting and verification of the amount of absorption by sinks (green areas) in urban parks, roads and rivers, in line with the IPCC Good Practice Guidelines.

(5) Enhancement of Measures and Policies related to the Kyoto Mechanisms

- The current Programme set the target of a 4.4% emission reduction through domestic measures. Thus, the Kyoto Mechanisms may be utilized to achieve a reduction of 1.6%, a difference between the 4.4% Guidelines target and 6% Protocol target. The current Programme, however, does not explicitly state the

1.6% reduction from the Kyoto Mechanisms, because there is a possibility that the target of individual domestic measures may be exceeded on the whole.

- However, given the projected emission reductions to be achieved in 2010 by means of domestic measures, which may be supplemented by the additional measures described in the preceding sections, it seems extremely difficult, even with the help of the additional measures, to reduce emissions of carbon dioxide from energy use. Furthermore, even if other gas-specific measures and sink measures are implemented, there is little probability that domestic measures overshoot the target and thereby produce a significant reduction of more than 4.4%, and thus eliminate the need to utilize the Kyoto Mechanisms.

- Consequently, in the future review of the Programme, it is necessary to first explicitly state the amount of credits needed to be earned through the use of the Kyoto Mechanisms if the reductions that domestic measures have failed to achieve are to be quantitatively compensated for. Then, full-scale measures for Mechanism utilization should be implemented.

- Among the Kyoto Mechanisms, primary instruments should be CDM and JI, which are supported by specific emissions reduction efforts and contribute to sustainable development of the host nation.

- Both CDM and JI require a lead time of 3-5 years from the project's planning stage to the issuance of credits. Any delay will let excellent projects be snatched by corporations in EU, increasing the possibility that adequate credits won't be secured. Particularly, in the case of CDM, credits are issued for reductions achieved before 2007. So, it is advisable to start utilizing this mechanism as early as possible. For reasons stated above, it is necessary to systematically implement full-scale initiatives, with a view to commencing utilization from the early part of the period set as the second step.

- Initiatives for full-scale utilization of the Kyoto Mechanisms must (1) offer business entities incentives to earn credits and (2) allow the acquired credit to be transferred to the government.

- Transferring credits to the government is a prerequisite to having emission credits that corporations have earned through the Kyoto Mechanisms utilized as a compliance achievement of the Kyoto Protocol. Transfer may be made through the following schemes:

  (i) Mandatory domestic emissions trading scheme
  (ii) Voluntary domestic emissions trading scheme
  (iii) Credit procurement by the government
  (iv) Credit transfer to the government through subsidy for facilities which are necessary for CDM/JI projects

- It is necessary to continue to conduct in-depth discussion about what specific policy initiatives should be implemented to earn credits, bearing in mind the 1.6% differential that needs to be compensated for. To avoid acting belatedly, steps must be taken, starting in the second step period, to ensure that sufficient numbers of CDM/JI projects are undertaken and measures should be implemented to allow the government to acquire credits in a systematic manner. Additionally, in promoting projects, there is need to seek understanding of the international community, review the proper utilization of ODA, and sort out how the credit should be treated under accounting and tax systems.

- It is also necessary for the government to develop the guideline concerning utilization of the Kyoto Mechanisms, which identifies approaches as well as target projects and regions, and to implement programs based on this policy.

5. Systems for Measures and Policy Implementation

(1) Government's Leadership Role and Dissemination

- To make all actors aware of their responsibilities and encourage them to push global warming prevention measures forward, the government, as a consumer of energy and fuels, must take the lead in the greenhouse gas reduction effort.

- The government has drawn up the "Action Plan for Greenhouse Gas Emission Reduction in Government Operations" (July 19, 2002. Hereinafter referred to as the "Action Plan") and publishes the results. First of all, the government should make aggressive efforts toward attaining the target of the Action Plan (reducing greenhouse gas emissions 7% from 2001 levels before fiscal 2006) through the following measures: acceleration of the shift to low-emission vehicles, in addition to the initiative to replace general government vehicles with lower emission vehicles, which is scheduled to be completed by the end of this year; and adoption of the Eco-Friendliness Diagnostic Check and ESCO to reduce electricity and fuel consumption at government buildings and facilities, which accounts for about half the emissions generated by the government. Next, when common rules that apply to the business and public sectors are laid down, the government should keep track of greenhouse gas emissions and disclose the data as required by the rules, while working to enhance measures.

- Local governments, and some trade and industry associations are also required to set an example for local actors by developing and steadily promoting the Action Plan that encompasses government buildings, public schools, community centers, hospitals, waste disposal facilities and tap water and sewage systems.

- When overhauling the Programme, it is important to enlist the participation of public institutions such as independent administrative corporations and public interest corporations in the implementation of pioneering projects described above, so that the efforts may be translated into widely implemented initiatives involving business entities and citizens.

(2) Clarification of the Roles of Actors Such as Citizens, Industries, NGOs/NPOs and Labor Unions, and Promotion of Well Coordinated Initiatives

- A review of the Programme has revealed that inter-ministry initiatives, which—if implemented with the collaboration of large numbers of interested actors at both demand and supply sides—are expected to become highly effective, have fallen short of expectations. This is because little collaborative efforts have taken place due to lack of clear-cut divisions of the roles of demand- and supply-side actors.

- One example is the transportation sector. Because the roles of the supply side (physical distribution service providers) and the demand side (consigners) are not defined clearly, the effectiveness of increased efficiency of physical distribution operations and modal shift is undermined. The poorly defined role divisions between the supply side—such as railroads and buses—and the demand side—users—has prevented the measures to promote use of public transportation from becoming fully effective.

- Similarly, in the commercial and household sectors, the effectiveness of the measures to improve energy efficiency of homes and buildings is undermined due to lack of clearly stated role divisions between builders, who supply housing and buildings, and demand-side actors, namely, clients, owners and tenants. Absence of the clear-cut role divisions between the supply side—manufacturers and marketers who supply devices and equipment—and the demand side—consumers—also undermines benefits arising from the widespread adoption of equipment with improved efficiency.

- On the production and distribution scene, labor unions are called upon to act as a go-between in connecting business entities (supply side) with consumers (demand side). They should assume leadership roles in workplace efforts toward promotion of global warming prevention initiatives undertaken by businesses, such as development and production of products free from greenhouse gases, thorough implementation of labeling, and the improvement in energy efficiency of production processes and physical distribution operations. As the consumer in local communities who acts across corporations, labor unions are also required to engineer a modal shift away from the private car to other modes of commuting while serving as a primary force that drives local measures to arrest global warming, drawing on their expertise acquired in the workplace.

- In overhauling the Programme, it is important to clearly define the roles assumed by each of the actors involved in different measures. It is equally important that the government and ministries work together, making full use of their capabilities, to enable many social actors such as companies, local governments, NGOs/NPOs and labor unions to participate and collaborate.
  It is also necessary to implement new-stage measures that affect the social structure, such as changes in transport systems, urban structure and lifestyle, through utilization of inter-ministry partnerships and collaboration among actors.

(3) Local Implementation of Measures and Roles of Local Governmnets

- To encourage actors to participate in global warming prevention measures throughout Japan, it is important that inter-ministry initiatives that entail collaboration across governmental ministries are intensively adopted so that large numbers of pioneer model communities, which serve as an example for other regions, will be created.

- To increase the ripple effect of these initiatives, active participation of the Prefectural Center for Promoting Activities to Prevent Global Warming, local councils for global warming measures and voluntary advisors who promote awareness raising for climate friendly lifestyles is required.

- Furthermore, it is vital that local governments, the primary instrument of each region’s well-thought-out environmental administration, use their own initiative. It is incumbent on local governments to institute global warming prevention measures within each region. Achieving the 6% reduction commitment made under the Kyoto Protocol is Japan’s obligation mandated by international law, and the government therefore should take the responsibility of implementing measures toward attaining the Protocol target. Benefits arising from greenhouse gas emission control measures undertaken by the local governments will spread beyond the region and will be shared nationwide. Consequently, the national government should actively support efforts of the local governments, through subsidization and other means.

6. Reductions through Additional Measures and Policies

- Shown in Tables 3 and 4 are projected greenhouse gas emission reductions expected to be realized if the additional measures described earlier are implemented (hereinafter referred to as the “Measure Enhancement Scenario”).

- After the compilation of an interim summary, the Central Environment Council intends to continue to review additional measures and policies during the time remaining until the revision of the Programme, with a view toward securing additional emission reductions in greenhouse gases and further enhancing carbon sinks. Thus, figures for the Measure Enhancement Scenario presented in Tables 3 and 4 are tentative values available at this point of time.

- Adjustments should be made to the Programme target, taking into account the amount of emission reductions that may be achieved through the additional measures.

Table 3: FY2010 tentative greenhouse gas emissions as estimated by the Ministry of the Environment [Measure Enhancement Scenario]

Greenhouse Gas	Base Year		Measure Enhancement Scenario（FY 2010）			Programme Target	
	Million t-CO2		Million t-CO2	% from total emission in base year		Million t-CO2	% from total emission in base year
① CO2 from energy use	1048.33		1054.25	＋0.5％		1023.59	-2%
CO2 from non-energy source, CH4, N20	138.88		121.51～128.38	-1.4%～-0.8％		132.69	-0.5%
② CO2 from non-energy source	73.94		71.12	-0.2%			
③ CH4	24.74		17.60～20.54	-0.6%～-0.3%			
④ N2O	40.19		32.78～36.71	-0.6%～-0.3%			
⑤ HFC	20.23		Close examination is underway	Close examination is underway		74.48	＋２％
⑥ PFC	12.59						
⑦ SF6	16.92						

(Notes)

*A close examination is underway for HFCs, PFCs and SF6 emissions (the rationality and validity of the parameters needed for estimation are currently being checked.)

*Measures other than those listed above are CO2 sink enhancement and utilization of the Kyoto Mechanisms.

*Figures in Programme's Target column represent values obtained by reclassifying the reductions achieved through the measures for "strengthening of the research and development of innovative environmental and energy technologies", and "promotion of global warming prevention activities by every social actor" to each greenhouse gas. See Figs. 9 and 10 on p.43 for the concept behind the reclassification.

*After the compilation of an interim summary, the Central Environment Council intends to continue to review additional measures and policies during the time remaining until the revision of the Programme, with a view to securing additional emission reductions in greenhouse gases identified as ①～⑦ in the Table, and further enhancing carbon sinks. Thus, figures for the Measure Enhancement Scenario shown above represent tentative estimates at present released by the Ministry of the Environment. Because other councils have arrived at different projection numbers, it is necessary to carefully examine the rationale for each of the projections and make adjustments so that those projections may be ultimately reconciled

Table 4: FY2004 tentative CO2 emissions from energy use as estimated by the Ministry of the Environment [Measure Enhancement Scenario]

Sector	Base Year		Measure Enhancement Scenario（FY 2010）			Programme Target (% from the base year)	
	Million t-CO2		Million t-CO2	% from the base year		Before distribution	After distribution
CO2 emission from energy use	1048.33		1054.25				
Industrial	476.08		417.15	-12.4%		- 7 %	-8.0%
Transport	217.21		254.48	+17.2%		+17%	+16.0%
Residential/Commercial	273.00		316.59	+16.0%		- 2 %	
Residential	129.15		140.99	+9.2%			-12.2%
Commercial and others	143.85		175.60	+22.1%			-6.2%

(Notes)

*Figures in Programme's Target column represent values obtained by reclassifying the reductions achieved through the measures for "strengthening of the research and development of innovative environmental and energy technologies", and "promotion of global warming prevention activities by every social actor" to each sector. See Figs. 9 and 10 on p.43 for the concept behind the reclassification.

*After the compilation of an interim summary, the Central Environment Council intends to continue to review additional measures and policies during the time remaining until the revision of the Programme. Figures for the Measure Enhancement Scenario shown above represent tentative estimates at present released by the Ministry of the Environment. Because other councils have arrived at different projection numbers, it is necessary to carefully examine the rationale for each of the projections and make adjustments so that those projections may be ultimately reconciled.

Conclusion

As the global warming problem becomes more serious, the policies and measures taken by various countries to tackle global warming are likely to develop into the coordination of international policies. The public policies of these countries in tackling global warming will, in fact, help create a foundation for the public good of the earth. The numerous deliberations are being undertaken by this Council in order to transform Japan into a society free of practices that may cause global warming, while at the same time creating a foundation for the assets of mankind and the public good of the earth.

We hope that the numerous deliberations conducted by the Council on measures to tackle global warming will not only fulfill Japan's responsibility of burden sharing in the international community but also give Japan great assets to enable it to take part in the global community in the not too distant future of the 21st century.

The implementation of measures to tackle global warming is the reform of Japan's socio-economic system, lifestyle, and work habits. They should be undertaken with the equal participation of all parties. In the assessment and review of the Climate Change Policy Programme, it is advisable to actively disclose the information gathered by related councils, ministries, and agencies in an easy-to-understand manner, listen to the opinions of citizens in different sectors of the society, and incorporate creative ideas and suggestions.

Such diverse ideas and suggestions have been deliberated and incorporated into the contents of the Council's interim report. We strongly hope that they will be reflected in the new Climate Change Policy Programme.