Interim Report

by

Global Environmental Subcommittee

Environmental Committee

Industrial Structure Council

# Perspectives and Actions to Construct a Future Sustainable Framework on Climate Change

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# Introduction

## (1) Background of Discussions at the Subcommittee

The climate change problem is a globally essential issue that must be addressed in the long term. Countries of the world have exerted efforts to create an international framework designed to cope with the climate change problem. These efforts have culminated in the United Nations Framework Convention on Climate Change and the Kyoto Protocol under this convention. The international community is now waiting to put the Kyoto Protocol into force. It is very difficult for Japan to achieve the emission reduction target stipulated in the Kyoto Protocol, which is a 6% reduction compared with the 1990 level, because Japan has already achieved high energy efficiency. Despite that difficulty, Japan will make the utmost efforts to implement various measures steadily under the new "Climate Change Policy Program" in a step-by-step approach. However, the Kyoto Protocol confines itself to specifying the targets pursued by developed countries to reduce emissions of greenhouse gases until 2012. The Protocol represents an important first step toward long-term efforts to solve the problem.

The United States, the world's largest greenhouse gas emitter, has announced its intention not to ratify the Kyoto Protocol. Meanwhile, developing countries' $CO_2$ emissions are rapidly increasing and are projected to exceed those of developed countries. Still, the Kyoto Protocol does not obligate developing countries to cut emissions of greenhouse gases. Accordingly, a truly meaningful framework for solving the climate change problem must be created.

The Kyoto Protocol mandates commencement of discussion about the next commitment period by the end of 2005. With this in mind, research and discussions have already started in various circles. At the 8th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP8) held in 2002 in New Delhi, India, participants focused on whether discussion on a framework after 2013 should be commenced or not. However, the disparity in positions among participating countries was so significant that the conference came short of drawing a forward-looking conclusion. Overcoming considerable differences in views among the Parties that became apparent at the COP 8 seems not to be an easy task.

In order to iron out these differences in viewpoints and build an effective framework involving the United States and developing countries, flexible, creative and innovative ideas are needed. While reviewing the results and lessons learned from the series of international negotiations leading to the Kyoto Protocol, active discussions should take place about what factors must be given weight in proceeding to the next step and what actions are needed to move ahead. And to expect fruitful results, such discussions must be started early. Discussions at this subcommittee are aimed to bring forward a perspective from which a framework after 2013 should be considered and to contribute to encouraging such discussions.

### (2) Discussions at the Subcommittee

Starting in October 2002, the Environmental Committee's Global Environmental Subcommittee has been carefully studying a future framework on climate change at its five sittings. While looking back on the process of negotiations concerning the United Nations Framework Convention on Climate Change and the Kyoto Protocol, the subcommittee has analyzed the actual situations in related countries from the viewpoint of the energy demand and supply structure and cleared up the points that should be taken into account to construct a future framework on climate change. The subcommittee invited the opinions of committee members and experts specializing in international politics and international laws.

Based on these discussions, this subcommittee has drawn up this Interim Report. International discussions and negotiations are yet to begin and may take a considerable period of time. As a consequence, this subcommittee's discussions are expected to evolve as future negotiations progress. Therefore, this Interim Report represents a first step toward creating active discussions and represents an interim summary of the subcommittee's views. This subcommittee hopes that the Interim Report will help arouse lively discussions and obtain diverse views and comments.

## Chapter 1. Characteristics of the Global Warming Issue

In considering a framework on the global warming issue, clarifying the nature of the problem is the first and most important thing to do. The four essential characteristics of this issue are described below.

### 1. Global Public Goods

The atmospheric concentration of greenhouse gases is a global public goods. As long as it is kept at an appropriate level, the earth maintains its temperature within a certain range so that countries of the world, their peoples and sebsequent generations can enjoy its benefit. From the economics point of view, it is difficult to exclude someone from benefiting from the atmospheric concentration of greenhouse gases (non-exclusivity), and another person's enjoying benefits does not alter the total amount (non-competitiveness). Therefore, the atmospheric concentration of greenhouse gases is typical public goods and, with its characteristic of global stretch, it can be called the global public goods.

A country's efforts to control global warming do not only serve the interests of that country but also benefit all commons on the earth. In a sense, such efforts have an altruistic aspect. In any attempt to encourage countries of the world to participate in such efforts, such characteristics of climate measures should be taken into account.

As public goods may induce free-riding, leaving this problem unsolved will undermine the benefits to the commons, which leads to difficulty in keeping up the motivation of entities participating in the efforts, making the system fragile. Properly addressing this problem is essential in creating a framework that is sustainable for a long period of time.

Furthermore, an appropriate approach is to take a facilitative, rather than strict, attitude toward countries that carry out measures for the public goods (insiders). This is because priority must be given to creating an environment that invites as many participants as possible through facilitation of their burden-sharing acceptance.

### 2. Long-term Challenge Requiring a Technological Breakthrough

It is such a long-standing challenge that it takes several generations to see the impact of anthropogenic greenhouse gas emissions becoming more acute on a global scale. A significant proportion of the global

warming problem is caused by the emissions of $CO_2$ produced by the combustion of fossil fuel. However, viable alternative technologies capable of extracting and sequestrating $CO_2$ from flue gases have not yet been developed. And energy sources capable of completely replacing fossil fuels, or technologies capable of achieving more radical energy conservation than now are yet to be developed.

Since countries' economic growth, development and the use of energy are closely related to one another, the development of alternative technologies is ultimately essential in reconciling the climate measures with economic growth and development. Efforts to cope with global warming must promote the development and diffusion of such technologies as well as diffusion of existing technologies, and must be advanced from the long-term perspective, with due consideration to the lead time needed for the development and diffusion of such technologies.

### 3. Challenge Requiring an Effort to Achieve Cost Effectiveness

Since sources of greenhouse gas emissions are very diverse, simply regulating specific entities' specific activities in certain countries and regions is not a satisfactory solution to deal with the climate change problem. Instead, wide-ranging economic activities should be dealt with through a wide variety of measures suitable for various countries, regions or sectors. Reflecting a difference in the energy supply and demand structure, the marginal costs of greenhouse gas reductions differ greatly from country to country, from region to region, or from sector to sector.

The issue has such a magnitude that the world as a whole will be required to bear tremendous costs to carry out these countermeasures. In this case, how to choose cost effective approaches from among various options is a key question that must be answered in order to prevent global warming in a more effective manner.

In regard to this discussion, developing countries which are believed to incur relatively lower marginal costs of greenhouse gas reductions may contend that consideration should be given to countries' cost-bearing capacities. It will be necessary to understand that the developing countries attach high priority to economic development. It must be recognized that in developing countries, capacity for cost-bearing changes in accordance with development stage.

In shaping a future framework, the first priority is to address the question of how we can meet the need for protection of the global

environment as cost-effectively as possible while giving consideration to developing countries' arguments about a difference in cost-bearing capacities.

Moreover, the cost of climate measures is a factor that may have a large impact on the modality of economic activities for country/sector. And this factor also affects conditions for competitiveness in the international marketplace. One of the prerequisites to maintaining countries' motivation to participate in such efforts is to ensure that the perspective of equity will be adequately incorporated in climate measures so as to minimize the impact on conditions for international competition.

## 4. Clarifying the Mechanism of Climate Change

Gases such as $CO_2$, methane, nitrous oxide, and F-gases (e.g. hydrofluorocarbons) have the effect of preventing heat from escaping surface of the earth into deep space, and as such, these gases are referred to as greenhouse gases. Scientific studies have revealed that the growing emissions of anthropogenically produced greenhouse gases have significant impacts on the ecosystem, such as in the form of a rise in sea and temperature levels, as well as on the economic and social activities of human beings. In the meantime, the Intergovernmental Panel on Climate Change's (IPCC) Third Assessment Report in 2002 projects that the impact of global warming in 2100 will raise the earth's temperature by 1.4 celsius degrees to 5.8 celsius degrees and result in a sea-level rise of 9 cm to 88 cm, thus providing a wide range of estimates (Table 1). A study is in progress to look into what kinds of human activities would have which kind of impact, and what the future of the earth would be like.

In this assessment, as several assumptions were used in regard to the population growth rate and the economic growth rate, the number of emission scenarios has increased. And these scenarios showed a substantial difference in estimates for the concentration of greenhouse gases, its impact on climate, and the degree of sea-level rise. As a result, the Third Assessment Report presented a wider range of estimates than the Second Assessment Report.

An attempt at devising an international framework for the global warming issue must bear in mind that a projection about global warming still involves some uncertainties.

<Information Column>

Comments by Major Countries on the Scope and Structure of the IPCC Fourth Assessment Report (April 2003)

The United States

- We would first note the importance of addressing recent criticisms of the emissions scenarios used in the Third Assessment Report (TAR). Failure to do so in an appropriate manner could raise legitimate doubts about the result of the AR4 effort, severely undermining the the credibility not only of the AR4, but also of the IPCC itself.
- Scenarios to be used in the Fourth Assessment Report should reflect new knowledge regarding the potential importance of concerns such as carbon-based aerosols and the need to reconsider particular assumptions regarding such factors as population and economic growth.
- We also urge that efforts be made to identify which scenarios are more likely than others.

Germany

- Scenarios (of socio-economic development, the resulting emissions, as well as climate) need updating and further development.
- High priority should be given to the issue of uncertainties in the sensitivity of the climate system.

Australia

The process will need to

- Consider developing a probability distribution around the IPCC temperature range in order to increase understanding of the likely extent of temperature rises.
- Investigate further the possible impact that using purchasing power parities rather than market exchange rates would have on the SRES scenarios.
- Assess whether probabilities can be attached to each scenario.

Table-1 Publication of IPCC Assessment Reports

| Date of IPCC Assessment Report Publication | First Assessment Report April 1990 | Second Assessment Report December 1995 | Third Assessment Report March 2001 |
|---|---|---|---|
| $CO_2$ concentration (by 2100) | About 800ppm | 750-1000ppm | 540-970ppm |
| Surface temperature (by 2100) | Up by about 3 celsius degrees | Up by 1.0-3.5 celsius degrees | Up by 1.4-5.8 celsius degrees |
| Sea level (by 2100) | Rise by about 0.65m | Rise by 0.13-0.94m | Rise by 0.09-0.88m |

## Chapter 2. Progress of International Negotiations Concerning the United Nations Framework Convention on Climate Change and the Kyoto Protocol

With the characteristics of the global warming issue in mind, this chapter summarizes the development of the current framework for tackling global warming.

### 1.Accumulating Scientific Knowledge while Negotiating on the Convention and the Protocol

Much still remains to be scientifically resolved as to the climate change problem. Thus, efforts are continuing to accumulate scientific knowledge of this phenomenon. On the other hand, out of belief that shaping an international framework after the accumulation of adequate scientific knowledge would be a belated effort, negotiations concerning the Convention and the Protocol proceeded with certain scientific uncertainties as a premise.

Right from the beginning, discussions about the climate change problem have been preceded by scientific debates, and debates conducted among scientists since the 1970s were taken over by policy-makers in the late 1980s, paving the way for negotiations on the Framework Convention. In these circumstances, the climate change problem came to arouse considerable concern. Not just a matter of scientific interest, climate change became a matter of social and economic concern.

On the other hand, the mechanism of global warming, the extent of the impact of human activities, and a future image of the earth are yet to be fully elucidated. Accordingly, while negotiations on the Framework Convention and the Protocol are going on, scientists are exerting ceaseless efforts to shed light on this phenomenon.

The Intergovernmental Panel on Climate Change (IPCC) was established in 1988 jointly by the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO) with a view to gaining scientific knowledge, studying the impact of climate change and working out measures to cope with this problem. The IPCC has been playing a central role in achieving subsequent progress in the accumulation of scientific knowledge. Since its inception, the IPCC has been studying climate change under three working groups: (1) Evaluation of Scientific Knowledge, (2) Assessment of Social and Economic Impacts, and (3) Formulation of Measures to Cope with Climate

Change, with continuous revisions of organizational structures.

The IPCC has been submitting assessment reports almost every five years and this activity has been exerting an influence on the progress of negotiations concerning the Convention and the Protocol. The 1990 IPCC First Assessment Report projected that by 2100, atmospheric temperature would rise by around 3 celsius degrees and sea levels would go up by 65 cm. This report was presented at the negotiating table on the Convention. The 1995 Second Assessment Report came up with the temperature rise estimates of 1.0-3.5 celsius degrees, giving a boost to negotiations on the Kyoto Protocol. The 2001 Third Assessment Report, which was submitted prior to the Marrakech Accords, forecast that atmospheric temperatures would soar by 1.4-5.8 celsius degrees. During this period, as mentioned earlier, diverse scenarios have been produced, providing rather a wider range of temperature rise projections. Projections on temperature and sea levels are still diverging.

The IPCC is scheduled to come up with the next assessment report in 2007. By that time, international negotiations on the next framework would be more likely to have been activated and, consequently, the extent to which further scientific knowledge will have been accumulated before the next assessment report is submitted is expected to have significant influence on the outcome of these negotiations. In this respect, Japan's contribution to the effort to enhance scientific knowledge is of vital importance.

## 2. From the Framework Convention to the Legally Binding Protocol

The process of structuring an international framework on climate change proceeded from the Framework Convention, which formulates a common basis for countries' activities on this issue, to the Protocol, which provides for legally binding numerical targets.

During discussions among policy-makers in the late 1980s, the necessity of forging an international framework was perceived. In 1990, the United Nations General Assembly formed an intergovernmental negotiating committee for the Framework Convention on Climate Change, and this Framework Convention was adopted in 1992. In the course of discussions about the Convention, some maintained that legally binding greenhouse gas reduction targets should be imposed. In the final outcome, however, legally binding numerical targets were not specified and, instead, the Convention required participating countries to take steps to reduce greenhouse gas emissions.

Subsequently, participating countries vehemently argued that the

Framework Convention alone would not be enough as an international framework and, consequently, specific gas reduction targets should be set for countries to accomplish. As a result, the First Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 1), held in 1995, agreed on commencing negotiations concerning the Protocol (the Berlin Mandate). After preliminary negotiations took place during the period from 1995 to 1997, the COP 3, held in Kyoto in 1997, adopted the Kyoto Protocol imposing legally binding numerical targets on countries.

The flow of efforts concerning the climate change problem from the Framework Convention to the Protocol can be described as a progression from soft law to hard law. This process implies the analogy with the international community's experience regarding the ozone layer protection that was addressed prior to the climate change problem. In regard to the ozone layer protection, which started based on a scientific hypothesis in the 1970s, the Vienna Convention as a framework convention was adopted in 1985 and the Montreal Protocol providing for more specific commitments to be met by countries was adopted in 1987. In subsequent years, the Montreal Protocol was revised on the basis of scientific elucidation.

Nevertheless, a large difference between the ozone layer protection issue and the climate change problem is observed in terms of types of gases covered and the range of regulations applied. Compared to greenhouse gases such as carbon dioxide which are not easily managed since they are produced from an extremely wide range of sources, places where ozone-depleting substances are produced are limited to chemical factories. From the technological point of view, alternative technologies --- so-called CFC substitutes --- were already developed, so that manufacturers were able to take measures to comply with regulations. It should be noted that the Montreal Protocol contains provisions to limit trade with non-member nations, thereby providing a free-rider prevention mechanism.

## 3. Numerical Targets Agreed without Calculation Formula

Whether or not numerical targets should be imposed on participating countries was the central issue that had been consistently discussed since negotiations began concerning the Framework Convention.

In negotiations on the Framework Convention, although European countries and Japan set their own voluntary targets in 1990, opinion was divided on whether legally binding targets should be prescribed by the Convention. Eventually the Parties agreed that the greenhouse gas reduction targets would

not be mandatory but, instead, that taking policies and measures for the purpose of reducing greenhouse gas emissions back to the 1990 levels by 2000 would be mandatory.

Negotiations on the Kyoto Protocol were conducted to set numerical targets for developed countries, based on the Berlin Mandate agreed upon at the First Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 1).

Two-year negotiations among countries proceeded with difficulty. Behind this was the fact that parties were unable to discuss numerical targets alone because the relative difficulty of accomplishing reduction targets would vary from country to country depending on the range of gases covered and the possibility of introducing flexibility mechanisms to be adopted as the Kyoto mechanisms.

Participating countries put forward various proposals on indicators to be considered in setting numerical targets. Japan, for example, proposed that per capita emissions be adopted as an option for target value or that a target value be set with due consideration for indicators such as per capita emissions, emissions per GDP, or the population growth rate. By contrast, the European Union (EU) maintained that a 15% reduction rate should be adopted, emphasizing its most proactive position on the global warming issue. At the same time, the EU insisted that the so-called "EU bubble" should be establihed. The process during this period continued to draw a great deal of worldwide attention. How countries could demonstrate a positive attitude toward the issue became an essential factor in negotiations.

**< Parties' Proposals on the Methods of Differentiating Quantified Targets >**

From the early stages of Ad hoc Group on Berlin Mandate (AGBM) meetings, intensive discussion took place on the subject of quantified targets, i.e. whether to adopt uniform reduction rates or to accept differentiation depending on each country. After AGBM5, the Parties actively submitted practical proposals.

**(1) "Optional" method** (Proposed by Japan at AGBM5)

Annex I countries need to select either of:

(a) Average $CO_2$ emission quantity shall be less than *p* Carbon ton per capita for (2000 + *x*) year till (2000 + *x* + [5]) year

Or

(b) Reduce average $CO_2$ emission quantity by *q* % from the 1990

level for (2000 + x) year till (2000 + x + [5]) year

**(2) Method "to discount the reduction rates from the unified standard reduction rate, using indexes"** (Proposed by Japan at AGBM8)

- As a chair country of the 3rd Conference of Parties, the Japanese Government proposed 5% as the standard reduction rate, which could be used to determine each Annex-I Party's reduction target, assuming that the country would accept the conditions (i) to (iii) stated below. (Base year 1990, and target period 2008 to 2012)

  (i) The greenhouse gases subject to this proposal shall include $CO_2$, methane and nitrous oxide.

  (ii) The quantified targets here presently embrace some unpredictable uncertainties, depending on technological innovation, energy situation, and industrial structure changes in the future. Therefore, the articles on compliance need to contain a certain level of flexibility. The said flexibility shall be expressively stipulated in a protocol or any other legal documents.

  (iii) Each party's target shall be differentiated depending on per GDP emissions, per capita emissions, and population growth. The parties fulfilling the following conditions can apply any of the differentiated reduction rates stated below:

  (a) The emissions per GDP (A) of a Party in 1990 were less than the emissions per GDP (B) of all Annex I countries in 1990:
  Reduction rate (%) = 5% x (A/B)

  (b) Per capita emissions (C) of a Party in 1990 were less than the per capita emissions (D) of Annex I countries in 1990:
  Reduction rate (%) = 5% X (C/D)

  (c) For countries that had population growth rates during the period 1990 to 1995 greater than the average rate of all Annex I countries for the same period, consideration shall be taken of such higher rate of population growth when deciding each Party's target,. The practical method of determining a reduction rate is to be established later .

- Banking, borrowing, emission trading, and joint implementation should be adopted under certain conditions.

- The total emission volume of the second budget period shall not exceed the total emission volume of the first budget period. A more precise differentiation method shall be applied to the second budget period.

**(3) System of "standard reduction rate + additional reduction commitment"**

(Proposed by Hungary and other countries at AGBM5)

Each Party is to commit to the stabilization, and to notify (commit) additional reduction quantity

**(4) Method of "differentiating target values using indexes"** (Proposed by many countries mainly at AGBM5)

- 3 indexes of emissions per GDP, per capita emissions, and per capita GDP (Norway)
- 4 indexes of emissions per GDP, per capita emissions, per capita GDP, and the share of renewable energies in consumption (Iceland)
- 5 indexes of projected population growth, forecast on the growth of per capita GDP, intensities of emissions against GDP, intensities of emissions against exports, and intensities of fossil fuels against exports (Australia)
- Relative contribution to the increase of GHG atmospheric concentration (historical emissions) (Brazil)
- Per capita emissions (France and Switzerland)

**(5) Method of "each party to commit for greater emission reduction in the next term"** (New Zealand at AGBM5)

- Each party to commit to a certain reduction rate, with the next term to have greater reduction than the previous term.

**(6) Method "to distribute after deciding the overall tolerance"** (Netherlands at AGBM3)

Safe Emission Corridor method, i.e. to determine the overall tolerance of total emissions from all developed countries, then to decide the emission quantity allowed for each developed country Party.

**(7) "Universal Bubble" method** (Russia at AGBM8+)

Each Party to propose own individual reduction target, then adopt the sum of individual targets as a collective target.

**(8) Method "to list each Party's target value"** (At COP3)

List the negotiation result of each Party's target.

Before COP3, USA maintained its support for the uniform reduction rate. Their proposal at AGBM8 was as follows:

(1) Designate 2008-2012 as the first budget period, and determine the **fixed rate of reduction from the 1990 level** during that period. From the second budget period, emissions shall start to go below the 1990 level.
(2) Apply **the uniform reduction rate**. Target every greenhouse gas including fluorocarbon alternatives.
(3) Utilize flexibility mechanisms such as emissions trading, joint implementation, and others including the net method.
(4) Seek developing country participation through the evolution system (for future participation) and the voluntary commitment by developing countries.

Eventually, negotiations failed to find any formula on which countries would agree. At the time when the COP3 commenced, participating countries were significantly divided in regard to reduction targets. As a result of a compromise reached at the last minute of the nearly two-week session, countries finally agreed on numerical targets. Nevertheless, reduction targets imposed on Japan, the United States and the EU - 6%, 7% and 8% - fell short of a scientific and objective basis of calculation. Furthermore, Russia, whose emissions already fell substantially below the 1990 level at the time of the agreement, was to accomplish a reduction target of ±0 %, meaning that the country gained an enormous surplus quota.

Moreover, the agreement resulted in stirring up an argument from the perspective of the equitable principle since it required countries to bear significantly different costs of achieving reduction targets.

## 4. Developing Countries' Participation

The contention that all participating countries should reduce greenhouse gas emissions was taken up whenever the opportunity arose --- when the Framework Convention was formulated, when the Berlin Mandate was drawn up, and when the Kyoto Protocol was formed. However, countries have not reached an agreement yet on developing countries' meaningful participation.

In the course of formulating the Framework Convention, the second intergovernmental negotiating committee took up a proposal to require all participating countries to commit themselves to achieve emissions reduction, but in a relatively early stage the convention imposed a general obligation on all participating countries, including developing countries, to

curb emissions of greenhouse gases and preserve sinks. And an obligation to take gas-reducing measures to bring greenhouse gas emissions back to the 1990 level by 2000 was imposed solely on developed countries. In the preamble to the Framework Convention, the phrase "common but differentiated responsibilities" was included, providing the grounds for developing countries' argument that "developing countries and developed countries have naturally different responsibilities, so developed countries should take the lead on reducing greenhouse gas emissions."

At the 1995 COP 1, participating countries conducted negotiations on a framework for subsequent negotiations concerning the Protocol and adopted a document called the Berlin Mandate. In the negotiations, because developed countries' national communications, submitted immediately before this conference, found that developed countries' emissions would not return by 2000 to the 1990 levels, developing countries once again contended that developed countries should take the initiative first in fulfilling their own responsibility for emissions reduction.

In that negotiation, developed countries gave more priority to avoiding the failure of the milestone COP1 conference than to accomplishing the original intention of making global efforts toward emissions reduction. Ultimately, the Berlin Mandate structured a framework for subsequent negotiations to impose numerical targets solely on developed countries. This aspect became a decisive factor that precluded the Kyoto Protocol from imposing new obligations on developing countries.

In the subsequent two-year negotiations on the Protocol, the United States put forward an evolutionary approach to encourage developing countries to participate in the process and a proposal to require more advanced developing countries to make a voluntary commitment of emissions limitations and reductions. However, the U.S. proposal failed to obtain agreement as it met with strong opposition from developing countries, which based their contention on the Berlin Mandate.

## 5. United States' Announcement of Withdrawal and the Marrakech Accords

After the Kyoto Protocol was adopted, while negotiations concerning the operating rules of this protocol were continued, the United States announced in March 2001 that it stood opposed to the Kyoto Protocol and

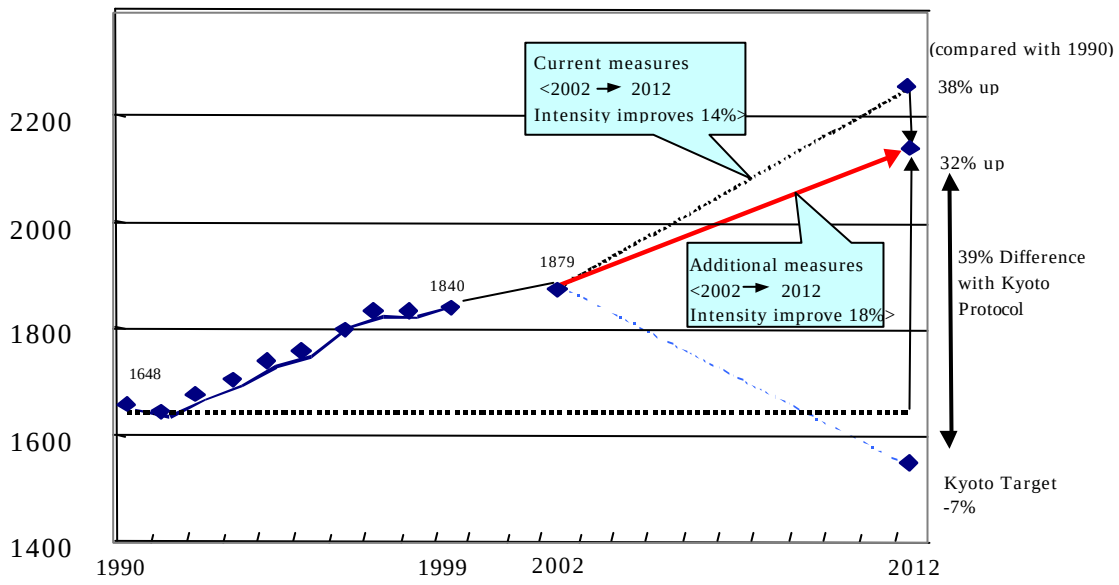
had no intention of ratifying it.

The United States explained the reason for its withdrawal as being that the targets under the Kyoto Protocol would have a negative impact on the U.S. economy and that developing countries did not take part in commitments for emissions reduction. In fact, this explanation had been used as the condition for unacceptability to the United States in the Byrd-Hagel resolution that the U.S. Senate unanimously adopted in July 1997, 5 months before the COP 3. Considering that the United States' ratification of this protocol will require an affirmative vote of the Senate majority of two-thirds, it seems that the Byrd-Hagel resolution carried a considerable weight just at the time when COP 3 negotiations commenced. Because of such a resolution, at the time when the Kyoto Protocol was agreed upon, it was predicted that the US ratification would encounter difficulties.

In February 2002, President Bush announced the "U.S. Climate Change Strategy: A New Approach." This initiative set the GDP intensity target, which is to reduce the emission per GDP by 18% by 2012 compared with 2002. Even if the US meets the target, emissions in 2012 are estimated to reach 32% above the 1990 level and thus a 39% difference compared with the Kyoto Protocol target (-7%)(Fig.1).

Fig.1 US GHG Emissions Trend and Outlook

Million tons of Carbon




Note: Emissions in 2002 and 2012 are estimated by METI using real GDP forecast at 2001 prices.

After the United States announced its withdrawal from the Kyoto Protocol in 2001, Australia also announced its policy of not ratifying the Protocol.

In these circumstances, negotiations on the operating rules of the Kyoto Protocol continued and COP 6 bis in June 2001 reached a political agreement on the core issues (the Bonn Agreement). At the COP 7 in November of the same year, the operating rules were nearly completed (the Marrakech Accords). The United States was represented at the conferences where these agreements were reached, but it virtually did not participate in the negotiations.

In the negotiations concerning the operating rules in Marrakech, one of the principal focuses was the handling of sinks, such as forests. In the COP 3 negotiations on the Kyoto Protocol, when the inclusion of forests and other sinks was allowed, Japan initially estimated that sinks would absorb approximately 3.7% of its greenhouse gas emissions and, based on this estimate, accepted achieving a 6% reduction target. Later on, the EU proposed handling forests and other sinks in a limited manner, coming into hard negotiation with Japan and other countries maintaining that making the most of forests and other sinks would be indispensable for achieving reduction targets under the Protocol. Participating countries also devoted considerable discussions to other issues, such as how flexibly the Kyoto mechanisms would be used and what (compliance) measures should be taken in the event of failure to achieve targets.

The completion of the operating rules paved the way for ratification by countries of the Protocol. So far, more than 100 countries, including Japan, have ratified the Kyoto Protocol.

## 6. Discussions on the Framework beyond 2012

The Kyoto Protocol stipulate that consideration on a commitment beyond 2012 should begin by the end of 2005.

At the Eighth Conference of the Parties to the United Nations Framework Convention on Climate Change (COP 8) held in October to November 2002, the focus was whether discussion on a framework beyond 2012 should begin early. Such parties as Japan, Canada, Norway and the EU argued for agreement on the early commencement of discussion, but developing countries came out against it, adhering to their position that they would not accept any argument obligating them to cut greenhouse gas

emissions. The United States took a stance that it would not assume any position on a future framework and would not approve the commencement of discussion on it. Thus, while participating countries were sharply divided in opinion, the Delhi Declaration was adopted. In regard to a future framework, the Delhi Declaration states that:

(1) Recognizing with concern the findings of the IPCC Third Assessment Report, which confirm that significant cuts in global emissions will be necessary to meet the ultimate objective of the Convention,
(2) Noting that mitigation actions are now taking place both in Annex I and non-Annex I countries and emphasizing that mitigation of greenhouse gas emissions to combat climate change continues to have high priority under the provisions of the Convention,
(3) Parties should promote informal exchange of information on actions relating to mitigation and adaptation to assist Parties to continue to develop effective and appropriate responses to climate change;

The above statements were the product of a compromise reached on the premise of the aforementioned differences in opinion. No agreement was reached on the commencement of discussion on a future framework. In this process, Japan has consistently been insisting on establishing "a common rule in which all countries, including the United States and developing countries, participate". This is because Japan attaches importance to laying down truly desirable rules for the protection of the global environment as an essential element to be incorporated in a future framework.

**(Opinions at the Committee)**

- In the negotiations on transboundary pollution (acid rain) conducted in Europe between the 1970s and the 1980s as well, diplomatic pressure rarely reinforced a country's internal administration.
- International laws in the environmental field undergo a transition from soft law to hard law and the rules of the game must be changed in order to get back to soft law.
- The Kyoto Protocol set reduction targets because the progress of global warming was obvious. The problem will remain unsolved for ten or

twenty years ahead unless we carry this momentum to real action.

- At the COP 8, the United States and developing countries demonstrated a negative opinion on negotiations for structuring a future framework. Participation of the United States, China, and India in a future framework is imperative.
- The United States would not take part in a framework during the second commitment period that is an extension of the Kyoto Protocol.
- A framework after 2013 must be presented before 2005, the time limit for commencement of negotiations during the second commitment period under the Kyoto Protocol.
- An alternative framework in which the United States and developing countries would accept to participate must be presented.

## Chapter 3 Characteristics of the Kyoto Protocol

In reviewing what the framework ought to be in the future, important clues are provided by looking into some aspects of the Kyoto Protocol. This chapter discusses three points that should be borne in mind regarding the Kyoto Protocol from such a point of view.

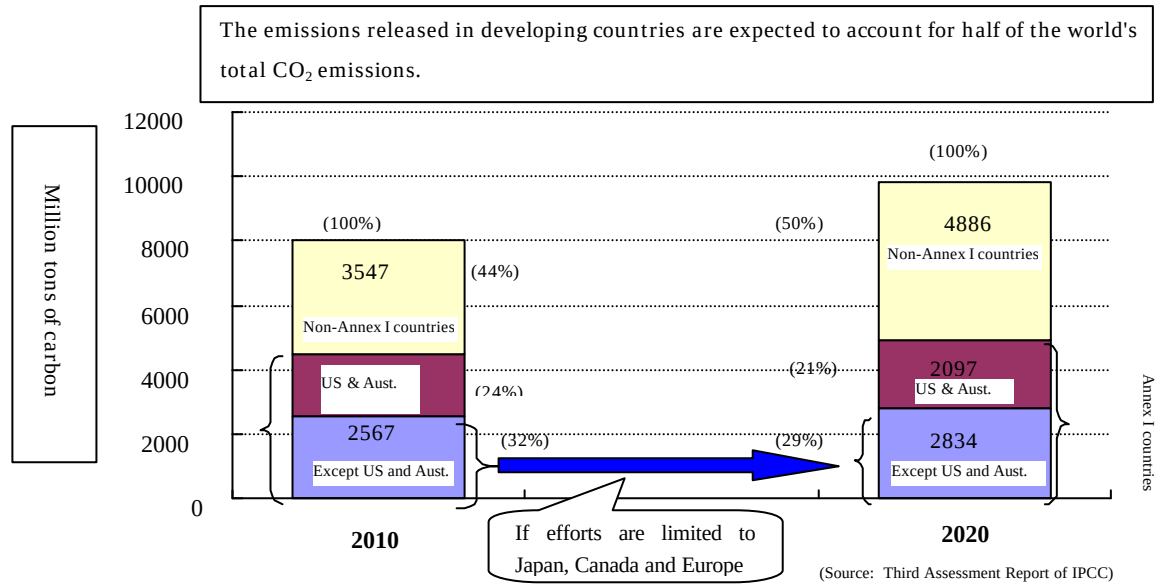
### 1. Kyoto Protocol Currently Dealing with Approximately One-Third of the World's Greenhouse Gas Emissions

One of the most important characteristics of the Kyoto Protocol adopted by the 3rd Conference of the Parties to the United Nations Framework Convention on Climate Change (COP3) in 1997 is the fact that it set legally binding numerical targets for emissions of greenhouse gases by developed countries. The protocol has become the first binding framework to reduce emissions of the world's greenhouse gases. Under the target prescribed by the protocol, the developed countries involved are required to reduce their emissions by 5.2% on average from the 1990 level between 2008 and 2012.

In March 2001, however, the U.S. expressed its intention of not participating in this framework. Then, Australia followed suit.

Among the countries in the world, greenhouse gas emissions are substantially increasing in developing countries. $CO_2$ emissions in developing countries are expected to account for half of the world's total $CO_2$ emissions (Fig.2). As the Kyoto Protocol has accepted the insistence of developing countries, which have concerns on possible restraint on their development and growth, developing countries are not committed to reduce their emissions. The U.S. is the largest country for emissions, accounting for about one-fourth of the world's total emissions, and its emissions have still been increasing in recent years (Fig.4).

Fig.2 Prospects for the World's $CO_2$ Emissions

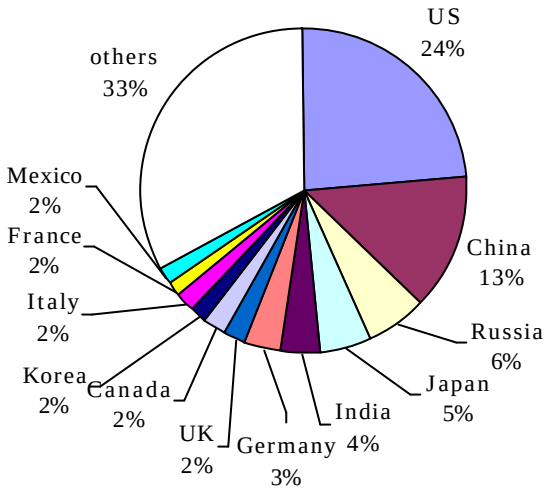



Annex I Parties: the countries listed in the Annex I of the Framework Convention on Climate Change (advanced countries + CEIT). Under the Kyoto Protocol, the countries listed in the annex are committed to reducing their greenhouse gas emissions.

Breaking down greenhouse gas emissions by country, neither the U.S. (ranked first), China (ranked second), nor India (ranked fifth) is committed to the emission reduction target prescribed by the Kyoto Protocol. Russia (ranked third) is required by the Kyoto Protocol to keep its emissions at plus or minus 0% from the 1990 level. But as its present emissions are far lower than the 1990 level because of the impact of the economic situatation in the first half of the 1990s, Russia now has large amounts of surplus allowances. Russia can be described as not being committed to any reduction target in an actual sense.

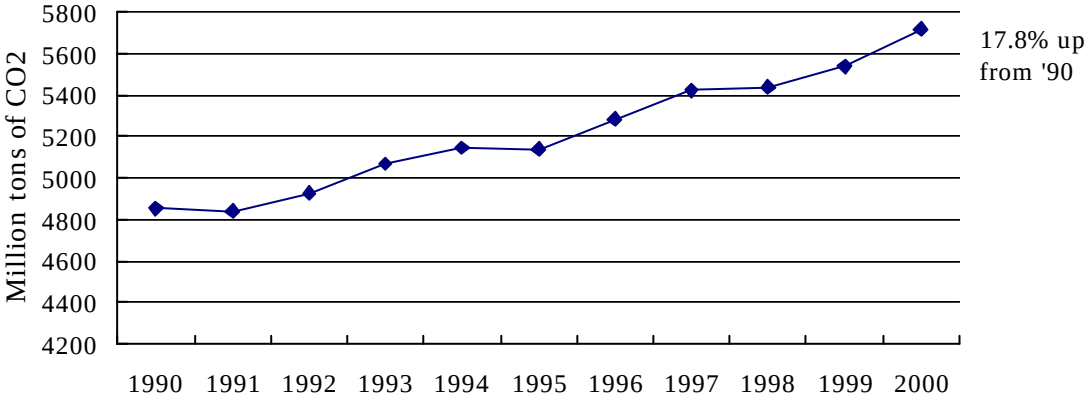
Now, among the top countries that account for about half of the world's total emissions (the countries placed in the right half of the pie graph below), Japan (ranked fourth) is the only country that has expressed its willingness to fulfill the emission reduction commitment prescribed by the Kyoto Protocol. Bearing a heavy burden of achieving its reduction target, Japan is playing a leading role to establish and implement this framework.

Fig.3 The World's Energy-Related $CO_2$ Emissions




Source: IEA/OECD, $CO_2$ Emissions from Fuel Combustion

Fig.4 $CO_2$ Emissions in the U.S.




Source: IEA/OECD, CO2 Emissions from Fuel Combustion

Excluding the U.S. and Australia from the developed countries that are mandated by the Kyoto Protocol to reduce their emissions, the emissions of the remaining developed countries account for only 35% of the world's total emissions in 1990 as the base year. According to IPCC's prospects, the share of emissions of these countries will continue to decrease even in a BAU case, and reach about 29% in 2020 (Fig. 2)

To prevent global warming in the future, it is indeed important to reduce the emissions in countries other than the developed countries that are committed to reduce their emissions under the Protocol. The Kyoto Protocol has not covered the areas where emissions are expected to significantly increase and have a great impact on the progress of global warming in the future.

## 2. Commitment to Reduce Total Amount of Emissions by Countries

The Kyoto Protocol has included the total amount of greenhouse gas emissions by countries in its legally binding commitment. Needless to say, greenhouse gases are emitted from a variety of economic activities as well as in everybody's daily life and the commitment should be met through voluntary and positive action by all, in accordance with their fair responsibilities. The government, as one stakeholder, plays the role of making basic and comprehensive policies and implementing them. In order to keep the total amount of emissions within a certain range, the government may adopt strong restrictions on people's broad economic activities and daily lives, but such restrictions have a limit. Technically speaking, of course, it is possible to achieve the reduction target through international emissions trading for a certain period after the completion of the first commitment period. However, this is merely an ex post facto measure for adjustment, and is not an essential factor of the reduction commitment.

This is a unique example among international laws. Originally, most international laws define their commitments as certain "acts" that can be realized responsibly by the government that ratified the relevant international law. The Kyoto Protocol, on the other hand, defines its commitment as "maintenance of certain status." In essence, its nature is realized by an integrated whole of economic activities, daily life, etc., and it has a limit that can be controlled by the government (government reach), if a market economy is a precondition.

As an alternative concept, it may be conceivable to select an approach that accumulates elements of various acts and policies in each sector, which are required to reduce greenhouse gas emissions. The Kyoto Protocol selected an agreement on total amount of emissions by countries, while other treaties on environment such as the Montreal Protocol adopted different approaches. Emission targets by countries are not necessarily the only option in theory.

## 3. Factors Concerning Numerical Targets

### (1) Differences in the Relative Difficulty of Accomplishing Reduction Targets

According to the reduction targets prescribed by the Kyoto Protocol for developed countries, the target of Japan is set at -6%, the U.S. at -7%, the EU at -8%, Canada at -6%, Russia at ±0%, and Australia at +8%. The numerical values of targets vary from country to country (Table 2).

Such relative difficulty of accomplishing reduction targets depends largely on the energy-saving level that each country has already achieved. Japan has already achieved the world's highest level of energy efficiency. So, it is not at all easy for Japan to further reduce its emissions from the present level. Therefore, analyses show that Japan's reduction costs would be higher than costs in other countries. On the other hand, in the countries where energy-saving levels are not comparatively high, there is significant room for investment in energy conservation at relatively low costs. According to IPCC's analyses, there is also a wide range of variation in respect of how many additional measures are required to accomplish reduction targets in consideration of the reality in each country, and the relative difficulty of accomplishing reduction targets varies widely from country to country. It is pointed out that Japan's cost of accomplishing a reduction target is the highest among major developed countries (Fig. 5).

Russia, on the other hand, has already been given a large amount of surplus allowances. It is deemed almost certain that Russia would accomplish its numerical target without any special measures. It is predicted that Russia will sell its surplus allowances to other countries.

Essentially, to promote the world's measures against global warming in the most efficient manner, such measures have to be promoted in a way that allows the marginal reduction costs to be equal. However, each

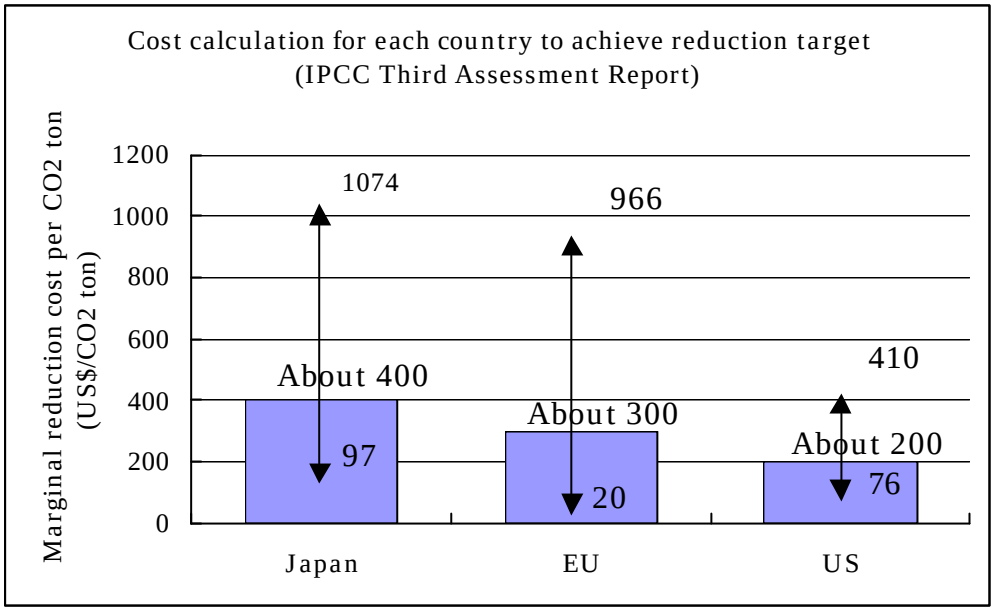
country's reduction target that was agreed upon in the process of working out the Kyoto Protocol has not sufficiently allowed for such a point of view.

Such differences in the relative difficulty of accomplishing reduction targets could be a factor that provokes arguments in terms of equity.

Table 2 Kyoto Protocol Annex B

| | Target | EU Target | | Target | | Target |
|---|---|---|---|---|---|---|
| EC | -8 | | EIT | | Others | |
| Portugal | -8 | 27 | Ukraine | 0 | Iceland | 10 |
| Greece | -8 | 25 | Russia | 0 | Australia | 8 |
| Spain | -8 | 15 | Croatia | -5 | Norway | 1 |
| Ireland | -8 | 13 | Hungary | -6 | NZ | 0 |
| Sweden | -8 | 4 | Poland | -6 | Canada | -6 |
| Finland | -8 | 0 | Bulgaria | -8 | Japan | -6 |
| France | -8 | 0 | Czech | -8 | USA | -7 |
| Netherlands | -8 | -6 | Estonia | -8 | Monaco | -8 |
| Italy | -8 | -6.5 | Latvia | -8 | Switzerland | -8 |
| Belgium | -8 | -7.5 | Lithuania | -8 | Liechtenstein | -8 |
| UK | -8 | -12.5 | Romania | -8 | | |
| Austria | -8 | -13 | Slovakia | -8 | | |
| Denmark | -8 | -21 | Slovenia | -8 | | |
| Germany | -8 | -21 | | | | |
| Luxembourg | -8 | -28 | | | | |

Fig. 5 Cost calculation for each country to achieve reduction target




Note: The vertical arrows represent the span of two or more trial calculations. The figures such as 400, 300 and 200 represent the average values of various trial calculations.

(2) Base Year

It is pointed out that the differences mentioned above are attributable to the fact that the Kyoto Protocol has adopted the year 1990 as the base year of reduction targets. In considering the changes in the emissions of the world's greenhouse gases, the year 1990 has special characteristics.

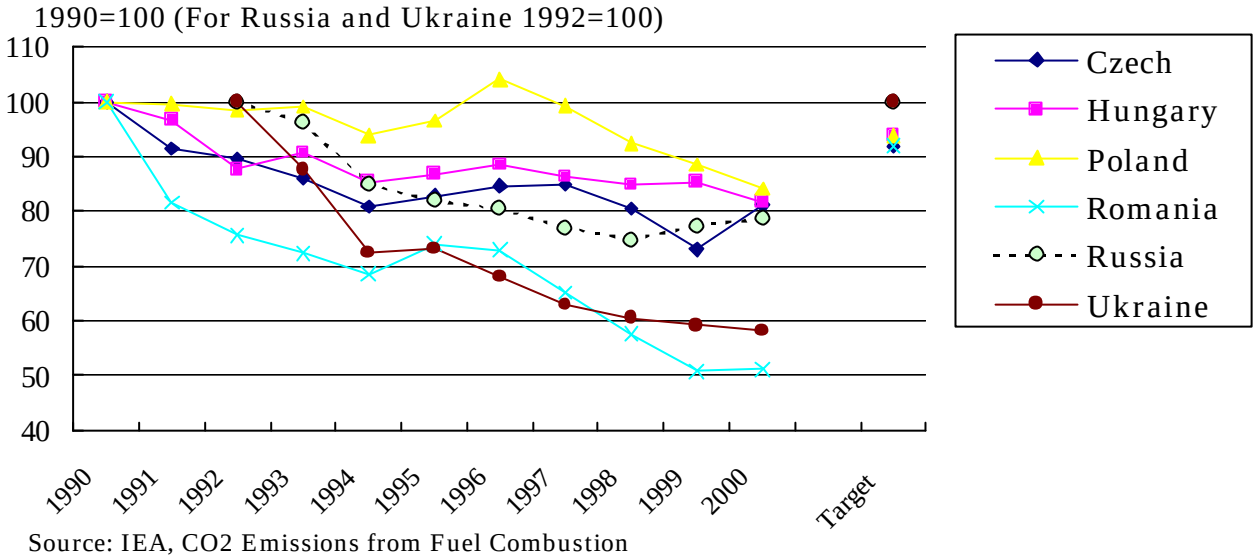
First, the economic activities in Russia and Eastern Europe remained sluggish in the first half of the 1990s due to the transition process from a planned economy to a market economy. During this period, their greenhouse gas emissions drastically decreased (Fig. 6). The fact that emissions in 1990, before such a decrease took place, were adopted as the base year resulted in Russia and Eastern Europe being provided with a large amount of surplus allowances.

During the same period, moreover, the U.K. and Germany already developed drastic changes in their energy supply and demand structure. First, the energy sources in the two countries shifted drastically from coal to natural gas in the 1990s, thus resulting in reduction of their greenhouse gas emissions (Fig. 7). The shift was promoted by the cost reduction required for the privatization of electric power companies as well as by closings of coal mines in the two countries. In Japan, natural gas is a clean but relatively expensive energy source because it is imported in a liquefied form. In Europe, on the other hand, natural gas is supplied through gas pipelines. So, the situations concerning natural gas are different in Japan and Europe.

If the price of natural gas for power generation in 1996 is set at 100, the prices

of coal for power generation in European countries are 53.4 in Germany and 73.6 in the U.K., according to data ("Competition and Liberalization in European Gas Markets" by Jonathan P. Stern). At first sight, the price of natural gas is higher than that of coal, but the unit cost of power generation is almost the same or lower with natural gas, if the thermal power generation efficiency of coal (a little higher than 30%) and the combined cycle efficiency of natural gas (50%) are taken into consideration.

Fig.6 CO2 emissions in EIT countries



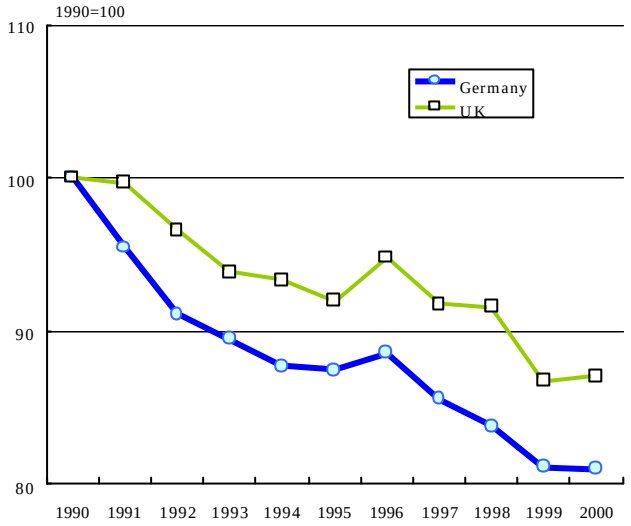

Source: IEA, CO2 Emissions from Fuel Combustion

Moreover, East Germany and West Germany were unified in 1990. Then, in the first half of the 1990s, inefficient facilities were closed or replaced by the newest facilities in the former East Germany, reducing energy consumption in Germany as a whole.

Out of the EU's emissions in 1990, the U.K. and Germany accounted for about half (Fig. 8). Significant reductions in emissions in these two countries are a large factor that makes it more promising for EU as a whole to accomplish its reduction targets.

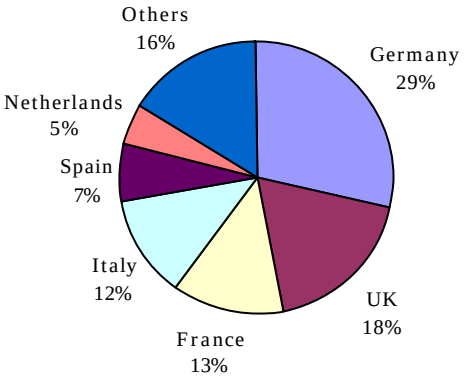
All of these factors are caused as a result of the adoption of the year 1990 as the base year. Originally, the Kyoto Protocol was negotiated as an extension of the Framework Convention on Climate Change. As the framework convention mentioned as a yardstick, "the return by the end of the present decade (2000) to earlier (1990) levels," the year 1990 has continued to be used as the base year.

Fig.7 GHG emissions in UK and Germany




Source: National report to UNFCCC
Note: Emissions are total of 6 GHG gases

Fig.8 Composition of GHG emissions in EU




Source: IEA/OECD, CO2 Emissions from Fuel Combustion, National report to UNFCCC

In the process of working out the Kyoto Protocol, the EU, Russia and Eastern Europe gained significantly favorable conditions by using the year 1990 as the base year, assuming the above-mentioned emission trends that were already in progress. This situation will continue to remain unchanged as long as 1990 is defined as the base year, when the future framework is considered.

(3) EU's Joint Fulfillment

The Kyoto Protocol allows for the joint fulfillment scheme that is called the "EU Bubble." As more than two countries are allowed to have joint reduction targets for greenhouse gas emissions, the EU as a whole has set its overall emissions reduction target at -8%. Within the EU, however, the overall reduction target is redistributed according to a separately agreed arrangement (Table 2).

Under the targets redistributed by the EU, some countries such as the U.K. and Germany are required to reduce their emissions by more than 10%. On the other hand, other countries such as Greece and Portugal are allowed to increase their emissions by more than 20%. If this point is compared with the fact that the targets of the countries listed in Annex B of the Kyoto Protocol fall within the range from -8% of EU countries to +10% of Iceland (Table 2), it could be said that the countries included in the "EU Bubble" reflect their respective realities in a more flexible manner. Moreover, if the EU as a whole fulfills its overall target, the fulfillment of each country's target will not be questioned, providing a more flexible mechanism in terms of commitment. The countries other than EU countries have to rely on the use of the Kyoto Mechanism

for the portions of emissions that they cannot reduce on their own. The EU countries, on the other hand, have gained a tool that allows them to flexibly and mutually coordinate their emissions without using the Kyoto Mechanism.

In the negotiations leading up to the COP3, Japan, the U.S., Canada, Australia, etc., had continued to oppose the idea of the EU Bubble because: "the relations of commitments between EU and member countries are ambiguous; there are concerns about the transparency in the case where EU decides or changes the sharing of commitments with its member countries regarding the numerical targets and; allowing only a part of EU countries to increase their emissions by a wide margin lacks equity and impairs the motivation of developing countries to address the reductions in their emissions."

Moreover, the EU expansion scheduled in 2004 means that many East European countries that have a large amount of surplus allowances will be integrated into EU. During the first commitment period, the scope of the EU Bubble is firmly limited to the present 15 countries and not allowed to expand. But, in considering the framework in and after 2013, the factor of these new member countries will have to be taken into account, too. The emissions of the ten new member countries are shown in Table 3 on the next page. If the EU Bubble that incorporates these countries is allowed, the EU will gain a more advantageous situation under the future framework.

(4) Penalties for Non-compliance

The measures which will be taken against any of the Parties that cannot comply with their reduction targets prescribed by the Kyoto Protocol are defined by the Marrakech Accords that were adopted by the 7th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP7). Specifically, the accords have measures or sanctions in a sense against the Parties such as deducting the emissions at the rate of 1.3 times the quantity not fulfilled from the allowances allocated to the next commitment period. So, the Kyoto Protocol applies severe schemes to the countries that commit to its reduction targets, while containing no measures against countries that are not Parties to the Kyoto Protocol. Its mechanism is severe for insiders but more tolerant for outsiders.

In terms of the basic characteristics and factors of a global environment treaty, it is important to facilitate and appreciate the Parties' intention to commit themselves to the framework, rather than imposing sanctions on non-complying countries. If any of the Parties cannot fulfill its commitment, it is important to "help" the Party to fulfill its commitment.

Moreover, in light of the request of global environmental issues to aim for an effective mechanism by encouraging participation as wide as possible, it could be said

that such an approach that applies the "view of human nature as fundamentally depraved" to the Parties is different from what it originally ought to be.

Whether the regulating measures against non-compliance should have legal binding force or not is still subject to further negotiations, and this issue is going to be discussed at the 1st Meeting of the Parties to the Kyoto Protocol that will be held after the Protocol enters into force. Japan is opposed to the idea of giving legal binding force to the Protocol because the establishment of severe measures will not serve as a positive factor, -- rather, it could work as an obstacle -- in expanding the framework in the future.

## Table 3 Total GHG Emissions of Annex B countries

(Million-ton CO2)

| Country | Total GHG | Total GHG | % change | Kyoto Target |
|---|---|---|---|---|
| Austria | 85.8 | 89.2 | 3.9 | -13 |
| Belgium | 141.3 | 158.5 | 12.2 | -7.5 |
| Denmark | 68.9 | 67.9 | -1.5 | -21 |
| Finland | 74.9 | 71.8 | -4.2 | 0 |
| France | 545.4 | 547.0 | 0.3 | 0 |
| Germany | 1,202.3 | 992.6 | -17.4 | -21 |
| Greece | 101.3 | 122.1 | 20.6 | 25 |
| Ireland | 54.6 | 67.0 | 22.7 | 13 |
| Italy | 514.1 | 538.6 | 4.8 | -6.5 |
| Luxembourg | 11.8 | 9.3 | -21.0 | -28 |
| Netherlands | 214.1 | 223.9 | 4.6 | -6 |
| Portugal | 65.2 | 87.2 | 33.8 | 27 |
| Spain | 290.3 | 389.4 | 34.1 | 15 |
| Sweden | 70.4 | 70.5 | 0.1 | 4 |
| United Kingdom | 748.8 | 659.0 | -12.0 | -12.5 |
| EU15 sub-total | 4,189.2 | 4,094.0 | -2.3 | -8 |
| Czech Republic | 185.9 | 142.0 | -23.6 | -8 |
| Estonia | 39.0 | 17.2 | -55.8 | -8 |
| Hungary | 104.2 | 83.8 | -19.6 | -6 |
| Latvia | 29.5 | 11.0 | -62.8 | -8 |
| Lithuania | 45.2 | 20.8 | -54.0 | -8 |
| Poland | 532.8 | 376.3 | -29.4 | -6 |
| Slovakia | 72.7 | 49.5 | -31.8 | -8 |
| Slovenia | 18.4 | 19.8 | 7.7 | -8 |
| EU25 Sub-total | 5,216.9 | 4,814.4 | -7.7 | |
| Australia | 415.8 | 497.5 | 19.7 | 8 |
| Canada | 608.1 | 736.7 | 21.2 | -6 |
| Iceland | 2.8 | 3.2 | 12.9 | 10 |
| Japan | 1,256.7 | 1,381.5 | 9.9 | -6 |
| New Zealand | 72.9 | 81.2 | 11.4 | 0 |
| Norway | 50.7 | 57.8 | 14.0 | 1 |
| Switzerland | 54.1 | 54.4 | 0.5 | -8 |
| United States of America | 6,167.2 | 7,020.7 | 13.8 | -7 |
| Non-EU developed countries sub-total | 8,628.3 | 9,833.0 | 14.0 | |
| Russian Federation | 3,031.1 | 2,006.9 | -33.8 | 0 |
| Bulgaria | 144.7 | 76.3 | -47.3 | -8 |
| Croatia | 27.8 | 25.6 | -7.6 | -5 |
| Romania | 267.4 | 121.2 | -54.7 | -8 |
| Ukraine | 907.4 | 457.5 | -49.6 | 0 |
| Economies In Transition Sub-total | 4,378.4 | 2,687.5 | -38.6 | |
| Annex B total | 18,223.6 | 17,334.9 | -4.9 | -5.2 |

(Source)IEA/OECD, CO2 Emissions from Fuel Combustion, UNFCCC National Communications

(Note:1)Base year for HFC's, PFC's and SF6 is either 1990 or 1995, whichever is larger, and base year of some EIT countries (Bulgaria, Hungary, Poland and Romania) for CO2,CH4 and N20 is also 1995.

(Note:2)EU25 excluding Malta and Cyprus

**(Major Comments at the Committee)**

- Japan will have to make further strenuous efforts despite its high level of energy-saving efficiency. On the other hand, developing countries do not have any intention to participate. There is something wrong with such a mechanism, and it should be reconsidered.
- Though Russia made a commitment to reduce its emissions under the Kyoto Protocol, it has no burden because of the so-called Hot Air.
- The Kyoto Protocol has a framework that places unnecessary costs on Japan only. Such circumstances will have to be avoided in the future.
- The fairness in burden-sharing within Japan will have to be maintained, too.
- The Kyoto Protocol does not take the export and import business into consideration. Its mechanism counts low-$CO_2$-emission products as emissions of the countries that export such products, and does not count them as the emissions of the countries that import such products.
- The base year is a very important factor, and must be carefully reviewed under the future framework.
- As Japan's ability to collect and provide information about the events in the EU in the 1990s (the post-Cold War period, the collapse of communist society, changes in energy supply and demand structure, etc.) was poor, the year 1990 was adopted as the base year.
- Under the Kyoto Protocol, the differences in the BAU growth between countries were not taken into consideration. If numerical values are decided from the viewpoint that BAU is the starting point and emissions are reduced therefrom, the results will be more satisfactory.
- The Kyoto Protocol provides for sanctions during the second commitment period as penalty measures for the first commitment period. With such sanctions, however, no agreement can be reached regarding the second commitment period.
- Considering participation of developing countries, too, the penalties must be reconsidered.
- The problems of the Kyoto Protocol are: (1) the establishment of "binding (enforcable) and fixed numerical targets by countries; and (2) lack of "significant participation of developing countries."
- Saying that keeping the total amount of emissions within a certain range is beyond the scope of the governmentreach is almost equal to state that the government will give up implementing counter measures for global warming.
- It is not impossible to restrict the people’s privilege for the sake of public welfare, however, those restrictions will not accepted due to scientific uncertainties, fairness among countries and effectiveness of the regulation.

## Chapter 4 GHG Emissions and the World Energy Demand and Supply Structure

When considering climate measures, the structures of world energy demand and supply and of greenhouse gas emissions are extremely important factors. If due attention is not paid to those factors, any discussion will end up in an impractical solution, and cannot lead to any sustainable framework.

### 1. Trend of GHG Emission in Developed Countries

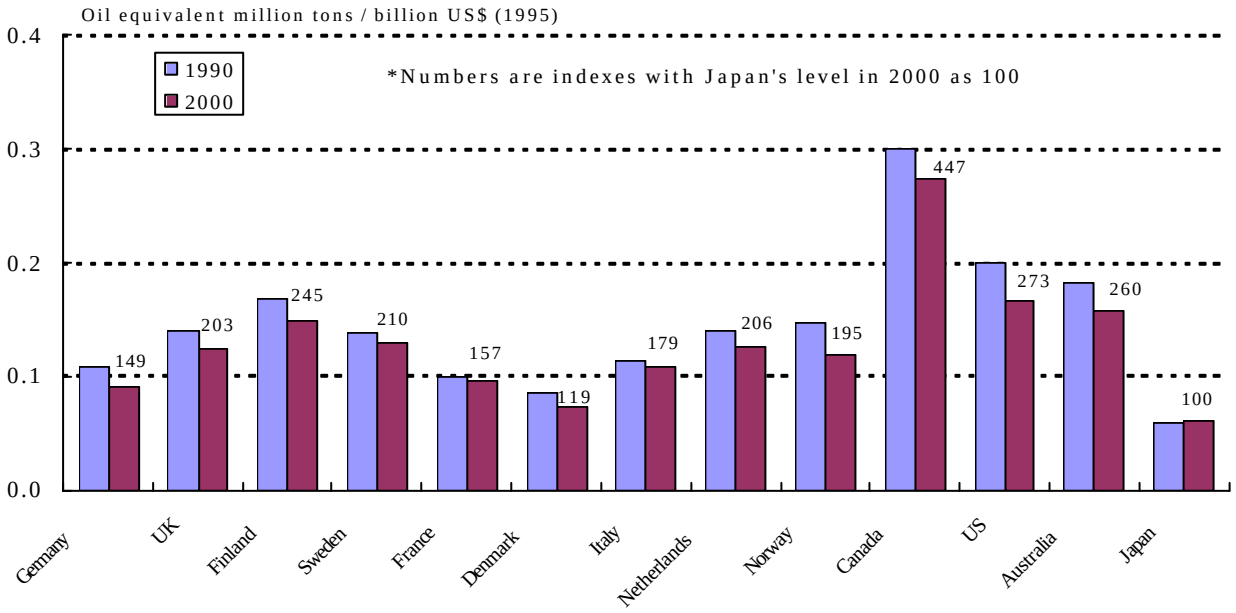
(1) Large Gap in the Rooms of Emission Reduction among Countries

The analysis of energy demand and supply in major developed countries indicates large differences in terms of a room of emission reductions.

In energy demand, there are considerable differences in energy efficiencies between countries. Japan has higher energy efficiencies in the country as a whole and in terms of sector-specific indexes (Fig. 9 and 10). This is the result of large-scale energy saving investment carried out by Japanese industries since the two Oil Crises, and the reflection of Japanese life-styles as well as the country's geographic and climatic factors.

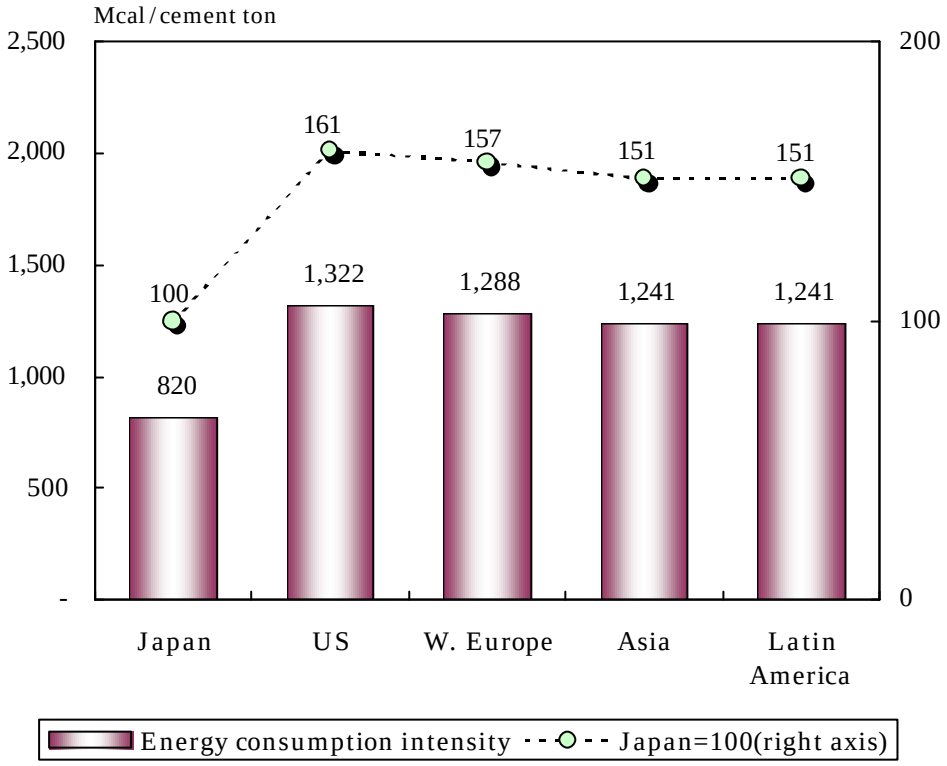
This fact indicates that Japan will incur relatively higher costs if it is to aim for the further improvement of energy efficiencies.

Fig. 9 End Energy Consumption per GDP unit in Major Developed Countries

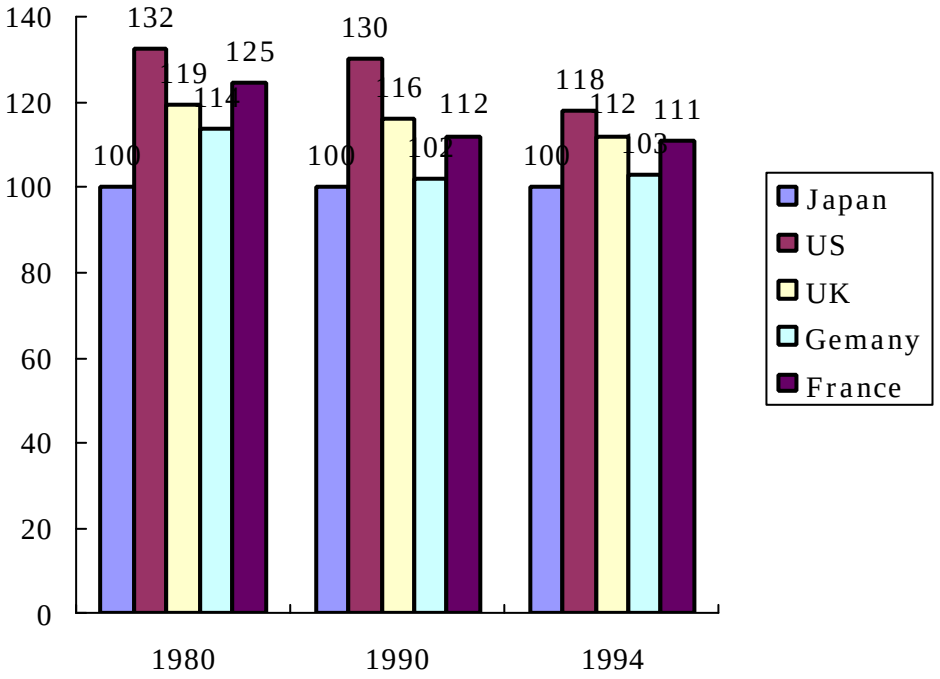



Source: OECD/IEA, Energy Balances of OECD

Fig. 10 Energy Consumption Unit in the Iron & Steel and Cement industries of Major Countries




Source: Japan Iron and Steel Association




(Source: CEMBUREAU, World Cement Directory)

Also in the energy supply aspect, the UK and Germany underwent significant fuel switching in the 1990's in the direction of departure from coal usage, as explained in the Third Chapter. One reason could be their extensive coal dependence in the past. Compared with these countries, Japan had, and has, lower dependency on coal, and coal-fueled thermal power stations are large-scale using new, sophisticated and economizing technologies constructed with a view to ensuring stable energy supply, Therefore, they will not be easily converted to other fuels. Moreover, natural gas costs are higher in Japan than in Europe. As seen here, the rooms for de-carbonization of fuels differ significantly depending on national circumstances.

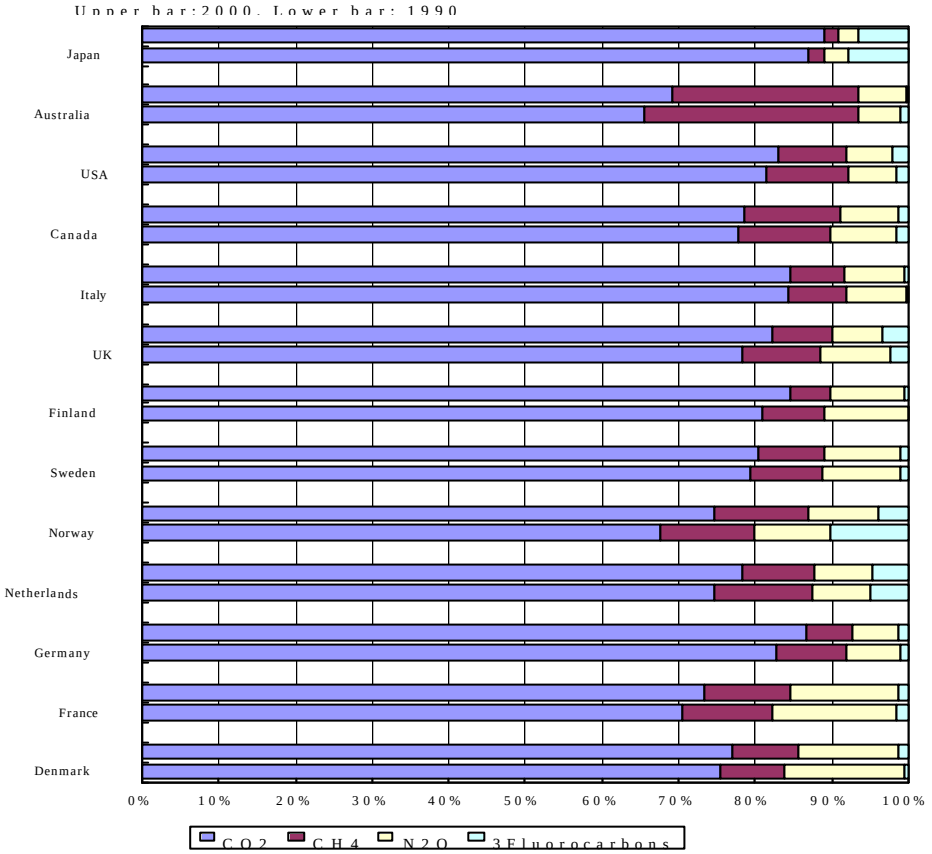
In Japan, nuclear power generation plays a significant role in the reduction of greenhouse gas.[1] Unfortunately, the Marrakech Accord stipulates that the Parties refrain from nuclear in using CDM and JI. The role of nuclear power on each country's emission reduction efforts should be addressed again in sincerity at the future negotiations.

Furthermore, the comparison of greenhouse gas composition in major developed countries indicates a large gap in the ratio of $CO_2$, which directly reflects economic activities. Japan has a relatively higher ratio of $CO_2$ (about 90%), while many other major developed countries have 70-80% $CO_2$ ratios, and instead indicate relatively higher ratios of other greenhouse gases such as methane and nitrous oxide (Fig. 11). The background of such differences can be, for example, the difference in the production quantity and manufacturing processes of adipic acids, use of landfill for waste disposal that leads to the emissions of methane gas, and the presence of methane gas emitted from coal mines.

Therefore, some countries have effectively reduced nitrous oxide emissions by the conversion of adipic acid manufacturing processes, or methane gas emissions by the enforcement of EU waste treatment acts or by the closure of domestic coal mines. Such differences in greenhouse composition can be another element of differentiating the emission reduction costs.

[1] Nuclear power generation has a significant role in the reduction of greenhouse gases in other countries such as the U.S., where the Bush Administration released the National Energy Policy in May 2001, which supported the expansion of nuclear energy usage which does not emit greenhouse gases.

Fig. 11 Comparison of GHG Emission Components of Each Country




Sources: Each country's report to UNFCCC
Note: If 3 fluorocarbons values in 1995 were greater than those of 1990, 1995 values were plotted in place of 1990 values. Relevant countries include Denmark, Germany, Netherlands, Sweden, UK, Italy, Canada, and Japan.

(2) Emission Reductions by Factors Other Than Climate Measures

In regard to energy-derived $CO_2$ emissions, Germany and the UK among European countries realized reductions from their 1990 levels, while Russia and other economies in transition had significant reduction. (Table 4). The background of such reductions includes unique factors in Europe, such as the renovation of old and inefficient facilities in the former East Germany following the unification of East and West Germany, and the fuel switching from coal to natural gas implemented in the UK. In the case of Russia and economies in transition, shrinking production activities are apparent in the amount of reduction in $CO_2$ emissions.

As seen here, a substantial part of emission reductions in energy-source $CO_2$ up to now was not due to the measures implemented to address global warming, but due to a changed economic situation or as a by-product of measures undertaken for some other purpose.

## Table 4 CO2 Emissions of Annex B countries

(Million ton of CO2)

| Country | Total CO2 (1990) | Total CO2 (2000) | % change |
|---|---|---|---|
| Austria | 56.9 | 62.8 | 10.3 |
| Belgium | 107.2 | 120.3 | 12.1 |
| Denmark | 50.6 | 50.1 | -0.9 |
| Finland | 55.0 | 54.8 | -0.3 |
| France | 352.7 | 373.3 | 5.8 |
| Germany | 964.1 | 833.0 | -13.6 |
| Greece | 70.6 | 87.8 | 24.3 |
| Ireland | 30.3 | 41.2 | 36.2 |
| Italy | 400.1 | 425.7 | 6.4 |
| Luxembourg | 10.5 | 8.0 | -23.2 |
| Netherlands | 159.8 | 177.1 | 10.8 |
| Portugal | 39.6 | 59.6 | 50.5 |
| Spain | 206.5 | 284.7 | 37.9 |
| Sweden | 51.2 | 52.0 | 1.6 |
| United Kingdom | 559.9 | 531.5 | -5.1 |
| EU15 sub-total | 3,115.0 | 3,161.9 | 1.5 |
| Australia | 259.7 | 329.3 | 26.8 |
| Canada | 430.2 | 526.8 | 22.4 |
| Iceland | 1.9 | 2.2 | 13.7 |
| Japan | 1,018.7 | 1,154.8 | 13.4 |
| New Zealand | 22.3 | 31.6 | 41.9 |
| Norway | 28.5 | 33.6 | 17.7 |
| Switzerland | 40.6 | 41.7 | 2.7 |
| United States of America | 4,825.7 | 5,665.4 | 17.4 |
| Non-EU developed countries sub-total | 6,627.6 | 7,785.4 | 17.5 |
| Russian Federation | 2,297.0 | 1,505.7 | -34.4 |
| Bulgaria | 82.4 | 42.7 | -48.1 |
| Croatia | 17.3 | 17.8 | 2.8 |
| Czech Republic | 153.8 | 118.8 | -22.8 |
| Estonia | 33.0 | 14.0 | -57.6 |
| Hungary | 82.7 | 55.2 | -33.2 |
| Latvia | 21.4 | 6.5 | -69.5 |
| Lithuania | 31.0 | 11.2 | -63.7 |
| Poland | 430.5 | 292.8 | -32.0 |
| Romania | 188.1 | 86.4 | -54.0 |
| Slovakia | 55.6 | 37.8 | -31.9 |
| Slovenia | 12.5 | 14.4 | 15.6 |
| Ukraine | 660.3 | 301.0 | -54.4 |
| Economies In Transition | 4,065.6 | 2,504.3 | -38.4 |
| Annex B total | 13,808.2 | 13,451.6 | -2.6 |

(Source)IEA/OECD, CO2 Emissions from Fuel Combustion

(Note)Some EIT countries (Bulgaria, Hungary, Poland and Romania) base year is 1995

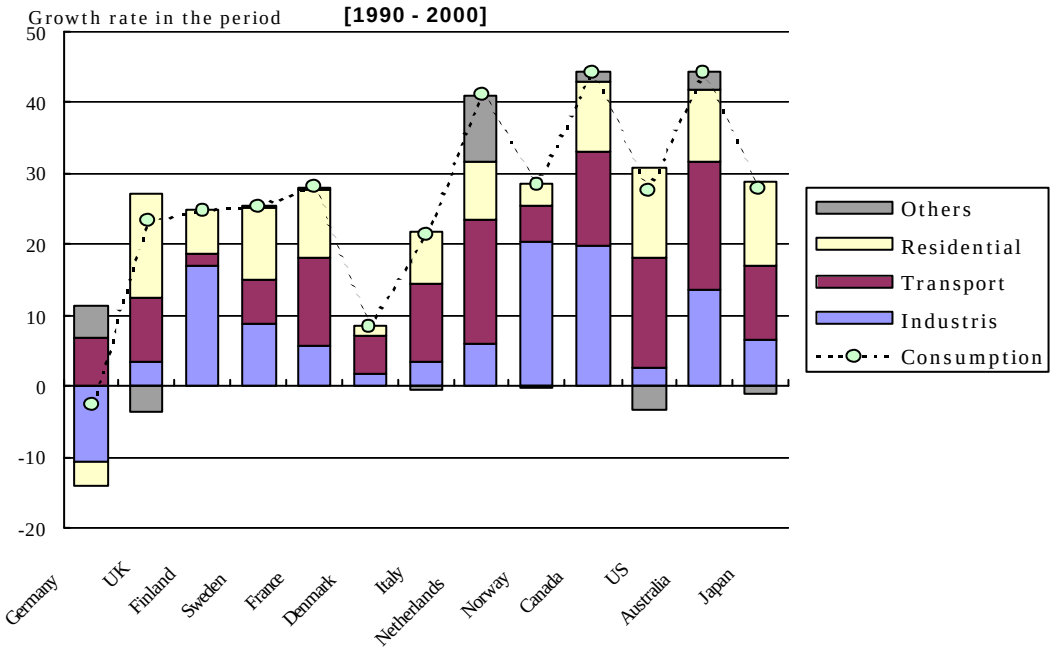
(3) Issue Common to Countries: Increased Energy Consumption in Transport and Residential Sectors

The gross energy consumption of major developed countries is on the increase as a whole (Fig.12). The record of $CO_2$ emissions in the past, however, indicates a considerable gap between countries, with some countries actually decreasing emissions. A major factor for this was because some countries successfully advanced decarbonization by changing the composition of energy supplies.

The ratio of each sector of industries, transportation, and residential differ, from country to country. Scandinavian countries (Finland, Norway, and Sweden) and Japan have a higher ratio for the industrial sector, while US, UK, Germany and France have a relatively lower ratio for the industry sector with a higher ratio for the life-related sectors such as transport and residential. In addition, the US and Australia have a higher ratio for the transportation sector (Fig.13).

Considering the changes in sectoral energy consumption for the past 10 years, the consumption changes in the industrial sector showed a considerable gap between countries, but the transportation and residential sectors seemed to indicate an increasing trend as a whole (Fig.12). Failure to find fundamental solutions in these sectors is a common problem among developed countries.

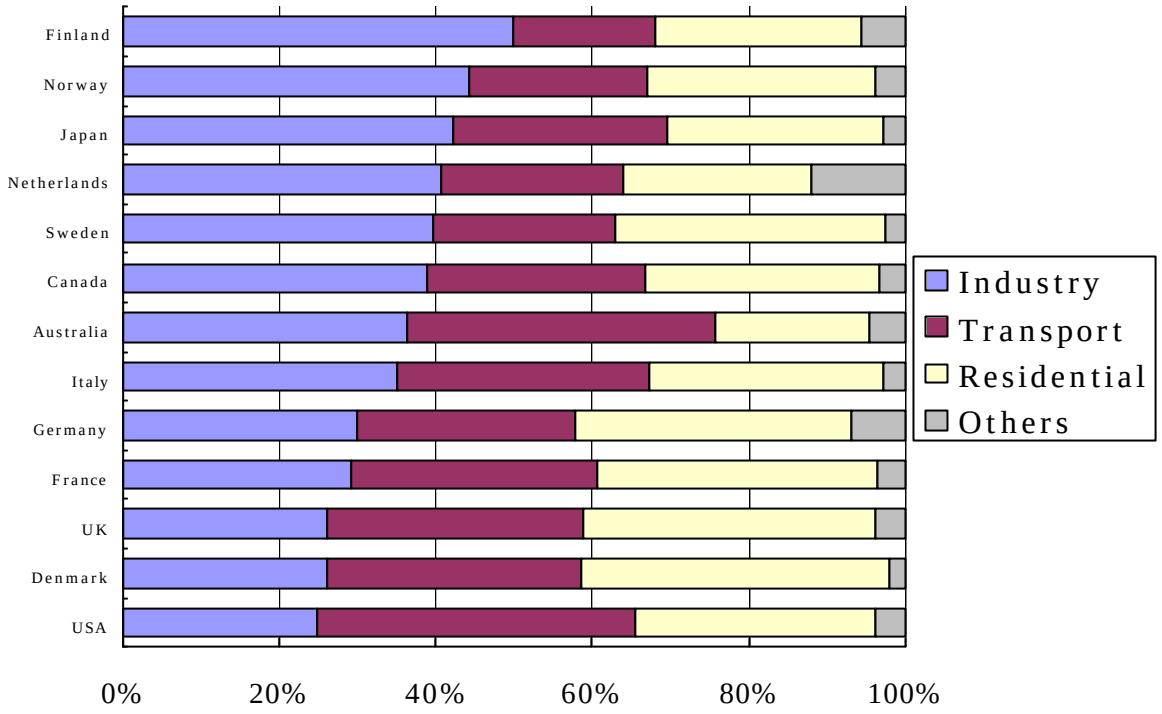
Fig.12 End Energy Consumption in Major Developed Countries and the Contribution of Each Sector




Source: OECD/IEA, Energy Balances of OECD Countries

Note: Industrial sector includes agriculture.

Fig. 13 Sectoral Ratio of End Energy Consumption in Major Developed Countries (2000)



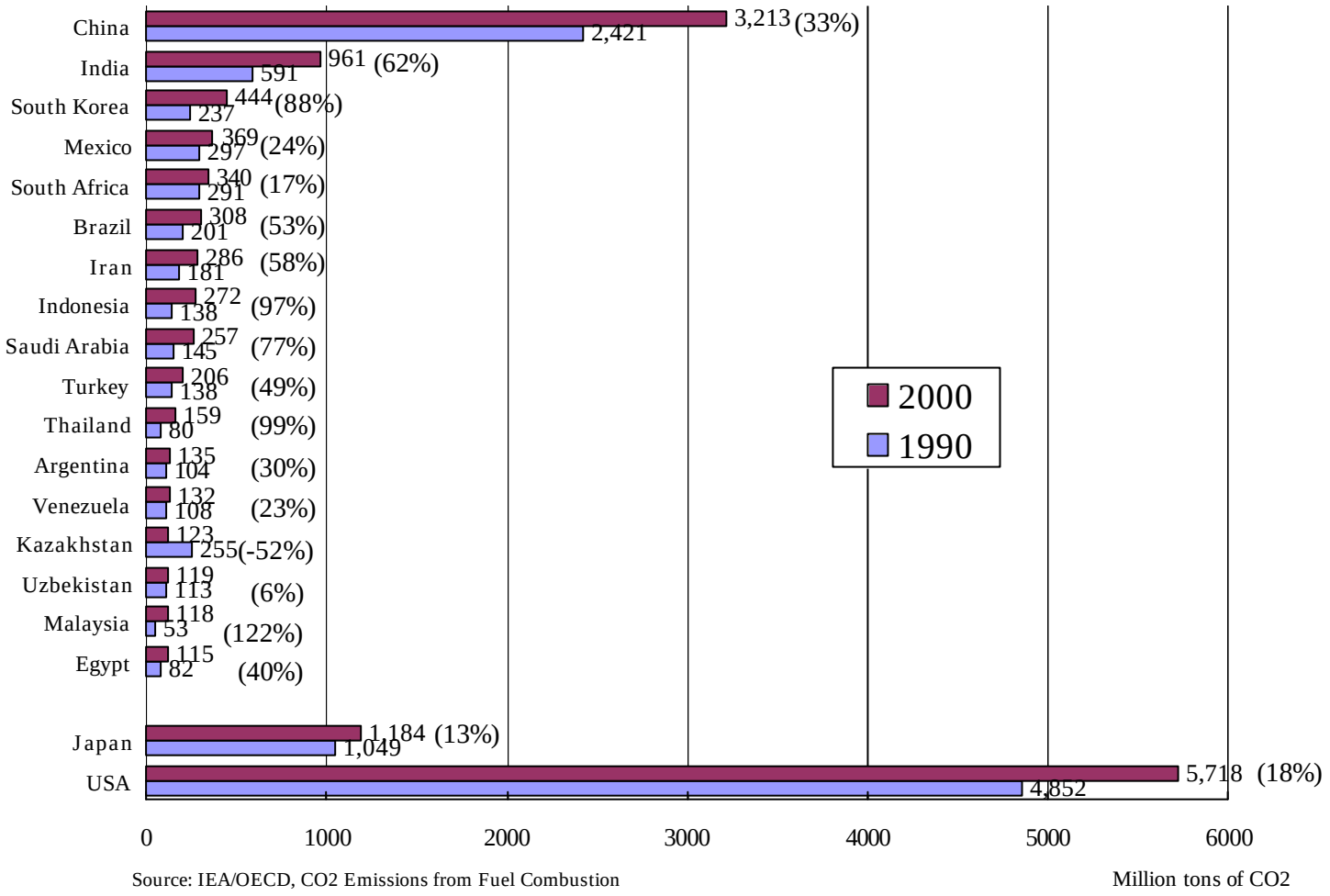

Source: OECD/IEA, Energy Balances of OECD Countries
Note: Industrial sector includes agriculture

## 2. Energy-derived $CO_2$ Emissions in Developing Countries

(1) Increase in All Sectors

Energy-derived $CO_2$ emissions in developing countries continue to show considerable increase associated with economic growth and population increase, except in the case of a few countries (Fig.14). In view of sectoral increase, developing countries find the problem of energy consumption increases in the transportation and residential sectors in addition to industrial sector, as in the case of developed countries (Fig.16).

Fig. 14 Energy-derived $CO_2$ Emissions in Major Developing Countries (1990-2000)




(2) Potential for Significant Emission Increase

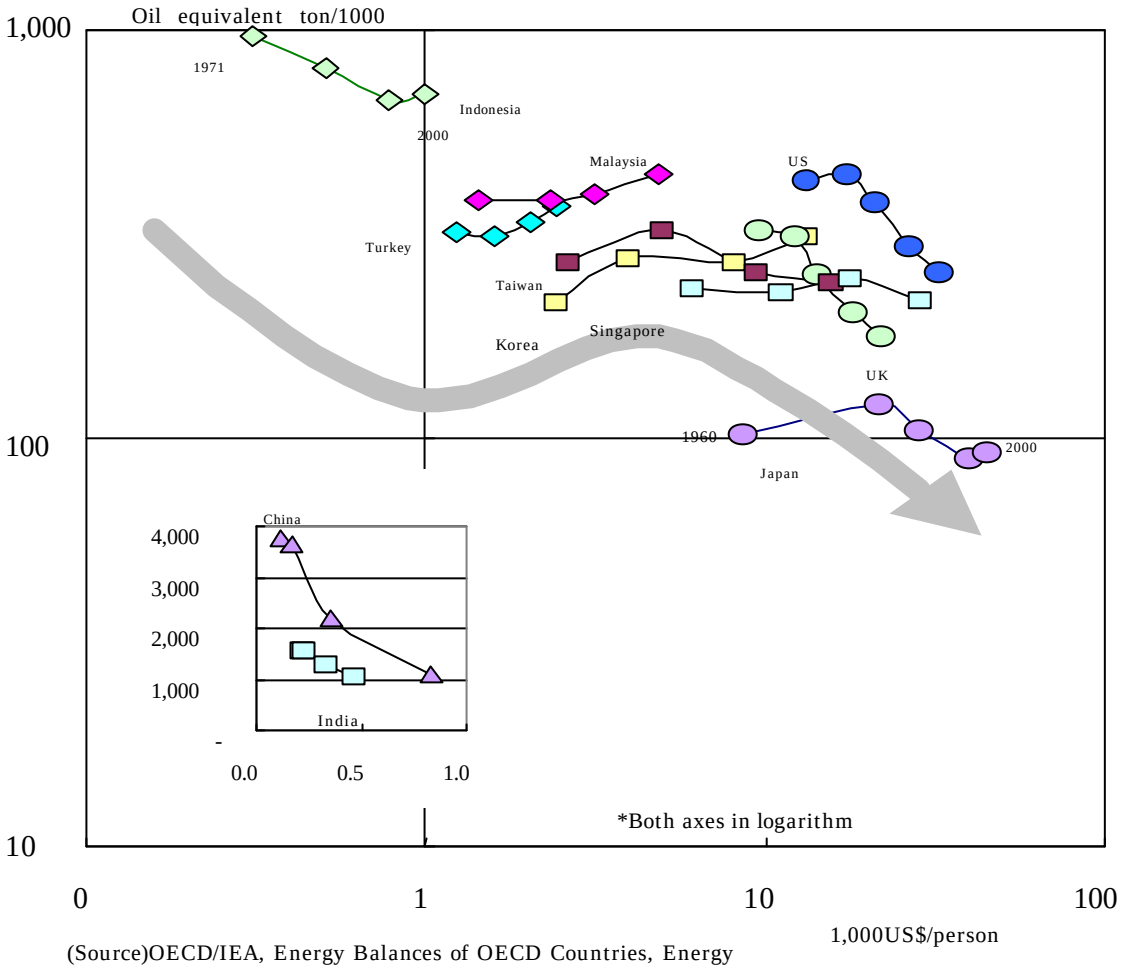
Developing countries are expected to continue to have higher energy consumption growth rates due to the improvement of living standards, the progress of motorization, and the development of the industrial sector.

In view of the relationship between economic growth and energy consumption, we can find a certain interesting pattern depending on each stage of economic development. Countries with lower GDP per capita will show energy efficiency improvement along with the increase of wages, in the course of their economic growth (First stage). Once GDP per capita increases to a certain level, energy efficiency deteriorates (Second stage). Further economic growth will result in the greater improvement of energy efficiencies at a pace faster than the pace of income increase (Third stage). Presupposing the economic growth of developing countries, it will be important to consider how to prevent the deterioration of energy efficiencies during the second stage, and how to shorten the period of this stage (Fig.15).

For developing countries, it will be necessary to pay more attention to their characteristic of having great room to earn significant effects from energy saving investments,

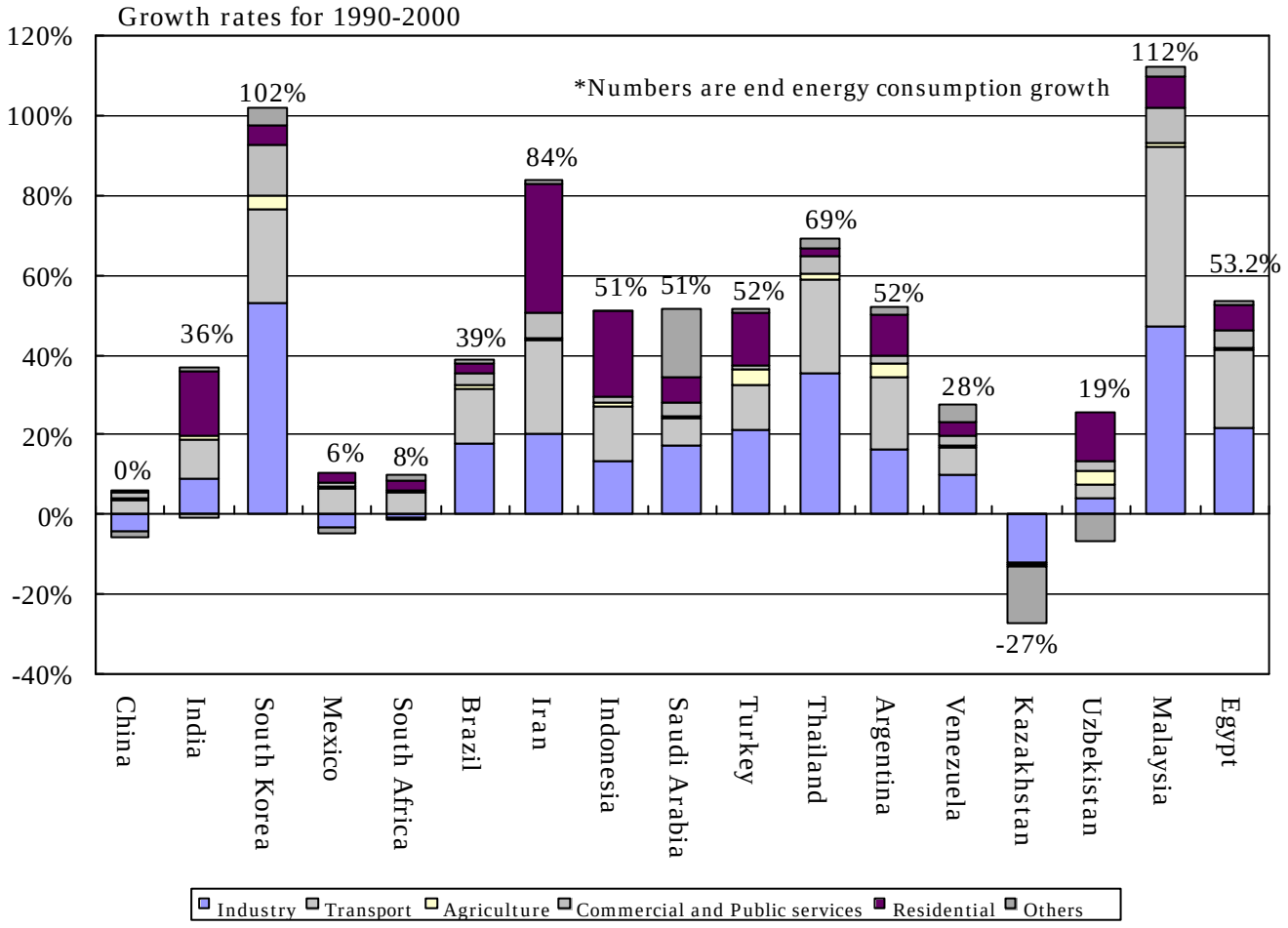
with such investments leading to further development of their economies.

Fig. 15 Per capita GDP and Primary Energy vs. GDP Intensity
(Developed countries: 1960-2000, developing countries:1971-2000)




(Source)OECD/IEA, Energy Balances of OECD Countries, Energy Balances of NON-OECD Countries

Fig. 16 Contribution of Major Developing Countries to the Sectoral Changes of Final Energy Consumption




Source: OECD/IEA, Energy Balances of Non-OECD Countries, Energy Balances of OECD Countries)

Note: Numbers for Kazakhstan and Uzbekistan are the changes in 1995-2000. China and India are evaluated with their 1994-2000 data, since their previous data did not include renewable energy consumption in residential sector.

Furthermore, developing countries find factors of greenhouse gas increase in an energy supply aspect as well as an energy demand aspect.

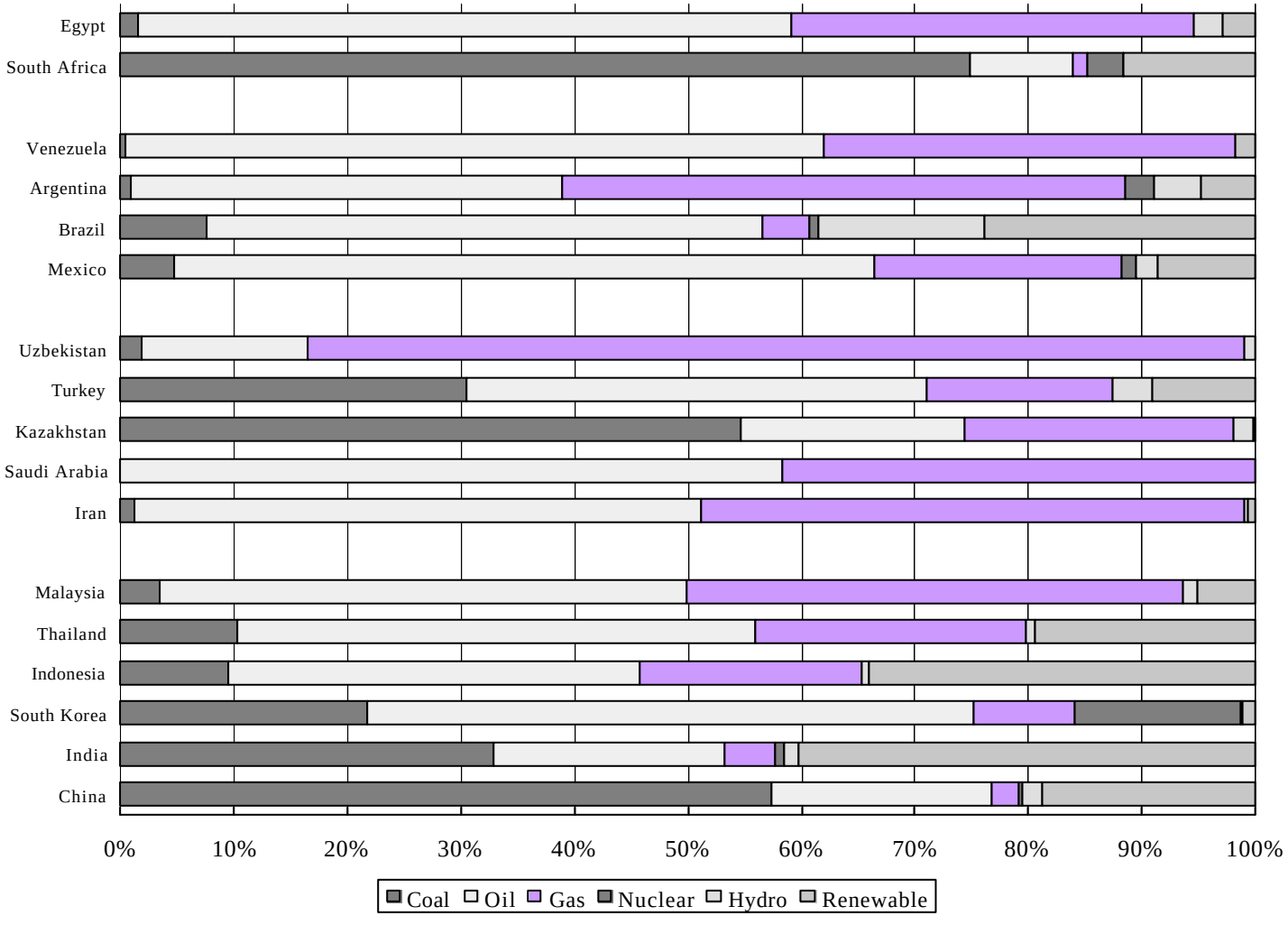
In view of energy mix in each country, those in the Asian region show a higher ratio of coal, while those in Middle East and Latin America show greater ratios of oil and natural gas (Fig.17), which seem to reflect the situation of energy resources in each region. Coal-producing countries, such as China and Indonesia, are projected to maintain or even increase the abundant amount of coal excavated within these countries, due to their views of preserving their own resources of oil exportable to other countries.

In addition, many developing countries have relatively higher dependence on non-commercial biomass energies (such as firewood and charcoals), but their dependence on such non-commercial energies will decrease while fuel switching to the commercial energy of

fossil fuels will advance, resulting in the increase of $CO_2$ emissions. Already, major developing countries such as China and India have shown a decreasing trend in the ratio of biomass such as firewood and charcoals, resulting in the greater ratio of fossil energies such as coal, oil, and natural gas, instead.

Up to now, developed countries have attempted to change their energy mix, as shown in the promotion of decarbonization on the part of Europe, which contributed to the reduction and control of $CO_2$ emissions. On the contrary, developing countries seem likely to move in the opposite direction from developed countries, causing further increase in their $CO_2$ emissions due to the changes in their energy supply structures.

Fig.17 Energy Mix of Primary Energy Supply in Major Developing Countries (2000)




Source: OECD/IEA, Energy Balances of non-OECD Countries and Energy Balances of OECD Countries

(3) No Simple Distinction between Developed and Developing Countries

The ranking of countries in several indexes related to greenhouse gas emissions indicates that developing countries and developed countries cannot be distinguished in a

simple way (Table 5,6,7 and 8).[2]

In terms of energy-derived $CO_2$ emissions, and energy-derived $CO_2$ emissions per GDP, those with higher numbers are a mixture of developed countries and developing countries. Energy-derived $CO_2$ emissions in 2000 showed 15 developing countries in the top 30, including China (ranked second), and India (ranked fifth). Japan ranked fourth in this respect (Table 5). Per GDP emissions in 2000 indicated that developing countries shared 21 out of the top 30 countries. Japan ranked 65th (Table 8).

Moreover, energy-derived $CO_2$ emissions per capita showed that developing countries ranked first to third (Qatar, Kuwait, and UAE) but the number of developing countries in the top 30 was only 10. Japan was 21st (Table 7).

As seen here, the developing countries' claim that "developed countries should take the lead in addressing" the global-scale climate issue would largely depend on which index is referred to and on the data to support such argument.

The argument presented by developing countries basically relies on the index of per capita emissions.

However, if we are to assume total emission as an index, then it is possible to claim that the countries with higher emission quantities such as China, India, Korea, Mexico, South Africa, Brazil, Iran, Indonesia, Saudi Arabia, Turkey, Thailand, Argentine, Venezuela, Kazakhstan, and Uzbekistan (developing countries in the top 30) should have responsibilities to take initiatives for the global environment.

Considering the method of burden sharing, it is necessary to adopt a compound view using various indexes, rather than adopting a single index.

[2] Here, "developing countries" are those with no obligation for emission reduction under the Kyoto Protocol. Therefore, OECD member countries such as Korea and Mexico are included in "developing countries."

**Table 5 Energy related CO2 Emissions**

| | | GDP 1billion US$(95) | Population Million | $CO_2$ Emission M ton-$CO_2$ | GDP/capita 1,000$/capita | $CO_2$/capita t-$CO_2$/capita | $CO_2$/GDP t-CO2/1,000$ |
|---|---|---|---|---|---|---|---|
| A | USA | 8,986.90 | 275.42 | 5,718.30 | 32.63 | 20.76 | 0.64 |
| D | China | 1,204.92 | 1,269.26 | 3,213.40 | 0.95 | 2.53 | 2.67 |
| B | Russia | 357.32 | 145.46 | 1,524.22 | 2.46 | 10.48 | 4.27 |
| A | Japan | 5,680.57 | 126.92 | 1,184.30 | 44.76 | 9.33 | 0.21 |
| D | India | 466.68 | 1,015.92 | 960.64 | 0.46 | 0.95 | 2.06 |
| A | Germany | 2,686.50 | 82.17 | 820.10 | 32.70 | 9.98 | 0.31 |
| A | United Kingdom | 1,303.75 | 59.76 | 552.00 | 21.82 | 9.24 | 0.42 |
| A | Canada | 704.88 | 30.75 | 515.10 | 22.92 | 16.75 | 0.73 |
| C | Republic of Korea | 617.50 | 47.28 | 444.50 | 13.06 | 9.40 | 0.72 |
| A | Italy | 1,204.87 | 57.73 | 427.20 | 20.87 | 7.40 | 0.35 |
| C | Mexico | 374.40 | 97.22 | 369.30 | 3.85 | 3.80 | 0.99 |
| A | France | 1,755.62 | 60.43 | 353.50 | 29.05 | 5.85 | 0.20 |
| B | Ukraine | 44.35 | 49.50 | 345.71 | 0.90 | 6.98 | 7.80 |
| D | South Africa | 170.57 | 42.80 | 340.11 | 3.99 | 7.95 | 1.99 |
| A | Australia | 451.61 | 19.16 | 328.60 | 23.57 | 17.15 | 0.73 |
| D | Brazil | 788.03 | 170.41 | 308.32 | 4.62 | 1.81 | 0.39 |
| B | Poland | 163.35 | 38.65 | 296.30 | 4.23 | 7.67 | 1.81 |
| D | Iran | 104.99 | 63.66 | 286.03 | 1.65 | 4.49 | 2.72 |
| A | Spain | 704.05 | 39.93 | 285.90 | 17.63 | 7.16 | 0.41 |
| D | Indonesia | 209.10 | 210.42 | 272.18 | 0.99 | 1.29 | 1.30 |
| D | Saudi Arabia | 139.44 | 20.72 | 257.06 | 6.73 | 12.41 | 1.84 |
| C | Turkey | 205.10 | 66.84 | 206.00 | 3.07 | 3.08 | 1.00 |
| A | Netherlands | 496.95 | 15.92 | 173.10 | 31.22 | 10.87 | 0.35 |
| D | Thailand | 170.34 | 60.73 | 158.99 | 2.80 | 2.62 | 0.93 |
| D | Argentina | 293.77 | 37.03 | 135.42 | 7.93 | 3.66 | 0.46 |
| D | Venezuela | 79.77 | 24.17 | 132.40 | 3.30 | 5.48 | 1.66 |
| D | Kazakhstan | 22.49 | 14.87 | 123.10 | 1.51 | 8.28 | 5.47 |
| B | Czech Republic | 54.56 | 10.27 | 122.00 | 5.31 | 11.88 | 2.24 |
| A | Belgium | 317.96 | 10.25 | 121.50 | 31.01 | 11.85 | 0.38 |
| D | Uzbekistan | 12.01 | 24.75 | 119.29 | 0.49 | 4.82 | 9.93 |
| D | Malaysia | 111.62 | 23.27 | 117.90 | 4.80 | 5.07 | 1.06 |
| D | Egypt | 78.42 | 63.98 | 115.10 | 1.23 | 1.80 | 1.47 |
| D | Pakistan | 71.28 | 138.08 | 101.05 | 0.52 | 0.73 | 1.42 |
| B | Romania | 32.75 | 22.44 | 87.71 | 1.46 | 3.91 | 2.68 |
| A | Greece | 139.07 | 10.56 | 84.90 | 13.17 | 8.04 | 0.61 |
| D | Iraq | 81.29 | 23.26 | 77.51 | 3.49 | 3.33 | 0.95 |
| D | Algeria | 48.82 | 30.40 | 70.04 | 1.61 | 2.30 | 1.43 |
| D | Philippines | 88.23 | 75.78 | 69.34 | 1.16 | 0.92 | 0.79 |
| D | UAE | 49.33 | 2.91 | 69.27 | 16.95 | 23.80 | 1.40 |
| A | Austria | 267.02 | 8.11 | 62.50 | 32.93 | 7.71 | 0.23 |
| A | Portugal | 129.32 | 10.01 | 59.70 | 12.93 | 5.97 | 0.46 |
| D | Singapore | 113.43 | 4.02 | 59.52 | 28.22 | 14.81 | 0.52 |
| D | Israel | 106.38 | 6.23 | 59.43 | 17.08 | 9.54 | 0.56 |
| D | Colombia | 96.86 | 42.30 | 59.14 | 2.29 | 1.40 | 0.61 |
| D | Belarus | 27.62 | 10.01 | 58.64 | 2.76 | 5.86 | 2.12 |
| D | Kuwait | 26.88 | 1.98 | 57.52 | 13.58 | 29.05 | 2.14 |
| A | Finland | 165.54 | 5.18 | 55.90 | 31.98 | 10.80 | 0.34 |
| B | Hungary | 54.41 | 10.02 | 55.20 | 5.43 | 5.51 | 1.01 |
| D | Chile | 81.45 | 15.21 | 53.05 | 5.36 | 3.49 | 0.65 |
| A | Denmark | 206.08 | 5.34 | 50.30 | 38.61 | 9.42 | 0.24 |
| D | Syrian Arab Republi | 13.58 | 16.19 | 48.94 | 0.84 | 3.02 | 3.60 |
| A | Sweden | 277.94 | 8.87 | 47.40 | 31.33 | 5.34 | 0.17 |
| D | Nigeria | 32.18 | 126.91 | 46.90 | 0.25 | 0.37 | 1.46 |
| B | Bulgaria | 12.28 | 8.17 | 43.63 | 1.50 | 5.34 | 3.55 |
| A | Ireland | 106.63 | 3.79 | 41.50 | 28.16 | 10.96 | 0.39 |
| D | Vietnam | 27.93 | 78.52 | 40.88 | 0.36 | 0.52 | 1.46 |
| D | Libyan Arab Jamahi | 34.20 | 5.29 | 40.78 | 6.47 | 7.71 | 1.19 |
| A | Switzerland | 335.86 | 7.19 | 39.90 | 46.74 | 5.55 | 0.12 |
| B | Slovakia | 22.47 | 5.40 | 35.40 | 4.16 | 6.55 | 1.58 |
| D | Qatar | 11.55 | 0.59 | 34.58 | 19.58 | 58.61 | 2.99 |
| A | Norway | 170.45 | 4.49 | 34.40 | 37.95 | 7.66 | 0.20 |
| A | New Zealand | 68.72 | 3.83 | 32.20 | 17.94 | 8.41 | 0.47 |
| B | Croatia | 22.54 | 4.38 | 17.77 | 5.15 | 4.06 | 0.79 |
| B | Estonia | 6.07 | 1.37 | 14.72 | 4.43 | 10.74 | 2.43 |
| B | Slovenia | 23.18 | 1.99 | 14.42 | 11.65 | 7.25 | 0.62 |
| B | Lithuania | 7.60 | 3.70 | 11.29 | 2.05 | 3.05 | 1.49 |
| A | Luxembourg | 24.63 | 0.44 | 8.10 | 55.85 | 18.37 | 0.33 |
| B | Latvia | 6.16 | 2.37 | 6.49 | 2.60 | 2.74 | 1.05 |
| A | Iceland | 8.82 | 0.28 | 2.20 | 31.38 | 7.83 | 0.25 |

Source: OECD/IEA, $CO_2$ Emissions from Fuel Combustion (Reference Approach Data)

Note: A: Annex B, B: Annex B(EIT's), C: Non-Annex B(OECD member), D: Non-Annex B(developing countries)
All data are from 2000

**Table 6 GDP per Capita**

| | | GDP 1billion US$(95) | Population Million | $CO_2$ Emission M ton-$CO_2$ | GDP/capita 1,000$/capita | $CO_2$/capita t-$CO_2$/capita | $CO_2$/GDP t-CO2/1,000$ |
|---|---|---|---|---|---|---|---|
| A | Luxembourg | 24.63 | 0.44 | 8.10 | 55.85 | 18.37 | 0.33 |
| A | Switzerland | 335.86 | 7.19 | 39.90 | 46.74 | 5.55 | 0.12 |
| A | Japan | 5,680.57 | 126.92 | 1,184.30 | 44.76 | 9.33 | 0.21 |
| A | Denmark | 206.08 | 5.34 | 50.30 | 38.61 | 9.42 | 0.24 |
| A | Norway | 170.45 | 4.49 | 34.40 | 37.95 | 7.66 | 0.20 |
| A | Austria | 267.02 | 8.11 | 62.50 | 32.93 | 7.71 | 0.23 |
| A | Germany | 2,686.50 | 82.17 | 820.10 | 32.70 | 9.98 | 0.31 |
| A | USA | 8,986.90 | 275.42 | 5,718.30 | 32.63 | 20.76 | 0.64 |
| A | Finland | 165.54 | 5.18 | 55.90 | 31.98 | 10.80 | 0.34 |
| A | Iceland | 8.82 | 0.28 | 2.20 | 31.38 | 7.83 | 0.25 |
| A | Sweden | 277.94 | 8.87 | 47.40 | 31.33 | 5.34 | 0.17 |
| A | Netherlands | 496.95 | 15.92 | 173.10 | 31.22 | 10.87 | 0.35 |
| A | Belgium | 317.96 | 10.25 | 121.50 | 31.01 | 11.85 | 0.38 |
| A | France | 1,755.62 | 60.43 | 353.50 | 29.05 | 5.85 | 0.20 |
| D | Singapore | 113.43 | 4.02 | 59.52 | 28.22 | 14.81 | 0.52 |
| A | Ireland | 106.63 | 3.79 | 41.50 | 28.16 | 10.96 | 0.39 |
| A | Australia | 451.61 | 19.16 | 328.60 | 23.57 | 17.15 | 0.73 |
| A | Canada | 704.88 | 30.75 | 515.10 | 22.92 | 16.75 | 0.73 |
| A | United Kingdom | 1,303.75 | 59.76 | 552.00 | 21.82 | 9.24 | 0.42 |
| A | Italy | 1,204.87 | 57.73 | 427.20 | 20.87 | 7.40 | 0.35 |
| D | Qatar | 11.55 | 0.59 | 34.58 | 19.58 | 58.61 | 2.99 |
| A | New Zealand | 68.72 | 3.83 | 32.20 | 17.94 | 8.41 | 0.47 |
| A | Spain | 704.05 | 39.93 | 285.90 | 17.63 | 7.16 | 0.41 |
| D | Israel | 106.38 | 6.23 | 59.43 | 17.08 | 9.54 | 0.56 |
| D | UAE | 49.33 | 2.91 | 69.27 | 16.95 | 23.80 | 1.40 |
| D | Kuwait | 26.88 | 1.98 | 57.52 | 13.58 | 29.05 | 2.14 |
| A | Greece | 139.07 | 10.56 | 84.90 | 13.17 | 8.04 | 0.61 |
| C | Republic of Korea | 617.50 | 47.28 | 444.50 | 13.06 | 9.40 | 0.72 |
| A | Portugal | 129.32 | 10.01 | 59.70 | 12.93 | 5.97 | 0.46 |
| B | Slovenia | 23.18 | 1.99 | 14.42 | 11.65 | 7.25 | 0.62 |
| D | Argentina | 293.77 | 37.03 | 135.42 | 7.93 | 3.66 | 0.46 |
| D | Saudi Arabia | 139.44 | 20.72 | 257.06 | 6.73 | 12.41 | 1.84 |
| D | Libyan Arab Jamahi | 34.20 | 5.29 | 40.78 | 6.47 | 7.71 | 1.19 |
| B | Hungary | 54.41 | 10.02 | 55.20 | 5.43 | 5.51 | 1.01 |
| D | Chile | 81.45 | 15.21 | 53.05 | 5.36 | 3.49 | 0.65 |
| B | Czech Republic | 54.56 | 10.27 | 122.00 | 5.31 | 11.88 | 2.24 |
| B | Croatia | 22.54 | 4.38 | 17.77 | 5.15 | 4.06 | 0.79 |
| D | Malaysia | 111.62 | 23.27 | 117.90 | 4.80 | 5.07 | 1.06 |
| D | Brazil | 788.03 | 170.41 | 308.32 | 4.62 | 1.81 | 0.39 |
| B | Estonia | 6.07 | 1.37 | 14.72 | 4.43 | 10.74 | 2.43 |
| B | Poland | 163.35 | 38.65 | 296.30 | 4.23 | 7.67 | 1.81 |
| B | Slovakia | 22.47 | 5.40 | 35.40 | 4.16 | 6.55 | 1.58 |
| D | South Africa | 170.57 | 42.80 | 340.11 | 3.99 | 7.95 | 1.99 |
| C | Mexico | 374.40 | 97.22 | 369.30 | 3.85 | 3.80 | 0.99 |
| D | Iraq | 81.29 | 23.26 | 77.51 | 3.49 | 3.33 | 0.95 |
| D | Venezuela | 79.77 | 24.17 | 132.40 | 3.30 | 5.48 | 1.66 |
| C | Turkey | 205.10 | 66.84 | 206.00 | 3.07 | 3.08 | 1.00 |
| D | Thailand | 170.34 | 60.73 | 158.99 | 2.80 | 2.62 | 0.93 |
| D | Belarus | 27.62 | 10.01 | 58.64 | 2.76 | 5.86 | 2.12 |
| B | Latvia | 6.16 | 2.37 | 6.49 | 2.60 | 2.74 | 1.05 |
| B | Russia | 357.32 | 145.46 | 1,524.22 | 2.46 | 10.48 | 4.27 |
| D | Colombia | 96.86 | 42.30 | 59.14 | 2.29 | 1.40 | 0.61 |
| B | Lithuania | 7.60 | 3.70 | 11.29 | 2.05 | 3.05 | 1.49 |
| D | Iran | 104.99 | 63.66 | 286.03 | 1.65 | 4.49 | 2.72 |
| D | Algeria | 48.82 | 30.40 | 70.04 | 1.61 | 2.30 | 1.43 |
| D | Kazakhstan | 22.49 | 14.87 | 123.10 | 1.51 | 8.28 | 5.47 |
| B | Bulgaria | 12.28 | 8.17 | 43.63 | 1.50 | 5.34 | 3.55 |
| B | Romania | 32.75 | 22.44 | 87.71 | 1.46 | 3.91 | 2.68 |
| D | Egypt | 78.42 | 63.98 | 115.10 | 1.23 | 1.80 | 1.47 |
| D | Philippines | 88.23 | 75.78 | 69.34 | 1.16 | 0.92 | 0.79 |
| D | Indonesia | 209.10 | 210.42 | 272.18 | 0.99 | 1.29 | 1.30 |
| D | China | 1,204.92 | 1,269.26 | 3,213.40 | 0.95 | 2.53 | 2.67 |
| B | Ukraine | 44.35 | 49.50 | 345.71 | 0.90 | 6.98 | 7.80 |
| D | Syrian Arab Republi | 13.58 | 16.19 | 48.94 | 0.84 | 3.02 | 3.60 |
| D | Pakistan | 71.28 | 138.08 | 101.05 | 0.52 | 0.73 | 1.42 |
| D | Uzbekistan | 12.01 | 24.75 | 119.29 | 0.49 | 4.82 | 9.93 |
| D | India | 466.68 | 1,015.92 | 960.64 | 0.46 | 0.95 | 2.06 |
| D | Vietnam | 27.93 | 78.52 | 40.88 | 0.36 | 0.52 | 1.46 |
| D | Nigeria | 32.18 | 126.91 | 46.90 | 0.25 | 0.37 | 1.46 |

Source: OECD/IEA, $CO_2$ Emissions from Fuel Combustion (Reference Approach Data)

Note: A: Annex B, B: Annex B(EIT's), C: Non-Annex B(OECD member), D: Non-Annex B(developing countries)
All data are from 2000

**Table 7 Energy related CO2 Emissions per Capita**

| | | GDP | Population | $CO_2$ Emission | GDP/capita | $CO_2$/capita | $CO_2$/GDP |
|---|---|---|---|---|---|---|---|
| | | 1billion US$(95) | Million | M ton-$CO_2$ | 1,000$/capita | t-$CO_2$/capita | t-CO2/1,000$ |
| D | Qatar | 11.55 | 0.59 | 34.58 | 19.58 | 58.61 | 2.99 |
| D | Kuwait | 26.88 | 1.98 | 57.52 | 13.58 | 29.05 | 2.14 |
| D | UAE | 49.33 | 2.91 | 69.27 | 16.95 | 23.80 | 1.40 |
| A | USA | 8,986.90 | 275.42 | 5,718.30 | 32.63 | 20.76 | 0.64 |
| A | Luxembourg | 24.63 | 0.44 | 8.10 | 55.85 | 18.37 | 0.33 |
| A | Australia | 451.61 | 19.16 | 328.60 | 23.57 | 17.15 | 0.73 |
| A | Canada | 704.88 | 30.75 | 515.10 | 22.92 | 16.75 | 0.73 |
| D | Singapore | 113.43 | 4.02 | 59.52 | 28.22 | 14.81 | 0.52 |
| D | Saudi Arabia | 139.44 | 20.72 | 257.06 | 6.73 | 12.41 | 1.84 |
| B | Czech Republic | 54.56 | 10.27 | 122.00 | 5.31 | 11.88 | 2.24 |
| A | Belgium | 317.96 | 10.25 | 121.50 | 31.01 | 11.85 | 0.38 |
| A | Ireland | 106.63 | 3.79 | 41.50 | 28.16 | 10.96 | 0.39 |
| A | Netherlands | 496.95 | 15.92 | 173.10 | 31.22 | 10.87 | 0.35 |
| A | Finland | 165.54 | 5.18 | 55.90 | 31.98 | 10.80 | 0.34 |
| B | Estonia | 6.07 | 1.37 | 14.72 | 4.43 | 10.74 | 2.43 |
| B | Russia | 357.32 | 145.46 | 1,524.22 | 2.46 | 10.48 | 4.27 |
| A | Germany | 2,686.50 | 82.17 | 820.10 | 32.70 | 9.98 | 0.31 |
| D | Israel | 106.38 | 6.23 | 59.43 | 17.08 | 9.54 | 0.56 |
| A | Denmark | 206.08 | 5.34 | 50.30 | 38.61 | 9.42 | 0.24 |
| C | Republic of Korea | 617.50 | 47.28 | 444.50 | 13.06 | 9.40 | 0.72 |
| A | Japan | 5,680.57 | 126.92 | 1,184.30 | 44.76 | 9.33 | 0.21 |
| A | United Kingdom | 1,303.75 | 59.76 | 552.00 | 21.82 | 9.24 | 0.42 |
| A | New Zealand | 68.72 | 3.83 | 32.20 | 17.94 | 8.41 | 0.47 |
| D | Kazakhstan | 22.49 | 14.87 | 123.10 | 1.51 | 8.28 | 5.47 |
| A | Greece | 139.07 | 10.56 | 84.90 | 13.17 | 8.04 | 0.61 |
| D | South Africa | 170.57 | 42.80 | 340.11 | 3.99 | 7.95 | 1.99 |
| A | Iceland | 8.82 | 0.28 | 2.20 | 31.38 | 7.83 | 0.25 |
| D | Libyan Arab Jamahi | 34.20 | 5.29 | 40.78 | 6.47 | 7.71 | 1.19 |
| A | Austria | 267.02 | 8.11 | 62.50 | 32.93 | 7.71 | 0.23 |
| B | Poland | 163.35 | 38.65 | 296.30 | 4.23 | 7.67 | 1.81 |
| A | Norway | 170.45 | 4.49 | 34.40 | 37.95 | 7.66 | 0.20 |
| A | Italy | 1,204.87 | 57.73 | 427.20 | 20.87 | 7.40 | 0.35 |
| B | Slovenia | 23.18 | 1.99 | 14.42 | 11.65 | 7.25 | 0.62 |
| A | Spain | 704.05 | 39.93 | 285.90 | 17.63 | 7.16 | 0.41 |
| B | Ukraine | 44.35 | 49.50 | 345.71 | 0.90 | 6.98 | 7.80 |
| B | Slovakia | 22.47 | 5.40 | 35.40 | 4.16 | 6.55 | 1.58 |
| A | Portugal | 129.32 | 10.01 | 59.70 | 12.93 | 5.97 | 0.46 |
| D | Belarus | 27.62 | 10.01 | 58.64 | 2.76 | 5.86 | 2.12 |
| A | France | 1,755.62 | 60.43 | 353.50 | 29.05 | 5.85 | 0.20 |
| A | Switzerland | 335.86 | 7.19 | 39.90 | 46.74 | 5.55 | 0.12 |
| B | Hungary | 54.41 | 10.02 | 55.20 | 5.43 | 5.51 | 1.01 |
| D | Venezuela | 79.77 | 24.17 | 132.40 | 3.30 | 5.48 | 1.66 |
| A | Sweden | 277.94 | 8.87 | 47.40 | 31.33 | 5.34 | 0.17 |
| B | Bulgaria | 12.28 | 8.17 | 43.63 | 1.50 | 5.34 | 3.55 |
| D | Malaysia | 111.62 | 23.27 | 117.90 | 4.80 | 5.07 | 1.06 |
| D | Uzbekistan | 12.01 | 24.75 | 119.29 | 0.49 | 4.82 | 9.93 |
| D | Iran | 104.99 | 63.66 | 286.03 | 1.65 | 4.49 | 2.72 |
| B | Croatia | 22.54 | 4.38 | 17.77 | 5.15 | 4.06 | 0.79 |
| B | Romania | 32.75 | 22.44 | 87.71 | 1.46 | 3.91 | 2.68 |
| C | Mexico | 374.40 | 97.22 | 369.30 | 3.85 | 3.80 | 0.99 |
| D | Argentina | 293.77 | 37.03 | 135.42 | 7.93 | 3.66 | 0.46 |
| D | Chile | 81.45 | 15.21 | 53.05 | 5.36 | 3.49 | 0.65 |
| D | Iraq | 81.29 | 23.26 | 77.51 | 3.49 | 3.33 | 0.95 |
| C | Turkey | 205.10 | 66.84 | 206.00 | 3.07 | 3.08 | 1.00 |
| B | Lithuania | 7.60 | 3.70 | 11.29 | 2.05 | 3.05 | 1.49 |
| D | Syrian Arab Republi | 13.58 | 16.19 | 48.94 | 0.84 | 3.02 | 3.60 |
| B | Latvia | 6.16 | 2.37 | 6.49 | 2.60 | 2.74 | 1.05 |
| D | Thailand | 170.34 | 60.73 | 158.99 | 2.80 | 2.62 | 0.93 |
| D | China | 1,204.92 | 1,269.26 | 3,213.40 | 0.95 | 2.53 | 2.67 |
| D | Algeria | 48.82 | 30.40 | 70.04 | 1.61 | 2.30 | 1.43 |
| D | Brazil | 788.03 | 170.41 | 308.32 | 4.62 | 1.81 | 0.39 |
| D | Egypt | 78.42 | 63.98 | 115.10 | 1.23 | 1.80 | 1.47 |
| D | Colombia | 96.86 | 42.30 | 59.14 | 2.29 | 1.40 | 0.61 |
| D | Indonesia | 209.10 | 210.42 | 272.18 | 0.99 | 1.29 | 1.30 |
| D | India | 466.68 | 1,015.92 | 960.64 | 0.46 | 0.95 | 2.06 |
| D | Philippines | 88.23 | 75.78 | 69.34 | 1.16 | 0.92 | 0.79 |
| D | Pakistan | 71.28 | 138.08 | 101.05 | 0.52 | 0.73 | 1.42 |
| D | Vietnam | 27.93 | 78.52 | 40.88 | 0.36 | 0.52 | 1.46 |
| D | Nigeria | 32.18 | 126.91 | 46.90 | 0.25 | 0.37 | 1.46 |

Source: OECD/IEA, $CO_2$ Emissions from Fuel Combustion (Reference Approach Data)

Note: A: Annex B, B: Annex B(EIT's), C: Non-Annex B(OECD member), D: Non-Annex B(developing countries)
All data are from 2000

**Table 8 Energy related CO2 Emissions per GDP**

| | | GDP | Population | $CO_2$ Emission | GDP/capita | $CO_2$/capita | $CO_2$/GDP |
|---|---|---|---|---|---|---|---|
| | | 1billion US$(95) | Million | M ton-$CO_2$ | 1,000$/capita | t-$CO_2$/capita | t-CO2/1,000$ |
| D | Uzbekistan | 12.01 | 24.75 | 119.29 | 0.49 | 4.82 | 9.93 |
| B | Ukraine | 44.35 | 49.50 | 345.71 | 0.90 | 6.98 | 7.80 |
| D | Kazakhstan | 22.49 | 14.87 | 123.10 | 1.51 | 8.28 | 5.47 |
| B | Russia | 357.32 | 145.46 | 1,524.22 | 2.46 | 10.48 | 4.27 |
| D | Syrian Arab Republi | 13.58 | 16.19 | 48.94 | 0.84 | 3.02 | 3.60 |
| B | Bulgaria | 12.28 | 8.17 | 43.63 | 1.50 | 5.34 | 3.55 |
| D | Qatar | 11.55 | 0.59 | 34.58 | 19.58 | 58.61 | 2.99 |
| D | Iran | 104.99 | 63.66 | 286.03 | 1.65 | 4.49 | 2.72 |
| B | Romania | 32.75 | 22.44 | 87.71 | 1.46 | 3.91 | 2.68 |
| D | China | 1,204.92 | 1,269.26 | 3,213.40 | 0.95 | 2.53 | 2.67 |
| B | Estonia | 6.07 | 1.37 | 14.72 | 4.43 | 10.74 | 2.43 |
| B | Czech Republic | 54.56 | 10.27 | 122.00 | 5.31 | 11.88 | 2.24 |
| D | Kuwait | 26.88 | 1.98 | 57.52 | 13.58 | 29.05 | 2.14 |
| D | Belarus | 27.62 | 10.01 | 58.64 | 2.76 | 5.86 | 2.12 |
| D | India | 466.68 | 1,015.92 | 960.64 | 0.46 | 0.95 | 2.06 |
| D | South Africa | 170.57 | 42.80 | 340.11 | 3.99 | 7.95 | 1.99 |
| D | Saudi Arabia | 139.44 | 20.72 | 257.06 | 6.73 | 12.41 | 1.84 |
| B | Poland | 163.35 | 38.65 | 296.30 | 4.23 | 7.67 | 1.81 |
| D | Venezuela | 79.77 | 24.17 | 132.40 | 3.30 | 5.48 | 1.66 |
| B | Slovakia | 22.47 | 5.40 | 35.40 | 4.16 | 6.55 | 1.58 |
| B | Lithuania | 7.60 | 3.70 | 11.29 | 2.05 | 3.05 | 1.49 |
| D | Egypt | 78.42 | 63.98 | 115.10 | 1.23 | 1.80 | 1.47 |
| D | Vietnam | 27.93 | 78.52 | 40.88 | 0.36 | 0.52 | 1.46 |
| D | Nigeria | 32.18 | 126.91 | 46.90 | 0.25 | 0.37 | 1.46 |
| D | Algeria | 48.82 | 30.40 | 70.04 | 1.61 | 2.30 | 1.43 |
| D | Pakistan | 71.28 | 138.08 | 101.05 | 0.52 | 0.73 | 1.42 |
| D | UAE | 49.33 | 2.91 | 69.27 | 16.95 | 23.80 | 1.40 |
| D | Indonesia | 209.10 | 210.42 | 272.18 | 0.99 | 1.29 | 1.30 |
| D | Libyan Arab Jamahi | 34.20 | 5.29 | 40.78 | 6.47 | 7.71 | 1.19 |
| D | Malaysia | 111.62 | 23.27 | 117.90 | 4.80 | 5.07 | 1.06 |
| B | Latvia | 6.16 | 2.37 | 6.49 | 2.60 | 2.74 | 1.05 |
| B | Hungary | 54.41 | 10.02 | 55.20 | 5.43 | 5.51 | 1.01 |
| C | Turkey | 205.10 | 66.84 | 206.00 | 3.07 | 3.08 | 1.00 |
| C | Mexico | 374.40 | 97.22 | 369.30 | 3.85 | 3.80 | 0.99 |
| D | Iraq | 81.29 | 23.26 | 77.51 | 3.49 | 3.33 | 0.95 |
| D | Thailand | 170.34 | 60.73 | 158.99 | 2.80 | 2.62 | 0.93 |
| B | Croatia | 22.54 | 4.38 | 17.77 | 5.15 | 4.06 | 0.79 |
| D | Philippines | 88.23 | 75.78 | 69.34 | 1.16 | 0.92 | 0.79 |
| A | Canada | 704.88 | 30.75 | 515.10 | 22.92 | 16.75 | 0.73 |
| A | Australia | 451.61 | 19.16 | 328.60 | 23.57 | 17.15 | 0.73 |
| C | Republic of Korea | 617.50 | 47.28 | 444.50 | 13.06 | 9.40 | 0.72 |
| D | Chile | 81.45 | 15.21 | 53.05 | 5.36 | 3.49 | 0.65 |
| A | USA | 8,986.90 | 275.42 | 5,718.30 | 32.63 | 20.76 | 0.64 |
| B | Slovenia | 23.18 | 1.99 | 14.42 | 11.65 | 7.25 | 0.62 |
| D | Colombia | 96.86 | 42.30 | 59.14 | 2.29 | 1.40 | 0.61 |
| A | Greece | 139.07 | 10.56 | 84.90 | 13.17 | 8.04 | 0.61 |
| D | Israel | 106.38 | 6.23 | 59.43 | 17.08 | 9.54 | 0.56 |
| D | Singapore | 113.43 | 4.02 | 59.52 | 28.22 | 14.81 | 0.52 |
| A | New Zealand | 68.72 | 3.83 | 32.20 | 17.94 | 8.41 | 0.47 |
| A | Portugal | 129.32 | 10.01 | 59.70 | 12.93 | 5.97 | 0.46 |
| D | Argentina | 293.77 | 37.03 | 135.42 | 7.93 | 3.66 | 0.46 |
| A | United Kingdom | 1,303.75 | 59.76 | 552.00 | 21.82 | 9.24 | 0.42 |
| A | Spain | 704.05 | 39.93 | 285.90 | 17.63 | 7.16 | 0.41 |
| D | Brazil | 788.03 | 170.41 | 308.32 | 4.62 | 1.81 | 0.39 |
| A | Ireland | 106.63 | 3.79 | 41.50 | 28.16 | 10.96 | 0.39 |
| A | Belgium | 317.96 | 10.25 | 121.50 | 31.01 | 11.85 | 0.38 |
| A | Italy | 1,204.87 | 57.73 | 427.20 | 20.87 | 7.40 | 0.35 |
| A | Netherlands | 496.95 | 15.92 | 173.10 | 31.22 | 10.87 | 0.35 |
| A | Finland | 165.54 | 5.18 | 55.90 | 31.98 | 10.80 | 0.34 |
| A | Luxembourg | 24.63 | 0.44 | 8.10 | 55.85 | 18.37 | 0.33 |
| A | Germany | 2,686.50 | 82.17 | 820.10 | 32.70 | 9.98 | 0.31 |
| A | Iceland | 8.82 | 0.28 | 2.20 | 31.38 | 7.83 | 0.25 |
| A | Denmark | 206.08 | 5.34 | 50.30 | 38.61 | 9.42 | 0.24 |
| A | Austria | 267.02 | 8.11 | 62.50 | 32.93 | 7.71 | 0.23 |
| A | Japan | 5,680.57 | 126.92 | 1,184.30 | 44.76 | 9.33 | 0.21 |
| A | Norway | 170.45 | 4.49 | 34.40 | 37.95 | 7.66 | 0.20 |
| A | France | 1,755.62 | 60.43 | 353.50 | 29.05 | 5.85 | 0.20 |
| A | Sweden | 277.94 | 8.87 | 47.40 | 31.33 | 5.34 | 0.17 |
| A | Switzerland | 335.86 | 7.19 | 39.90 | 46.74 | 5.55 | 0.12 |

Source: OECD/IEA, $CO_2$ Emissions from Fuel Combustion (Reference Approach Data)

Note: A: Annex B, B: Annex B(EIT's), C: Non-Annex B(OECD member), D: Non-Annex B(developing countries)
All data are from 2000

**(Comments at the Committee)**

- In terms of energy supply structure, not only the prospect of $CO_2$ emission reduction but also the prospect of energy supply stability is an important issue. After overcoming two oil crises, Japan expanded the introduction of coal and promoted nuclear power generation. Attaining the best mix of power generation sources will continue to be an important matter for Japan in terms of ensuring stable energy supply.
- Other important factors are measures in the residential and transportation sectors. We need a strategy to address these as issues of national scope affecting all citizens.
- As developing countries have shown significant changes in their economic growth rates, it may be a good idea to consider standards for determining the promotion from developing to developed country status.
- Efforts will also be needed to reflect the results of environmental ODA on a future framework.
- OPEC countries are focusing on technology to refurbish oil and gas fields without burning flare gas, and on the alleviation of poverty caused by population growth.
- Coal production in China started to decrease from the latter half of the 1990's in their official statistics, but it has been said that a considerable part of production is not covered in their statistics.
- Development of a statistical system is important for promoting developing country participation.
- There are countries that reduce emissions at their own cost, and countries that do not. If a framework is established in a way that asks those countries with cost-bearing capacity to bear costs, then it will conform to the principles claimed by developing countries such as placing higher priorities on economic development and poverty alleviation.
- Developing countries will not have sufficient funds to allocate for climate measures. They have asked developed countries for funds and technologies. In this sense technological cooperation by the private sector will become a key.
- Developing countries need to implement their own national measures, based on the principle of common but differentiated responsibility.
- Considering significant changes in demographic, technological, and industrial structures, negotiators should have clear standards on the prospects for the world's future, when participating in international negotiation.

## Chapter 5 Perspectives and Actions to Construct a Future Sustainable Framework

To consider a future framework that addresses the global warming issue with the aforementioned elements in mind, this chapter will present various viewpoints for discussion. Although the future negotiation for such a framework may take a long time, it will be beneficial for all countries to share, from early stage, the understandings on the important issues and the procedures that shall be taken. The elements below can constitute a platform of discussion for such purpose.

### 1. Four Factors Concerning the Global Warming Problem

When considering the international actions against global warming, the following elements should be born in mind:

#### (1) Need for Technological Breakthroughs

The ultimate solution of the global warming issue requires breakthroughs in technology still unrealized today as well as diffusion of existing technology.

Therefore, when contemplating measures for this issue, it is important to draw a road map for the development and dissemination of innovative technologies and plan our actions based on a long-term viewpoint founded on such a road map

#### (2) Diversified Agenda in Each Nation, Region, and Sector

Emissions of greenhouse gases are brought about by extremely diversified and broad-ranged economic and everyday activities, and closely tied to the nature of the economy, industry and lifestyle of each country. The actions required to prevent global warming may vary widely depending on the specific situation of each nation, region, and sector, and there are very significant variations in the costs for those actions.

Furthermore, it is necessary to recognize that many of these elements are beyond the reach of direct control by governments, given the nature of market economies.

#### (3) Tremendous Global Cost

Prevention of global warming will require the world to bear enormous costs for measures, since emissions of energy-source carbon dioxide dominate greenhouse gas emissions, and current technologies are not capable of substantially curtailing

emissions from energy use.

Global efforts involving both developed and developing countries are essential. A key requirement for long-term, sustainable, and effective measures is determing how to proceed with addressing this issue in the most cost-effective way.

In addition, costs for mitigation have very significant implications for economic activities. Economic model analysis to determine the degree of impact can provide important suggestions on future measures.

Gglobal warming is an environmental issue, an energy issue, and an economic issue. Negotiation on global warming is actually affected by the each nation's perception of how global warming alters their competitiveness and development strategy.

Therefore, fully incorporating the equity viewpoint will be a prerequisite, in order to sustain the acceptance to bear costs and the motivation to participate in measures.

**(4) Scientific Uncertainties Remain**

As mentioned in Chapters 1 and 2, the mechanisms and effects of climate change still have significant uncertainties. IPCC's Third Assessment Report indicated that it would be necessary to promote further research in order to improve the ability to detect, attribute, and understand climate change, to reduce uncertainties, and to project future climate changes.

**(Comments at the Committee)**

- In international law legislation, it will be important to discuss the extent of governmental reach.
- To build a framework, political and technological feasibilities should be closely examined.
- Cost effectiveness analysis may be an effective way to promote developing countries' awareness of the needs for participation in the framework. Through cost analysis of the health hazards attributed to global warming, each country can predict the required costs.
- Considering IPCC's significant influence, support for, and utilization of, IPCC activities should be given a higher priority.
- If the international community shares a consensus and a projection on the effects of climate change, developing countries may not venture to expressly state their non-participation in the framework.
- Balancing adaptation and mitigation measures will be important in the long term, requiring constant and immediate responses and review at each stage.

## 2. Four Basic Concepts for a Sustainable Framework

Addressing global warming will require not merely adjustment of technical details of the current framework, but also discussion with creative and flexible thinking. Such discussion should be based on the concepts below:

### (1) Focus on Technological Solutions

For addressing climate changes in the future, response measures need to reflect and incorporate scientific knowledge accumulation and technological innovation, from a long term perspective. Any framework based on a shorter term viewpoint will make it difficult to consider responses that will incorporate the development and dissemination of new technologies. The future framework needs to be evaluated from the viewpoint of its ability to contribute to the promotion of technological innovation needed for the ultimate solution of this issue and to the introduction of such technologies.

In that process, due attention needs to be paid to such factors as technological development policies, standards on technologies to be introduced or adopted, and international cooperation for technology dissemination. Such measures are likely to enable us to reflect technological feasibility, directly address technological agenda in each sector, and identify which direction each sector needs to aim for.

### (2) Simultaneous Achievement of Effectiveness, Efficiencies and Equity

#### (i) Need to cover most global emissions

In order to ensure effectiveness, it is necessary to cover most global greenhouse gas emissions. If the effectiveness is questioned, any framework may impair the motivation of countries to participate, failing to achieve a sustainable framework.

Climate measures will require costs from broad-ranging economic and everyday activities. In order to maintain political consensus on such cost bearing, governments undoubtedly need to provide a rational explanation to the general public. What is very important here is to prevent free-riders. These considerations lead us to recognize that the prerequisite for Japan's participation in a framework beyond 2012 would be that an effective framework be built with the participation of the US and major developing countries.

In the light of characteristics of this issue affecting global public goods, future discussion will need to focus on how to incorporate the elements of free-rider prevention, participation incentives, and non-participation disincentives. Because of

this, minimizing the possibility of major countries' withdrawal from the framework will become an important element in the consensus building for the next framework. It is necessary to take into consideration that developing countries have limited capacity to take measures depending on their development stages and necessity for adaptation measures such as counter-measures for floods and constructing seawalls.

**(ii) Pursuit of cost-effectiveness**

In order to address this issue requiring enormous costs to be born by the whole world, an important viewpoint for the sake of effective conservation of the global environment is how to respond as cost-effectively and efficiently as possible.

**(iii) Rationale**

An important task is to ensure equity in each country's commitment. This is because a system which imposes unevenly heavy burdens on some countries will not be persuasive enough to the people of such countries who bear the economic and daily burden. In other words, it is essential to have rational and logical explanations for how each country's commitment satisfies the requirement for equity. Thus, the first thing to do will be bottom-up type analysis and discussion based on the specific situation of each country and each sector, as well as estimating costs of measures and the room for further reduction.

Only through such processes can realistic discussion on commitments be achieved and, thereby, equity realized. In addition, the commitments must be based on technological feasibilities, in other words the prospects for technological development and technology transfers. Any resolution not incorporating such elements may not lead to a sustainable framework in the long term, although it may help agreements to be realized more easily for the short term.

**(3) Contribution both to Economy and Environment**

Since the ultimate solution of the global warming issue requires technological breakthroughs and tremendous global costs to develop and disseminate technologies, the future framework must be founded on the concept of achieving dual targets for economy and environment. It is necessary to aim for the development and dissemination of technologies which are to be realized through economic growth.

**(4) Multi-stakeholder Participation and various forms of commitments**

**(i) Multi-stakeholder participation involving governments, industries, NGOs, and**

**individuals**

Addressing the future measures for global warming will involve extremely varied issues, with some beyond the government reach. Therefore, it will be essential to involve not only the nation-states but also entities of broader scope and levels including regions, sectors, industries, individuals, etc.

Bearing in mind that the global warming problem has many elements which the government cannot control fully, discussions, not only on international obligations by governments but also on activities required for various sectors and entities, are expected to be activated in various fora. The effective solution may be that such discussions at various fora mutually complement one another, and thereby, constitute effective measures as a whole.

When the government addresses climate change, hybrid responses realized through various fora of global, regional and bilateral levels might be effective.

Entities other than governments, such as industries, NGOs, and individuals, are encouraged to aim for building international consensus and commitments based on concrete actions in each sector, industry or daily life, in order to resolve the issue of climate change, reflecting on the responsibility and capability of each entity.

**(ii) Various forms of commitments**

In order to promote multi-stakeholder participation, commitment should be pursued on qualitative aspects such as standards and technological requirements as well as on the quantitative aspect. Such an approach is likely to effectively accommodate equity issues, due to the capability of responding to actual situations in each field. Furthermore, there should be a search for various options suitable to each entity, including voluntary agreements and voluntary target setting. A framework shall not contain features to induce each entity to postpone the participation in anticipation of non-compliance, but rather, shall serve as a scheme to encourage each entity to take the lead in implementation, so that it can produce earlier and more concrete effects.

**(Comments at the Committee)**

- In international negotiation we need to make better use of Japan's technology development policies, such as internationally common technological benchmarks, and top-runner methods.
- An approach to utilize sector-specific intensity will be important. The EU is in the process of reviewing the introduction of best available technologies and benchmarks for each sector.
- In terms of developing countries' participation, we need to study efficiency benchmarks for newly-constructed factories, indexes or targets in improving automobile fuel efficiencies, and other factors which are more acceptable to

developing countries.

- We also need to demonstrate that, by combining the most advanced technologies in the world, emissions can be reduced to a considerable extent using case studies. It is meaningful to select an industry as the unit of entity for addressing the issue.
- For domestic measures, the effect of voluntary action plans by industries have been identified already.
- Due to the tremendous costs of domestic measures, it is time for Japan to start preparation for the emissions trading system.
- In addition to its reduction targets, the EU proposed taxes and technological standards prior to the Kyoto Protocol, but maintained that their umbrella could not determine the details for making the system more flexible to incorporate each nation's unique situation. The EU ended up dropping the articles on policies and measures.
- If we are to propose a framework involving only technical standards and to eliminate the emission reduction target of each country, then that would leave the fields without technological elements not covered by the framework.
- It may be difficult to build an international consensus through the approach of summing up energy constituents only.
- For the future framework, we need to review the consideration of trade. International trade relates to the consumption, greenhouse gas emission, and industrial structure of each country.
- The reduction of $CO_2$ is inseparable from industrial competitiveness and the economy of each country.
- The essence of the Kyoto Protocol is who will bear the costs. Thus, even if the consensus is achieved on the top-runner method, the result will not be different for Japan from the case of the Kyoto Protocol, as long as Japan is to bear the costs of the top-runner method.
- We need to review the possibility of securing equity and fairness in the cost burden of each country based on each country's contribution to global warming analyzed by the country-specific accumulation of greenhouse gas emissions and the accumulation in the atmosphere.
- The position of nuclear power generation should be considered with its role in climate measures. Japan needs more than ever to send out information on its sincerity in the addressing of nuclear power generation to other countries , and to win greater trust.
- Japan's post-Kyoto strategy should be promoted from the two approaches of "principled diplomacy" (universal values and longer-term viewpoint) and "pragmatic diplomacy".
- The global environmental issue as a universal value issue needs to acknowledge the importance of political statements.
- We must accumulate scientific knowledge from the view point of a long time-span of one century, and need to constantly review such knowledge, and technological innovation.
- The important thing is how to formulate a concept. It would be necessary to re-define the principles of the Framework Convention (common but differentiated

responsibilities: if developed countries have responsibility for their past actions, developing countries have responsibility for the future), and sustainable development (as developing countries need long-term development, developed countries need stable growth), and to shift from commitment to target to commitment to actions.

- In regard to the issue of participation by the US and developing countries, we need to study the possibility of voluntary measures and cooperation outside the framework of Kyoto.
- For the alliance with developing countries, we need to study voluntary financial and technological assistance, environmental support as a part of development, and a framework for regional cooperation.
- In regard to the joint efforts with the US, we must review the development of universal values and concepts, cooperation in technological development, and the formulation of a developed countries' framework.
- As the basic characteristics and elements of global environmental treaties, we need to consider: (1) the theory of parties being "innately good," and non-parties "innately evil"; (2) voluntary commitment and mandatory commitment; (3) consideration of the special conditions of developing countries; and (4) the establishment of an organization to secure the initiatives of major countries (special stakeholders).
- In regard to the pre-suppositions on a framework beyond and after 2013, we need to consider: (1) the effectiveness of a method to add revisions to the Kyoto Protocol on the basis of the Kyoto Protocol's continuation (country-specific and fixed caps); (2) the review of elements needed for an alternative framework outside the Kyoto Protocol; and (3) consideration of the political conditions, timing and methods of an alternate framework proposal.
- Major elements of a new framework to replace the Kyoto Protocol shall include: (1) setting a framework with WTO/GATT as a model; (2) establishing the "conferring country system" mainly consisting of major emitting countries; and (3) the idea of establishing the WEO (World Environment Organization).

## 3. Actions for Constructing a Future Sustainable Framework

In expecting discussion based on the principles stated above, two options below are proposed. These options are not alternates , but rather complement each other for simultaneous introduction.

### (1) Multi-Facet Approach

Each entity is expected to discuss and act on various stages, depending on its responsibility and capability. If a future framework relies on a single approach, for example the setting of country-specific caps, there are considerable uncertainties whether the negotiation can lead to truly practical and meaningful measures. If we fail

to realize such measures, then the long process of negotiation in the past will be wasted. On the other hand, if a multi-facet approach is applied, in which various participants will discuss various measures and accumulate one by one the actions for each field and sector, then it will provide a benefit of continuously creating measures that can have direct impact while conforming to the actual situation in each field.

The system of a multi-dimensional and multi-facet structure, in which various types of negotiations and measures simultaneously progress and thereby bring about greater effect as a whole, may lead to provide concrete and tangible effects in each field. If so, governments will be able to not only negotiate for treaties and protocols, but also to conduct international coordination in broader areas of regional, bilateral, and other levels. Similarly, and in parallel to such governmental actions, industries, NGOs, and individuals respectively can build their own feasible international agreements and commitments. By each sector and each level addressing the issue in the multi-facet approach, the global scale action on the global scale issue can be realized.

To implement the "multi-facet approach," it will be important to consider solutions consistent with the actual status of greenhouse gas emission sources. Discussion must cover not only the total amount of emissions but also various aspects including technological standards, research and development policy, and technology transfers and diffusions in each sector. By adopting various classifications such as those based on sectors including industries, transport, and residential, or those based on fields of industries such as power generation, iron and steel, chemical, and automobiles, it becomes possible to search for more practical solutions with more extensive equity.

Already countries and regions have introduced various measures including technology requirements to improve energy efficiencies in various fields, legislation for target values, and voluntary commitment by industries. It may be worthwhile to review, for example, seeking international participation in these measures, starting from whichever areas are possible.

### (2) Major Emitters Initiative

Unless major emitting countries that dominate the top ranks of greenhouse gas emissions in the world will actually participate in the framework, it will not lead to an effective solution.

No matter what successes international negotiation provides, it is likely to lead to only insignificant achievement if the framework lacks the participation of major emitting countries. Major emitters have the responsibility to lead the discussion on the

future international framework, and need to present a sustainable system. It is necessary to pursue an approach in which major emitting countries take an initiative, with authority and responsibility, to discuss measures for reduciton of greenhouse gas emissions.

It is highly likely that discussions among major emitting countries might pave the way for a truly feasible and effective framework. In the review of such process, not only environmental ministers but also economy and energy ministers of each country should be included in active discussion. Allowing the participation of ministers with responsibilities for response measures in various fields will lead to the climate change discussion fully reflecting technology development and actual situations in each field. A creative and more practical approach in terms of the consensus building process is required in future international discussion.

**(Comments at the Committee)**

- In international negotiation where stakeholders' interests and calculations intertwine in a very complex way, Japan needs to make good use of its past experience earned through the history of multilateral-trade negotiation.
- Not only multilateral negotiation but bilateral negotiation should be utilized to advance discussion among major countries. Especially important is to earn tacit consent from the channel of the biggest player, the US.
- The post-Cold War era of the 1990's saw active cooperation in regional environmental efforts. To involve developing countries and non-participating countries, we need to adopt the viewpoint of regional responsibility.
- As the WTO's new round will include discussion on "Trade and Environment," won't it be possible to have discussions involving such peripheral activities?
- It may be necessary to depart from the preconceived idea of developing countries versus developed countries. To have sector-specific commitment to actions such as the promotion of cross-border measures in the same industry (for example, the automobile manufacturing sector) may be feasible.
- The past system did not accommodate the synergy effect of industries and NGOs. Essentially, to presuppose governmental systems all the time is not reasonable. We must set a framework not for each country but for the world as a whole.
- The Japan-US Business Conference also addressed global environmental problems.
- There are huge differences in environmental measures between the US government and its state governments and business corporations. To create a favorable environment for including NGOs and corporations from the early stage can be an important step.
- In view of adding social pressures on developing countries, it is necessary to integrate the activities of domestic NGOs and NPOs in China and India.
- The current Kyoto Protocol concept has some built-in difficulties. After the

second commitment period, it will be important to seek a change of concept.

- Apart from the Kyoto Protocol, a flexible review of the issue shall be attempted. What we need is a more down-to-earth approach.
- In building a future framework, we need a strategy on "how to protect Japan's national interests." Basically, it is important to base negotiation on "national interests."
- Since environmental diplomacy is founded on precedents, its progress tends to follow the progress of previous international frameworks. If the framework for the second commitment period will be a simple extension of the Kyoto Protocol framework, then Japan will have too heavy a burden.
- How about conducting a study of best available technology with Japan's neighbors or under a Japanese initiative? In the global warming issue, we need to expand the energy-savings society on a global scale, despite the risk of overseas transfer of high efficiency manufacturing facilities, such as in the case of emission reductions in the iron and steel industry of China.
- The current picture of negotiation suggests that the origin of developing countries' unity is their sharing of a view that the Kyoto Protocol constraint their development. Although it is essential to promote consensus among developing countries on how the global environmental issue is vital for them as well, developing countries will not likely move toward mitigation unless they feel a sense of economic benefit from it.
- Japan needs to show the desirable direction for the Asian region as a whole to take. While keeping the possibility of future economic changes in mind, Japan needs to consider involving China, Korea, and India in the discussion, including industry-wide burden sharing among Asian countries.

## Conclusion

Fundamentally addressing climate change requires a continued search for appropriate measures and further analysis of actual situations based on a long term viewpoint.

As the Chair country of the Conference that adopted the Protocol named after Kyoto, Japan became one of the early ratifying parties of the Protocol, and maintains a position of taking leadership in building a future framework on climate change.

Upon publication of this "Interim Report", broader discussion on climate change with participation by the general public in every sector and at every level is expected to be facilitated. At the same time, it is sincerely hoped that further international discussion toward a truly effective and equitable framework on climate change will take place.

**(Comments at the sub-committee)**

- First, it is important to exert the utmost efforts for the first commitment period of the Kyoto Protocol. In the negotiation of a future framework, it will be important for Japan to demonstrate such actions.
- Japan needs to demonstrate its diplomatic strategy in the field of global environmental issues as a platform for creating a new national and diplomatic image of Japan.