WWF for a living planet®

Decarbonizing Japan

- A Proposal for Domestic Emissions Trading Scheme

Toru Morotomi, Masataka Shimizu and Kae Takase
A Report Commissioned by WWF Japan

The original Japanese version of this report was written by Toru Morotomi (Kyoto University School of Government, Associate Professor), Kae Takase (Governance Design Laboratory, Director & Senior Economist) and Masataka Shimizu (Yokohama National University International Graduate School of Social Sciences, Doctoral Course). It was published by WWF Japan in March 2007.

English Translation: Nozomu Kawamoto (Text) and WWF Japan (Figures and Tables)

Index

Tables

Figues

Introduction

Even as we entered the Kyoto Protocol's First Commitment Period, greenhouse gas emissions in Japan continue to increase, with no sign of declining. According to preliminary statistics on greenhouse gas emissions for fiscal year (FY) 2005, emissions in FY 2005 increased by 0.6% over the previous year, resulting in an 8.1% increase over 1990 levels. This indicates, regrettably, that the Japanese government's climate change policy to date is not delivering results.

Incidentally, FY 2007 is also the year in which an evaluation and review of Japan's Kyoto Protocol Target Achievement Plan is scheduled to take place. The time is ripe, therefore, to put forward our proposal for introducing a policy framework that would prompt businesses and households to become more active in effecting a transition to decarbonized society, thereby enhancing the feasibility of measures to combat climate change. In order to realise this objective, we propose, as a policy instrument, the introduction of an emissions trading scheme. This scheme would cover large-scale emissions from industry, industrial process, and energy conversion sectors, and would promote a cost-efficient reduction of emissions, as well as providing an incentive for innovation. Our proposal consists of a "policy mix" in which the emissions trading scheme would be complemented by other policy instruments for sectors not covered by the scheme, i.e., transport, commercial, and household sectors and small- and medium-sized enterprises (SMEs).

The Emissions Trading Scheme is a means of maintaining total greenhouse gas emissions under a certain level at minimum cost to society. While the government would impose a cap on total emissions, the scheme would permit individual companies to buy and sell allowances for emissions, allowing for flexibility in their decision-making. Denmark was the first to introduce such a scheme for greenhouse gas emissions, adopting in 2000 a carbon trading scheme limited to the electricity sector. Other examples such as the UK's Emissions Trading Scheme (UK ETS) introduced in 2002, the Regional Greenhouse Gas Initiative (RGGI) scheduled to be implemented in seven states in the north-eastern U.S., and the NSW Greenhouse Gas Reduction Scheme (GGAS) already underway in New South Wales, Australia, show that emissions trading schemes are currently being implemented in various parts of the world. Especially, the EU ETS is the biggest cap and trade emissions trading scheme in the world operating since 2005 and covering 25 EU countries.

Eventually, these markets will be linked together and emissions trading will be carried out on a global level. In preparation for the emergence of such a global emissions trading market, Japan needs to promote the participation of its companies to establish its own domestic trading market and to lay down the informational and institutional infrastructures, as well as the trading rules necessary for its operation. We therefore propose that a domestic emissions trading scheme should be introduced, not only because it will serve as a policy tool to ensure that emissions are reduced, but also because we believe that, if there is eventually to be a global emissions trading market, a corresponding domestic market should be established in Japan at an early stage so as to allow Japanese companies to actively participate.

Chapter 1 Current State of Japan's Greenhouse Gas Emissions and Climate Change Policy

1.1 Current State of Greenhouse Gas Emissions in Japan

This chapter will clarify the current state of greenhouse gas emissions in Japan and identify the problem areas in the government's climate change policy. An understanding of these two points is necessary in discussing the features of an emissions trading scheme, which will be taken up in the following chapter.

Greenhouse gas emissions in Japan continue to increase with no sign of declining, as shown in Table 1-1 and Figure 1-1. According to preliminary statistics, emissions in fiscal 2005 increased by 0.6% over the previous year, resulting in an 8.1% increase over the Kyoto Protocol's base year of 1990. One direct factor behind the rise was the severe winter, but even without this seasonal element, the likely trend is for total emissions to continue rising in the coming years, buoyed by the recent economic recovery.

Table 1-1: Total GHG Emissions

	Base Year (BY) of the KP	FY2004 (Compared with the BY)		Change from FY2004	FY2005 Preliminary Figures (Compared with the BY)	
Total	1,261	1,355	(+7.4%)	→+0.6%→	1,364	(+8.1%)
Carbon Dioxide (CO_2)	1,144	1,286	(+12.4%)	→+0.8%→	1,297	(+13.3%)
Energy-Originated Carbon Dioxide	1,059	1,286	(+12.4%)	→+0.8%→	1,206	(+13.9%)
Non-Energy-Originated Carbon Dioxide	85.1	89.4	(+5.2%)	→+1.1%→	90.4	(+6.3%)
Methane (CH_4)	33.4	24.4	(-26.8%)	→-1.1%→	24.4	(-27.6%)
Nitrous Oxide (N_2O)	32.7	25.8	(-21.2%)	→-0.2%→	25.8	(-21.3%)
Three Fluorinated Gases	51.2	19.1	(-62.6%)	→-11.6%→	16.9	(-66.9%)
Hydrofluorocarbons (HFCs)	20.2	8.3	(-58.7%)	→-14.5%→	7.1	(-64.7%)
Perfluorocarbons (PFCs)	14.0	6.3	(-55.0%)	→-10.2%→	5.7	(-59.6%)
SulphurHexafluoride (SF_6)	16.9	4.5	(-73.6%)	→-8.1%→	4.1	(-75.7%)

Unit: Mt-CO_2

Source: Ministry of the Environment (2006) p. 1, Table 1.

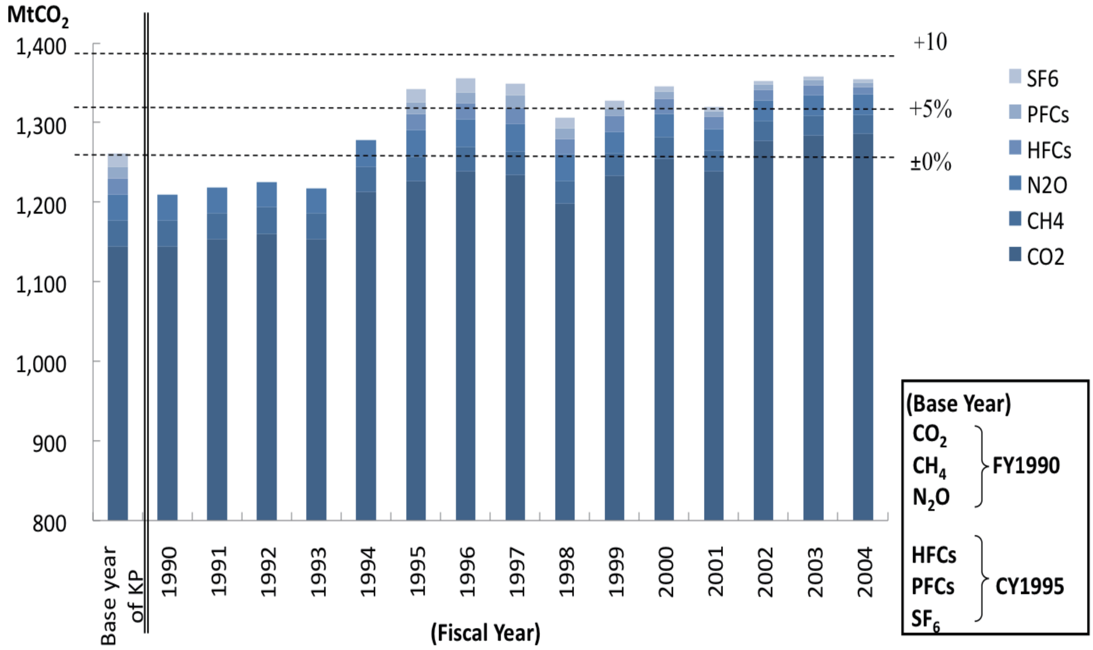
Table 1-1 shows that CO_2 accounted for 95% of the total greenhouse gas emissions in FY 2005. The share is likely to continue growing, as emission levels of only CO_2 among greenhouse gases are rising. There was a particularly sharp jump in CO_2 from energy sources, moreover, which accounted for 88.4% of total greenhouse gas emissions.

From the perspective of both total emissions and the rate of increase, it is clear that the reduction of CO_2 emissions needs to be given policy priority.

Figure 1-2 and Figure 1-3 trace emission trends of just CO_2 in the various sectors. It should be noted that emission levels here refer to "direct emissions." That is, the emissions from the energy-conversion sector are calculated as having been from this sector, rather than being allocated to the sectors that actually used the heat and electricity generated. Figure 1-3 shows that the biggest emitters were the factories and other facilities in the industrial sector, which accounted for 389 million tons in 2004, followed by the energy-conversion sector (382 million tons), the transport sector (254 million tons), and the commercial sector (106 million tons).

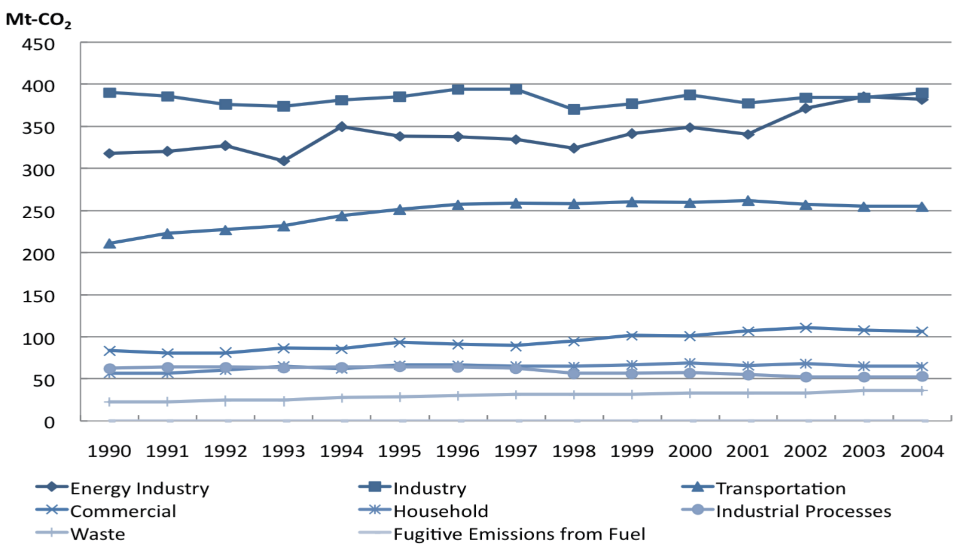
Figure 1-2 indicates, moreover, that the industry and energy-conversion sectors alone accounted for nearly three-fifths (58%) of the total emissions. The addition of the transport sector raises the share to approximately four-fifths (78%), and the further inclusion of the commercial sector brings the share to 86%, or close to nine-tenths of all emissions. In considering the introduction of an emissions trading scheme, its coverage rate (the percentage of the total emissions covered by the scheme) should ideally be as high as possible; the scheme should thus cover as broad an array of sectors as possible. From this point of view, the industrial and energy-conversion sectors should be first to be targeted. In addition, there would be a need to discuss how such relatively large emitters as the transport and commercial sectors are to be treated. This point will be addressed in greater detail in the following part, that discusses the design of an emissions trading scheme.

Figure 1-1: Trend of Total GHG Emissions



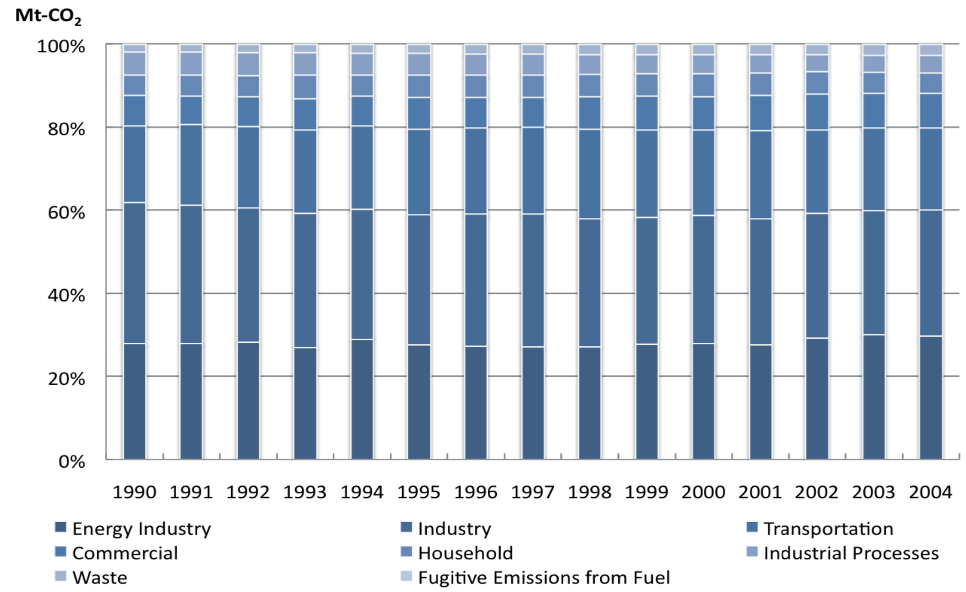
Source: Ministry of the Environment (2006) p. 2, Figure 1.

Figure 1-2: Trends of CO_2 Emissions in Each Sector (Direct Emissions)



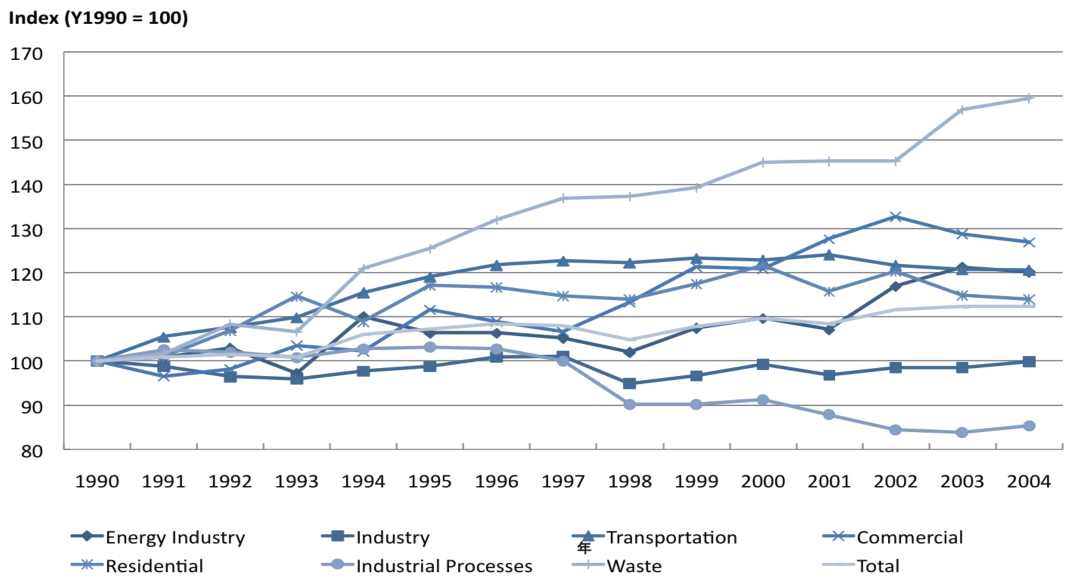
Source: Greenhouse Gas Inventory Office of Japan [August 30, 2006]

Figure 1-3: Trends in Share of CO_2 Emissions by Sector (Direct Emissions)



Source: Greenhouse Gas Inventory Office of Japan [August 30, 2006]

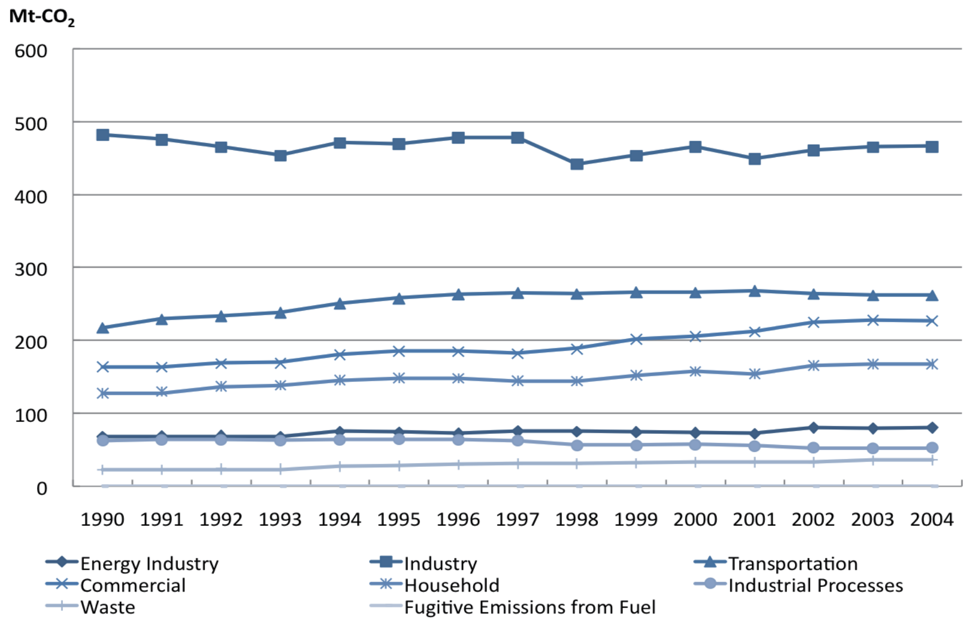
Figure 1-4: Change in CO_2 Emissions from Each Sector since 1990 (Direct Emissions)



Source: Greenhouse Gas Inventory Office of Japan [August 30, 2006]

In discussions of Japan's climate change policy, arguments are sometimes made that industrial emissions have either leveled off or are declining and that greater attention should be given to the rapidly rising emissions from the transport and household sectors. Is this a valid argument? Figure 1-4 shows the changes over time in CO_2 emissions with 1990 levels set at 100. This does suggest that emissions from the industrial sector have either leveled off or are declining, but it should be remembered that the Japanese economy as a whole was in the midst of a prolonged recession during the 1990s. Output from the transport, commercial and household sectors in FY 2004, by contrast, increased by 20.6%, 26.9%, and 13.9% over the base year.

Figure 1-5: Trends of CO_2 Emissions in Each Sector (Indirect Emissions)



Source: Greenhouse Gas Inventory Office of Japan [August 30, 2006]

This trend becomes even more pronounced when viewed in terms of "indirect emissions," that is, the emissions resulting from the generation of electricity and heat calculated as allocations to the various sectors that actually consume them. This is premised on the idea that emissions from the generation of electricity and heat should be the responsibility of the consumers, since it is their demand that triggered the emissions in the first place. The trends in indirect CO_2 emissions are shown in Figure 1-5.

As a comparison of Figure 1-2 and Figure 1-5 clearly shows, the allocated (indirect) emissions from the energy-conversion sector are naturally much lower and the output from industrial, transport, commercial, and household sectors are, correspondingly much higher. FY 2004 levels are slightly lower than in 1990 for the industrial sector, but in the other sectors, one can perceive an upward trend.

While the volume of emissions is nowhere near the levels of the industrial sector, there is an undeniable trend toward increasing emissions from the transport, commercial, and household sectors. There is a need, therefore, to enforce stronger countermeasures in these areas. Whether an emissions trading scheme can be implemented that includes these sectors as well, though, is a question requiring further debate. Even if they were not included, it would still be necessary to cover their emissions through a "policy mix" of complementary policy instruments.

1.2 Problem Areas in Japan's Climate Change Policy

1.2.1 Problems with the Kyoto Protocol Target Achievement Plan

Are Japan's climate change policies effectively addressing this trend toward increasing emissions? There are three fundamental principles that must be considered in building an integrated climate change policy. The first of these is that the effectiveness of environment-related policies must be ensured. The second is the desirability of achieving established policy goals in a cost-effective way. And the third is the need for measures that encourage technological innovation through economic incentives.

Addressing these three considerations demands a comprehensive policy structure encompassing the industrial, transport, commercial, and household sectors. It is desirable, moreover, for emission reductions to be advanced through mechanisms whereby reductions are rewarded economically, rather than being simply enforced through regulations or ordinances, so that the various sectors would have an incentive to undertake reduction efforts. The introduction of an emissions trading scheme and environment tax would meet such requirements. In addition, for a climate change policy to work, an accurate accounting of the total volume of emissions by various economic entities is a must, as this forms the foundation of an emissions trading scheme and environment tax. In order that a climate change policy is to be successful, in other words, the building of an information infrastructure is indispensable.

Is this issue adequately being addressed, though, by the Kyoto Protocol Target Achievement Plan (announced in August 2005 by the Global Warming Prevention Headquarters), which forms the core of Japan's climate change policy? The plan outlines the following "basic philosophies" on the prevention of global warming:

Shift from patchwork measures to an integrated approach

The Japanese government will rethink Japan's energy supply and demand structure from an integrated, wide-ranging perspective in order to change the structure itself into a CO_2-saving structure. In other words, it will maximize CO_2-saving through such measures as reform of Japan's socioeconomic structure, including the structure of cities and regions and the public transport infrastructure, and the design of CO_2-saving cities and transport systems.

Transcend the individual boundaries of each stakeholder

Each stakeholder involved in energy supply and demand should aim to further improve energy efficiency not just within the areas they directly manage but also in collaboration with other suppliers and users of energy.

Combine supply- and demand-side approaches placing the priority on demand-side countermeasures

In order to effectively implement CO_2-saving countermeasures, it is necessary to take measures on both the energy supply and demand sides. However, if the countermeasures are to produce results by the First Commitment Period, priority must be placed on countermeasures on the energy demand side.

Approaches placing priority on improvement of energy intensity

In order to steadily advance CO_2-saving countermeasures, the Japanese government will place priority on improving the energy intensity and the carbon dioxide emission per unit of energy consumption by improving the efficiency of energy use.

Effective measures to respond to the factors behind increases in emissions

The Japanese government will steadily promote countermeasures in the commercial sector and the transport (trucks and public transport systems, etc.) sector and will place priority on formulating effective countermeasures in other sectors including offices and other business facilities, the household sector and the transport (passenger cars for personal use) sector.

These basic philosophies recognize the importance of structural changes in society, the necessity of cross-sectoral policies, and the important role played by demand-side management in addition to supply-side measures. They are thus appropriate indicators of the approaches necessary in dealing with climate change — which is different from pollution — and are desirable as far as the direction of government policy is concerned. Strong doubts about their effectiveness emerge, however, upon closer inspection of the specific measures indicated in the Target Achievement Plan.

The first problem is that there is no guarantee that their implementation will reliably lead to the attainment of the stated targets. The Kyoto Protocol ascribes to Japan a quantitative target of 6% reduction in greenhouse gas emissions compared to the base year of 1990. Thus policy instruments must be adopted that will ensure achievement of this target. To be sure, the Target Achievement Plan cites various countermeasures for each sector and the accompanying attached Table 1 indicates quantitative estimates of projected emission reductions for each measure. The thrust of the plan is that it is possible to reach the 6% target through these reductions, as indicated in Table 1-2. Ensuring that these reductions will actually be achieved, though, requires the introduction of effective policy instruments that will provide the conditions assumed at the time the emission reductions were calculated. In actual fact, policies to guarantee such conditions are extremely precarious, with the exception of a limited number of measures, including the Top Runner Program, the GHG Calculation, Reporting, and Public disclosure system, and the special measures law on the use of new energy by electric power suppliers (law no. 62, 2002; commonly called the RPS, or Renewables Portfolio Standard, Law), which is designed to encourage the use of new energy sources. An additional problem is that the menu of countermeasures listed in the Target Achievement Plan is simply an aggregation of isolated policies and has not been systematically organized. Virtually no hints are given in the plan as to how the various countermeasures are related to one another and in what directions they will change Japan's social structure in order to achieve decarbonization.

The second problem is the absence of the notion of cost effectiveness. The plan's menu of countermeasures appears to be a collection of all conceivable policies taken in isolation of one another. Even if cost-benefit analyses had been made, there are no signs that they were incorporated into the Plan. Under normal circumstances, a policy system should be built in which the most cost — effective measures-identified through such analyses — would be given priority to enable the achievement of the targets at least total cost. The most effective approach incurring the least administrative cost is the adoption of an environment tax and an emissions trading scheme. If an index of the "price of carbon" were to be created using this approach, one can suppose that the most cost-effective countermeasures would automatically be selected. This is because measures that can be implemented at marginal cost — not exceeding the price of carbon — will be embraced, while costlier measures will automatically be rejected by the market, whose choices are determined from the viewpoint of cost effectiveness. The Target Achievement Plan does not set a clear course for the introduction of an environment tax, however, saying only that such a tax "is an issue for which comprehensive studies must be seriously considered." In so doing, efforts must be made to obtain the understanding and cooperation of citizens, companies, etc." As for a domestic emissions trading scheme, the Plan merely identifies it as "an issue that must be comprehensively studied with a wide range of discussion points, including a comparison of the domestic emissions trading system with other methods and their effects and the impact on industrial activities and the national economy." Such a stance is tantamount to an abandonment of efforts to achieve a cost-effective system.

The third problem is the dearth of incentives for technological innovation. The Target Achievement Plan, certainly, gives importance to the development of technologies to counter global warming. But it merely lists the need to "promote technology development," "implement assistance," "support promotion," and "advance dissemination" without discussing what policy tools are needed and what schedule should be followed to promote technological innovation. It does refer to the establishment of systems for subsidies and tax breaks, and they would no doubt provide a degree of incentive. In addition, there are cases where the government can play a pertinent role, such as when technology development entails high risks and when massive R&D funds are required. Implementing systems of subsidies and tax breaks, though, requires that target technologies be specified, inviting an unwanted situation where the direction of technology development is fixed beforehand by the government. As long as the government lacks the information infrastructure to make long-term projections about the directions of technology development, the selection of specific technologies to receive subsidies and tax breaks will have to be made from a short-term perspective. There is thus the risk that the course of technology development could head in the wrong direction should the government misread the situation. (Ito 2005).

Rather, the role of government should be to offer economic incentives for technology innovation. After all, the leading players in such innovation are private companies. The government should chart a long-term vision of how the social structure is likely to change as society moves toward decarbonation to enable these companies to make GHG-reducing investment decisions. By doing so, these companies will be able to make technology development decisions deemed most appropriate under such a vision. There is also a need to enhance understanding of the fact that technology development efforts will "pay off" from an economic perspective. This will require the government to create a scenario for decarbonizing society from a very long-term perspective and to clearly demonstrate its intention to introduce a series of policy instruments in accordance with that scenario, as the UK did.

Table 1-2: Indicative Targets for Each Sector in Energy-originated CO_2 Emissions

Estimated Results	Base Year (FY1990)	FY2002		Targets in Each Sector for FY2010		<Reference> Difference Between the FY2010 Targets and the FY2002 Level of Emissions
	A	B	(B-A)/A	C	(C-A)/A	
	Mt-CO_2	Mt-CO_2	% change to BY in each sector	Mt-CO_2	% change to BY in each sector	
Total Energy-Originated CO_2	1,048	1,147		1,056		
Industry Sector	476	468	-1.7%	435	-8.6%	Emissions are expected to increase due to factors such as increase in production from economic growth if countermeasures and policies are not taken. Provisional calculations show that emissions can be reduced by 33 million tons from FY2002 levels through countermeasures and policies.
Commercial and Residential Sector	273	363	+33.0%	302	+10.7%	
Commercial and Other Sectors	144	197	+36.7%	165	+15.0%	It is expected that if countermeasures and policies are not formulated emissions will increase through increases in the floor area in buildings etc. Provisional calculations show that emissions can be reduced by 31million tons from FY2002 levels through countermeasures and policies.
Residencial Sector	129	166	+28.8%	137	+6.0%	It is expected that if countermeasures and policies are not formulated, emissions will increase through increases in the number of households and the per household device ownership rate, etc. Provisional calculations show that emissions can be reduced by 29 million tons from FY2002 levels through countermeasures and policies.
Transport Sector	217	261	+20.4%	250	+15.1%	It is expected that if countermeasures and policies are not formulated, emissions will increase through increases in the number of automobiles owned, etc. Provisional calculations show that emissions can be reduced by 11 million tons from FY2002 levels through countermeasures and policies.
Energy Conversion Sector	82	82	-0.3%	69	-16.1%	This is self-consumption such as at power plants, petroleum processing facilities, etc. Provisional calculations show that by continuing to steadily develop efficient energy use in these facilities, etc., emissions can be reduced by 13 million tons from FY2002 levels.

Source: Global Warming Prevention Headquarters (2005), Figure 3 in p. 14

From this perspective, what is to be avoided at all costs is irresolution in government policy. The worst-case scenario would be for the Ministry of the Environment and the Ministry of Economy, Trade, and Industry to quarrel with one another, preventing the introduction of effective policy instruments; investment in the private sector would stagnate due to doubts about technology development, and emissions would continue rising unabated. The government's role, therefore, is not to prefix the direction of technology development through short-sighted subsidies but to send a signal to society by clearly indicating the direction of social change from a long-range perspective. It is to give private companies the confidence that investments in GHG-reducing technologies will pay off economically in the long run and to prepare a policy framework that will actually induce such investments. Seen from this point of view, the Target Achievement Plan deserves a failing grade; a clear signal must be sent to the market, instead, through the introduction of an emissions trading scheme and an environment tax.

1.2.2 Consideration of Several Notable Policy Instruments

That said, the Target Achievement Plan does contain several important policy instruments that could become seeds for advancing Japan's climate change policy. Some of those measures are discussed below from the viewpoint of introducing an emissions trading scheme, which is the gist of this report.

GHG Calculation, Reporting, and Public disclosure system

Under this system, introduced with the promulgation of the revised Law Concerning the Promotion of Measures to Cope with Global Warming on June 17, 2005, high-volume emitters of greenhouse gasses ("Specified Emitters") have been required since April 1, 2006 to calculate their own emission levels and submit a report to the government. The entities listed in Table 1-3 must file such a report for each facility every fiscal year. The reported data will, with a few exceptions, be publicly disclosed.

Table 1-3: Emitters Covered in the System for GHG Emission Calculation, Reporting and Public Disclosure ("Specified Emitters")

Type of GHG	Covered Emitters ("Specified Emitters")
Energy-originated CO_2 Emissions (Fuel combustion, use of electricity and/or heat provided by others)	Owners of Type I and Type II designated factories under the Energy Conservation Law
	Specified Freight Carriers, Specified Consigners, Specified Passenger Carriers and Specified Air Carriers
Non-energy-originated GHG Emissions	For each GHG, owners of facilities meeting the following conditions (limited to those ones with hiring 21 or more employees in total on a regular basis)
Non-energy-originated CO2 Emissions	Facilities emitting more than 3,000 t
Methane (CH_4)	Facilities emitting more than 3,000 t-CO_2
Nitrous Oxide (N_2O)	Facilities emitting more than 3,000 t-CO_2
Hydrofluorocarbons (HFCs)	Facilities emitting more than 3,000 t-CO_2
Perfluorocarbons (PFCs)	Facilities emitting more than 3,000 t-CO_2
Sulfur Hexiafluoride (SF_6)	Facilities emitting more than 3,000 t-CO_2

Source: Ministry of the Environment and Ministry of Economy, Trade and Industry's website on the System for GHG Emission Calculation, Reporting and Pulic Disclosure.

Revised Energy Conservation Law

That such a system of calculation, reporting, and public disclosure was introduced in Japan is of great and positive significance. Granted, this system in itself will not — unlike an emissions trading scheme or environment tax — directly prompt emission reductions. Nevertheless, an accurate grasp of GHG emission levels is valuable infrastructure that could serve as the basis for a range of climate change policies, including an emissions trading scheme. Because of the public disclosure requirement, moreover, the system can be positioned as a type of basic policy instrument (Ueta 1996, pp. 107-8). The public disclosure of information on each company's emissions down to the facility level will, in other words, enable third-party monitoring and assessment of a company's reduction efforts. The environmental NGO Kiko Network, for example, has already been requesting information on energy use by various facilities — the reporting of which is mandatory under the Energy Conservation Law — and conducting analyses of the disclosed data. Emitters are more likely to curb emissions in the presence — rather than absence — of a disclosure requirement, which enables third parties to conduct monitoring.

The system is also of great significance for the emissions trading scheme that this report proposes. This is because the system can be used as a source of information on the greenhouse gas emissions of each facility in the implementation of this scheme. The calculation, reporting, and public disclosure system is intimately linked to the Law Concerning the Rational Use of Energy (revised in 2005; hereafter the "Revised Energy Conservation Law") in facilitating the implementation of an emissions trading scheme, and so this law will be discussed next.

The Revised Energy Conservation Law was enacted and promulgated in August 2005, and has been in force since April 2006. Its importance relative to the Calculation, Reporting, and Public disclosure system is that, as Table 1-3 shows, the "Specified Emitters" who are required to submit a report of their CO_2 emissions in that system are also the entities targeted under the Energy Conservation Law.

The most recent amendment calls for the integrated management of heat and electricity consumption, which had hitherto been regarded separately. As a result, the cut-off criteria applied to designated factories were in effect lowered and the number of targeted factories and facilities increased from approximately 10,000 to 13,000. Such designated factories are divided into Type 1 and Type 2, which are obligated to perform the following:

Type 1 designated factories (energy usage of 3,000 kl crude oil equvialent/year

- Obligation to assign energy management officer
- Obligation to submit medium- to long-term consumption plans
- Regular reports on energy usage, etc.

Type 2 designated factories (energy usage of 1,500 kl crude oil equivalent/year)

- Assignment of energy management personnel
- Regular reports on energy usage, etc.
- Elimination of distinction between heat and electricity and introduction of restrictions covering both heat and electricity usage (crude oil equivalent)

When the performance of the above obligations is deemed grossly inadequate in the light of judgment criteria, the Minister of Economy, Trade and Industry can issue a warning. The Revised Energy Conservation Law thus demands the reporting of energy consumption levels, which can be converted fairly easily into CO_2 emission levels in the light of the fixed relationship between energy use and CO_2 emissions.

In addition to enabling the ascertainment of CO_2 emission levels, the obligations are important to an emissions trading scheme because they involve the notion of a cut-off point. An emissions trading scheme cannot target all emitters, since that would entail excessively high administrative and monitoring costs; the scheme must therefore be limited to entities exceeding a certain level of emissions. On the other hand, an overemphasis on narrowing down the targeted entities would result in a scheme with too small a coverage rate. The point is to strike a balance between the competing demands for savings on administrative and monitoring costs and a higher coverage rate; this requires the establishment of a realistic cut-off point, which the Revised Energy Conservation Law provides. In other words, applying the cut-off criteria for Type 2 designated factories — energy usage of 1,500 kl/year —to the emissions trading scheme appears to be a realistic approach.

Keidanren Voluntary Action Plan on the Environment

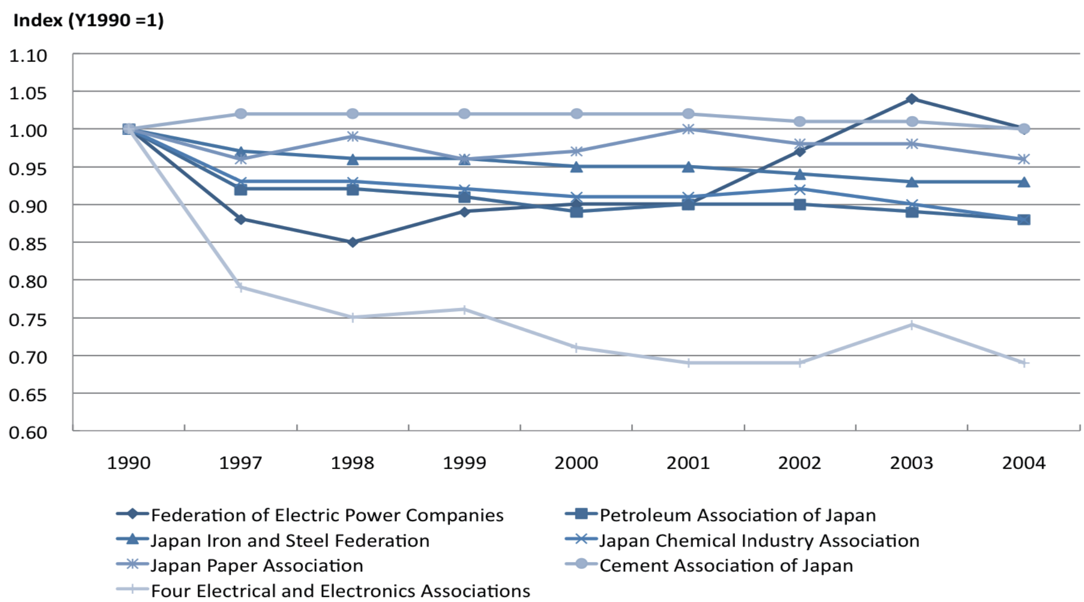
Keidanren, the largest federation of Japanese industries, has established voluntary targets measured either in terms of "intensity," such as per-product energy consumption or CO_2 emission, or "total volume." Annual reviews of achievement levels are carried out, and the results are publicly disclosed. Because the targets are not based on government policy but are established by industry groups themselves, the initiative is called a Voluntary Action Plan. Keidanren as a whole seeks to reduce CO_2 emissions in the industrial and energy-conversion sectors in FY 2010 to FY 1990 levels or below.

According to a FY 2005 follow-up, 35 industries from the industrial and energy-conversion sectors participated in the Voluntary Action Plan, and their CO_2 emissions, by 1990 standards, accounted for 45% of the national total and 82% of the industrial and energy-conversion sectors. The follow-up survey showed that CO_2 emissions in FY 2004 were 0.5% lower than in 1990 (0.1% higher than in FY 2003), indicating that the voluntary target had been reached for five consecutive years since FY 2000 (Nippon Keidanren 2005, p. 1).

The results warrant a more detailed examination. Figure 1-6 charts the index for emission intensity of the seven major industrial groupings, with emission levels in 1990 calculated as 1.0. As this figure shows, the intensity of CO_2 emissions in the seven leading groupings — including the energy-conversion sector — are either on a par with or lower than 1990 levels. Figure 1-7, meanwhile, shows the total volume of CO_2 emissions for the same seven groupings. Clearly, there has been a trend toward higher emissions compared to 1990. This is attributed to an expansion in production volume exceeding the improvements in intensity. The materials industry has recovered from a recent recession and is once again booming, and there is a possibility that the trend toward higher emissions could become even more prominent in the future.

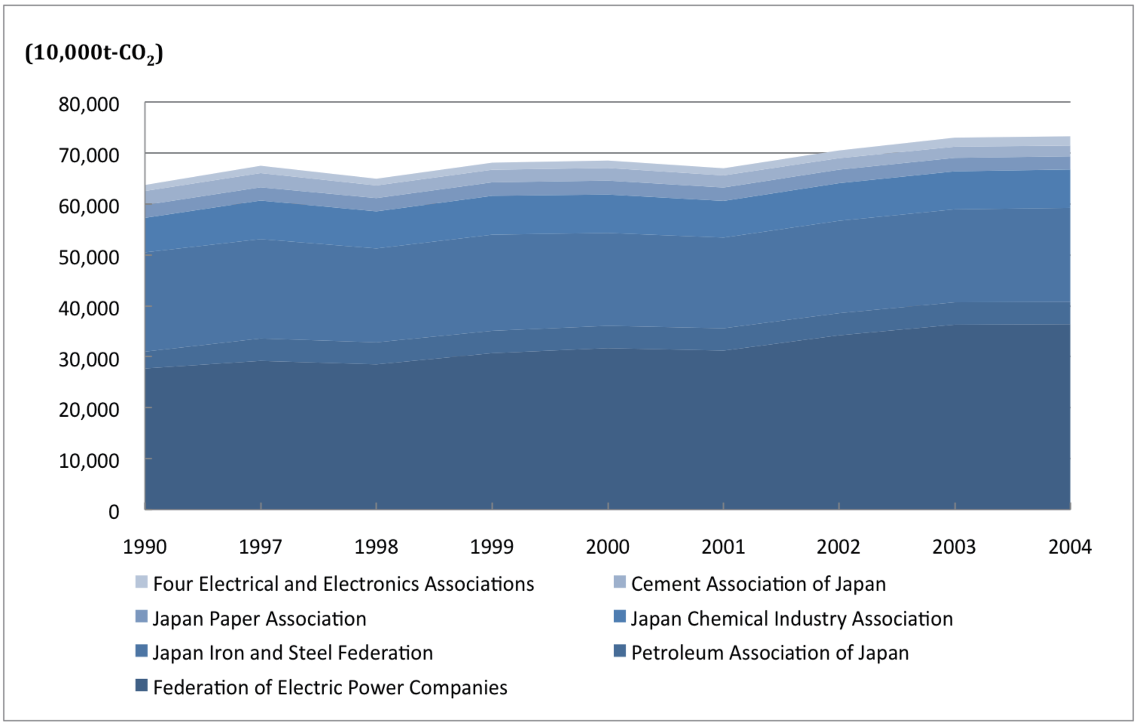
Figure 1-8 indicates trends in energy consumption per IIP (Indices for Industrial Production) in the materials industry. As the figure indicates, the intensity index has deteriorated since 1990 for all components of the industry, with the exception of paper and pulp. The conclusion that can be drawn from this is that while the steep rise in petroleum prices triggered by the oil crises propelled efforts by the Japanese industry to improve energy efficiency, the trend has reversed, albeit slightly, in recent years, and energy efficiency appears to be declining. This worrisome trend can be attributed to the fact that, because oil prices remained relatively low until 1999, companies did not have an economic incentive to enhance energy efficiency.

Figure 1-6: Index for Emission Intensity of the Seven Major Industrial Groupings



Source: Keidanren, Results of the Follow-Up to the Voluntary Action Plan

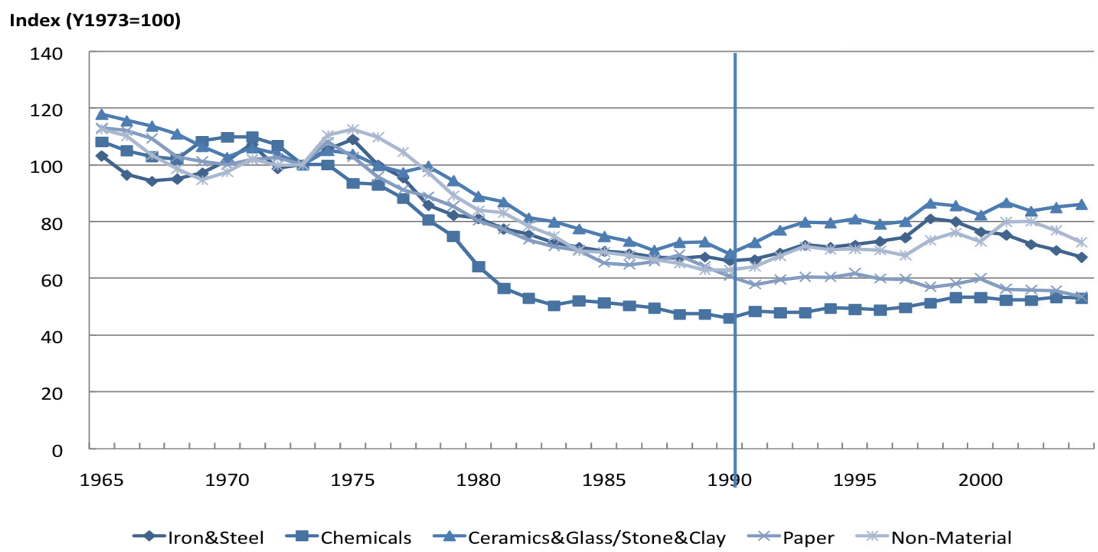
Figure 1-7: Trends of CO_2 Emissions in the Seven Major Industrial Groupings



Source: Keidanren, Results of the Follow-Up to the Voluntary Action Plan

Note: In this figure, due to the limited data availability, emissions from non-power industrial groupings include emissions from electricity use, which leads to double counting with emissions from the power industry.

Figure 1-8: Index for Energy Consumption per IIP (Indices of Industrial Production) in Materials Industry



Source: Energy Data and Modelling Center, Institute of Energy Economics, Japan (2006).

From these considerations, Keidanren's Voluntary Action Plan merits praise for achieving some improvements in energy efficiency and reductions in emission levels, as expressed as an intensity index. But for reasons cited below, the implementation of a voluntary plan should not preclude the introduction of additional policy measures targeting the industrial sector.

First of all, many of the industry-specific targets are indicated on a per-unit basis. This means that, even if the voluntary targets are met, an expansion in production volume may result in higher overall emissions, exceeding the per-unit improvements, as seen above for the seven industrial groupings. From the viewpoint of securing the environmental effectiveness of environmental policy, then, the setting of voluntary targets based on intensity alone is problematic. The second reason is the failure to address the issue of cost efficiency. Because the targets contained in Keidanren's plan are established voluntarily by each industrial group, there are no mechanisms to equalize the marginal reduction costs among the various industries. Were the voluntary targets to be carried over to an emissions trading scheme so that they could be achieved at least cost, this would benefit not only the Japanese industry but also the national economy as a whole. The third reason is that the implementation of the calculation, reporting, and public disclosure system and the Revised Energy Conservation Law is already leading to the creation of an information infrastructure needed to accurately account for absolute levels of CO_2 emissions and energy consumption. Converting the intensity targets established by each industry into those for absolute volume in accordance with this information infrastructure will not be technically difficult. Advancing the voluntary targets one step forward should involve the switching of various targets from intensity to absolute basis. Most of the technical hurdles that could prevent this process have already been removed.

Japan's Voluntary Emissions Trading Scheme

The Ministry of the Environment has been implementing a voluntary emissions trading scheme (J-VETS) on an experimental basis since 2005. There are two forms of participation in the scheme. The first is as a "participant with targets." Such participants pledge to reduce a certain amount of CO_2 emissions and receive subsidies for investment in energy-saving facilities or fuel switching and are allocated allowances. The second is as a "trading participant." These participants, who are not initially allocated allowances, open accounts in the registry to conduct trade in emission allowances.

After calculating their emissions for FY 2006, participants with targets have the figures certified by a verification agency. Depending on their own emissions levels, these companies may trade allowances with either other participants with targets or trading participants. At the end of a trading period, the allowances allocated to the participating companies are compared with the actual emissions. In case emissions exceed the allowance, companies may make up for the difference by purchasing emission allowances. In case they still cannot achieve the targets, they are obliged to return the subsidies paid to them.

J-VETS is a voluntary program at the moment and cannot be considered a policy instrument targeting the industrial sector as a whole. Indeed, the number of participants is still very limited; during FY 2005, which was the first trading period, there were 32 participants with targets and 8 trading participants, and in the second period covering FY 2006, there were 23 participants with targets. J-VETS should thus be considered an experiment prior to the implementation of a full-scale emissions trading scheme sometime in the future. By highlighting the need for infrastructure improvements and problem areas in the system design, though, the scheme is expected to become a source of valuable experience and opportunities for learning.

As it stands today, Japan's climate change policy is lacking in terms of ensuring the effectiveness of environment-related policies, cost effectiveness, and measures to encourage technological innovation through economic incentives. It is not only incapable of guiding Japan toward a decarbonized society but also of making any headway in the achievement of Japan's emission reduction target of 6%, as prescribed in the Kyoto Protocol. There have been some legal reforms, though, that — while rather inconspicuous — do help to lay the foundations for future policy progress. They are not effective as environmental policies in themselves but are nonetheless significant for creating an information infrastructure that will be indispensable in the implementation of an emissions trading scheme. In a sense, then, the infrastructure is already in place for an emissions trading scheme, and all that is needed now is the political will to launch such a system. These policy tools should be put to better use to build an even more effective environmental policy. The remaining issue is how to design a domestic emissions trading scheme. This will be explored in greater detail in the following sections.

Chapter 2 A Proposal for a Downstream Emissions Trading Scheme

2.1 Basic Considerations in Designing a Domestic Emissions Trading Scheme

2.1.1 Comparison of Upstream and Downstream Schemes

In introducing an emissions trading scheme in Japan, the first question that must be addressed is whether it should be implemented "upstream" or "downstream" n the energy flow. By "upstream" is meant the stages of extraction, import, and refining of fossil fuels, while "downstream" refers to the final consumption stage of those fuels. As used below, an upstream emissions trading scheme will mean a scheme implemented upstream in the energy flow, while a downstream emissions trading scheme will refer to the one conducted downstream. There are merits and drawbacks to both systems, and these will be clarified first.

2.1.1.1 Merits and drawbacks of an upstream scheme

The biggest advantage of an upstream emissions trading scheme is its high coverage rate. Because Japan relies on imports for nearly 100% of its fossil fuels, a scheme implemented upstream would, in effect, cover all domestic economic entities, enabling a roughly 100% coverage rate. Emission levels of greenhouse gases could be calculated by converting the carbon content of the extracted and imported fossil fuels. Companies involved in extraction and importing would need to secure allowances for greenhouse gas emissions from the fuels they themselves extract or import. In case such allowances exceed or fall short of emissions, they may trade allowances with one another in accordance with actual emissions. At the end of the trading period, they will be called upon to demonstrate to the government that their allowances correspond to their emissions. If an upstream scheme were established using such a framework and trading were to begin, the price paid for the allowances would determine the carbon price. The cost borne for such allowances by upstream trading entities would eventually be passed on to entities further downstream as price signals. As long as the cost is fully passed on, and the carbon price is accurately reflected downstream, marginal emission reduction costs would be equalized among direct downstream emitters. This would enable the achievement of the reduction target at least cost.

The second advantage of an upstream scheme is its effectiveness as an environmental policy. Because the coverage rate is nearly 100%, complete control of the volume of emissions would become possible by strictly managing the supply of emission allowances at the upstream stage. This is a big plus for the upstream scheme, since it is consistent with the quantitative nature of the reduction target identified in the Kyoto Protocol.

The third advantage is that the costs of administering this scheme can be curtailed. Compared with a downstream scheme, an emissions trading scheme conducted upstream has fewer participants, facilitating the monitoring of the volume of fossil fuels extracted, imported, or refined and the enforcing of penalties in case of noncompliance, such as when participants exceed their allowances. Administrative costs for these tasks, moreover, are not expected to be very high.

The ease with which an upstream scheme can be implemented is a double-edged sword, however, for it is also the source of the system's many problems. The fact that there are few participants means that the economic conditions for perfect competition are not in place. The participants will be able to act strategically, with the result that the improvements in efficiency that trading was intended to engender will be limited. Trading on the open market may become sporadic, and the scheme itself could dissipate without delivering the promised benefits in the form of enhanced efficiency.

Can one assume, moreover, that the carbon price established in an upstream scheme would be fully passed on to downstream through the prices charged for energy products? There are two problems with this assumption. The first concerns the degree to which such costs are passed on. The second is the possibility that the costs would be passed on in different ways according to the type of fossil fuel. As for the first point, the extent to which prices are passed on would be determined by the relative price elasticity of fossil fuel supply and demand. So, there is a possibility that the carbon price may not be shifted 100% to downstream: the smaller the percentage, the weaker the effect of price incentives for downstream economic entities. As for the second point, there is no guarantee that prices would be passed on uniformly for coal, petroleum, heavy oil, and kerosene, for example. In fact, it would be more reasonable to assume that the rates would differ according to types of fuel. In that case, the marginal costs would not be equalized among the various downstream emitters and the cost efficiency of an upstream scheme would be lost.

2.1.1.2 Merits and drawbacks of a downstream scheme

A downstream emissions trading scheme, by contrast, would have the following advantages. The first is the convergence of the points of energy consumption and regulatory action. The effect of incentives to reduce emissions would no doubt be maximized under such an emissions trading scheme. From an economics point of view, the resource distribution effect of the carbon price would be the same regardless of whether it is derived upstream and then passed down, or established through transactions further downstream. The same price signal effect as that gained from passing on the cost of allowances upstream can be anticipated downstream, moreover, through the introduction of an environment tax. The real significance of having the points of energy consumption and regulatory action converge is that incentives can be applied more directly to the energy consumers than under an upstream system.

In other words, when a downstream emitter becomes a participant in an emissions trading scheme, they would be required to calculate and report their own greenhouse gas emissions, demonstrate to the government that such emissions are congruent with their allowances at the end of the trading period, and subject those disclosures for third-party monitoring and verification. While the emission-reducing effect of this process cannot be established quantitatively, there is likely to be considerable impact. The process will lead to the introduction of audits for greenhouse gas emissions — similar to the system now employed in corporate accounting — and each company will establish a management system for these emissions. Decisions regarding appropriate emission allowance levels and the cost of acquiring additional allotments, which were hitherto outside the concern of corporate management, will come to take on immense significance. As a result, companies will be compelled to review their production processes and to look for less costly emission reduction opportunities. Because downstream emitters are the ones actually consuming energy, they are in a position to know and make judgments on how they can reduce emissions and what technologies need to be developed to implement such measures. Thus, the convergence of the points of energy consumption and regulatory action under a downstream scheme should provide greater incentive for emission reduction than a price-shifting mechanism under an upstream one, since the former targets participants that actually have the knowledge and skills to reduce emissions.

The second advantage of a downstream scheme is that it more closely provides the conditions for perfect market competition through the larger number of participating traders. This will diminish the leeway for strategic behavior among the participants. There will thus be more active trading, and the benefits of improved efficiency through the introduction of an emissions trading scheme can be maximized. This, though, can also become a drawback. That is, if there are too many participants ranging from large scale emitters to individuals-administrative costs would become prohibitive. In implementing a downstream scheme, therefore, there would be a need for a cutoff point so that only large-scale energy consumers would be targeted. But this, again, would lead to the problem of a lower coverage rate than an upstream scheme.

2.1.1.3 "Direct emissions" and "indirect emissions"

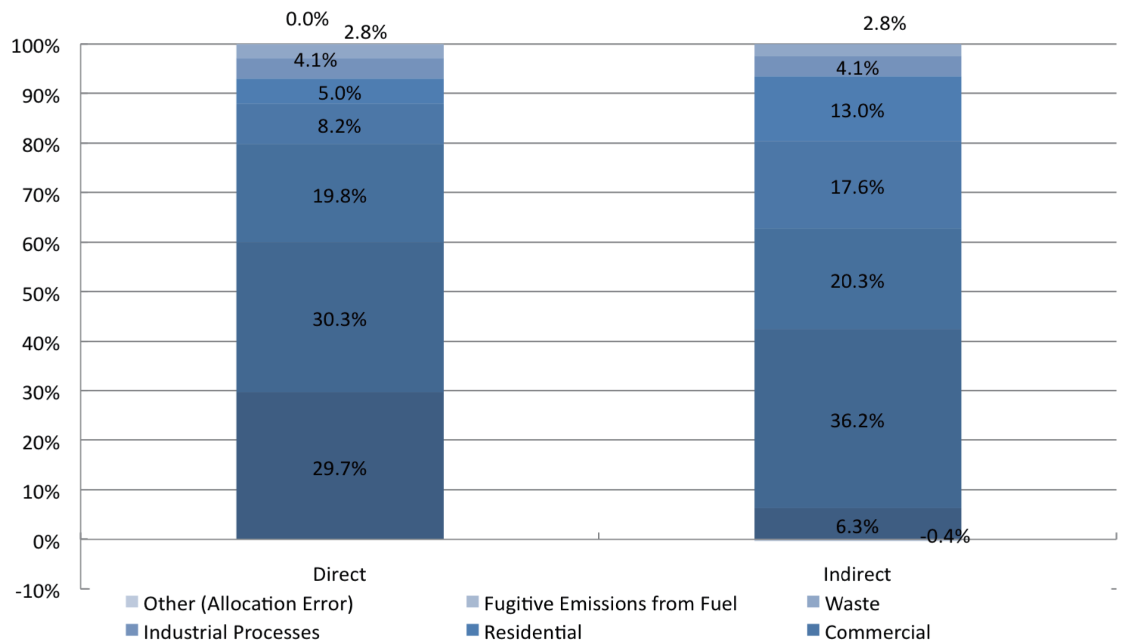
Osaka University professor Tatsuyoshi Saijo and others have already conducted excellent research concerning the choice of an upstream or downstream scheme (Saijo 2006), in which an upstream system is recommended. We feel, however, that, in the light of the above arguments, the downstream option will engender greater benefits, despite a lower coverage rate. To make up for the low coverage rate while taking full advantage of its strengths, the downstream scheme should be adopted as part of a policy mix of complementary policy instruments to help boost the coverage rate. The downstream scheme would have to exclude the transport, commercial, and household sectors to keep down administrative costs, and, so, some sort of additional measures covering these sectors would become necessary.

As will be discussed in Chapter 3, the complementary policy mix that we propose would cover the excluded sectors by introducing a tax or a separate emissions trading scheme. Although the presented views differ from our own, a good reference on how these sectors may be incorporated into a climate change policy mix is provided by Akihiro Amano, who addresses the problem of low coverage by suggesting a "hybrid" emissions trading scheme incorporating both up- and downstream approaches (Amano 2000).

A detailed analysis of these approaches will be left for Chapter 3, and for now another important consideration regarding the coverage rate will be addressed: the question of whether the downstream emissions trading scheme should deal with "direct emissions" or "indirect emissions." This is a choice that is essential to the question of how the energy-conversion sector, including the electric power, is to be treated.

As was discussed in Chapter 1, there are two ways of calculating emissions: one is through "direct emissions," in which emissions from the heat and electricity generateion are accounted as emissions from those producing them and not from consumers, and the other is through "indirect emissions," in which emissions are accounted from the consumer side. Even if a decision were made to implement a downstream emissions trading scheme, the actual design of the scheme would differ depending on whether it is to be based on direct or indirect emissions. This choice would also affect the system's coverage rate.

Figure 2-1: Direct and Indirect Emissions



Source: Greenhouse Gas Inventory Office of Japan [August 30, 2006]

A direct emissions scheme would target the industrial and energy-conversion sectors, while an indirect scheme would cover not only these two sectors but also the transport, commercial, and household sectors. In the former, incentives to reduce emissions can be applied by regulating the direct emitters of greenhouse gases. The industrial and energy-conversion sectors are the ones possessing emission-reducing technologies, so being able to offer them incentives to reduce emissions is a major advantage of this scheme. By targeting the electricity sector, the commercial and household sectors — which are the principle consumers of electricity — are also included indirectly into this system.

Under an indirect emissions scheme, while it would be technically possible to offer energy-saving incentives to the transport, commercial, and household sectors, implementation would prove to be difficult because keeping track of the innumerable entities in these sectors would push up administrative costs. For this reason, our proposal is for a downstream emissions scheme based on direct emissions.

Figure 2-1 shows the breakdown of sector-by-sector emissions when measured in terms of direct and indirect emissions. In a direct emissions scheme covering the energy-conversion, industrial, and industrial-process sectors, the coverage rate would be 64% (when cutoff criteria are not considered). This would also enable the indirect coverage of the commercial and household sectors, whose major source of emissions is electricity use. If the transport sector, too, could be included in some way, the coverage rate would rise to 84%, an adequate standard for an emissions trading scheme.

2.1.2 Designing a Cap-and-Trade Emissions Trading Scheme

2.1.2.1 Long-term and short-term targets

Once a decision is made to introduce a downstream emissions trading scheme, the next step in terms of design is to determine how to establish a cap. While this was not explicitly discussed, there are two types of trading systems: one based on “cap and trade” and the other on “baseline and credit.” Our discussions thus far have implicitly assumed the adoption of the former type. Under this scheme, the government establishes a cap on total emissions and allocates only the corresponding volume of allowances. No matter how the allowances are traded under this system, therefore, the total volume can be effectively controlled.

In the baseline-and-credit approach, meanwhile, credits are issued for measures implemented to reduce emissions below their baselines. This approach is generally adopted to encourage reductions where no absolute targets have been designated in such case as Clean Development Mechanism in developing countries. The establishment of a baseline involves the calculation of hypothetical emissions that would have resulted in the absence of emissions-limiting measures, to be compared with actual output, and some degree of arbitrariness is unavoidable. The biggest shortcoming of this approach, moreover, is that there are no guarantees that actual emissions will remain within the target cap. For these reasons, the arguments advanced herein will be premised on the adoption of a cap-and-trade scheme.

The most important consideration in designing an emissions trading scheme based on cap and trade, needless to say, is deciding a cap. If our ultimate goal is to prevent greenhouse gases from irreversibly and adversely affecting the earth’s climate, we will need to ascertain the global reduction levels necessary to stabilize the atmosphere and to achieve such reductions through joint efforts, with countries establishing domestic caps in accordance with international agreements. Indeed, scientific studies are being advanced in Europe and elsewhere to determine the reductions in greenhouse gas emissions necessary to prevent irreversible and adverse climate change.

The Climate Action Network (CAN) is a network of environmental NGOs operating in over 80 countries around the world. Based on the findings of the Third Assessment Report of the Intergovernmental Panel on Climate Change, CAN issued a position paper in 2002 entitled Preventing Dangerous Climate Change, in which it maintained that the global average temperature increase since the Industrial Revolution should be kept to within 2 °C to avoid irreversibly and adversely affecting the earth’s climate and ecosystem. Since then, “below 2 °C” has come to be regarded as a threshold for preventing dangerous global warming. Even an increase of just 1°C will have an impact, resulting, for instance, in the bleaching of coral reefs, but when the average temperature rises over 2 °C, there will be much higher risks of dramatic changes in oceanic circulation and the ecosystem, which would have a socioeconomic impact as well (Harasawa 2005). How much must greenhouse gas emissions be reduced in order to achieve the “below 2 °C” target?

The atmospheric CO_2 concentrations of 450 ppm to 550 ppm have been the frequently cited target levels. More recent research has shown, though, that 550 ppm is too high to keep the average temperature increases below 2 °C (Meinshausen 2005). Even in the most optimistic scenario, studies show that there is a 68% likelihood of the temperature rising more than 2 °C if the atmospheric CO_2 concentrations stabilized at 550 ppm. If concentrations are kept between 400 ppm and 450 ppm, the chances of exceeding the 2 °C target are lowered. A study announced at the “Avoiding Dangerous Climate Change” symposium hosted in February 2005 by the UK government, claimed that achieving the 2 °C target with 60% probability or higher would require the stabilization of greenhouse gas concentrations at the 400 ppm level (Meinshausen 2005). It added that global emissions in 2050 must be halved from the 1990 levels after allowing them to peak in 2015.

What has been Japan's reaction to these points? Yasuaki Hijioka claims that greenhouse gas concentrations must not exceed 475 ppm to achieve the 2 °C target, adding that this requires Japan to reduce emissions by 10% in 2020 and by half in 2050 compared to the 1990 levels (Hijioka 2005). Yuzuru Matsuoka believes, furthermore, that 2050 emissions must be slashed by 80% compared to the 1990 levels in order to achieve the concentration of 475 ppm (Matsuoka 2005).

One can thus see that, even when there is agreement on the 2 °C target, there are differences among scientists regarding stabilization levels for greenhouse gas concentrations and the emission reductions necessary to achieve those levels. Nonetheless, there is accumulating scientific evidence on the validity of the 2 °C benchmark, and broad agreement is forming on long-term needs for 50% reductions by 2050, far in excess of the Kyoto Protocol targets. Given these scientific findings, the Japanese government needs to establish a long-term emissions reduction target and chart a roadmap toward that goal. In this process, the reductions target identified in the Kyoto Protocol should be repositioned as a milestone indicating the way toward a much bigger goal.

Thus we need to reorient our perspective to consider not just how to ride out the First Commitment Period under the Kyoto Protocol but also how to prevent greenhouse gases from causing irreversible damage in a much longer timeframe. In addition to a long-term goal, there is a need for shorter-term targets consistent with that goal. Indeed, the UK and Germany already have long-term goals extending to 2050 as part of the EU burden-sharing mechanism to meet the Kyoto Protocol targets. It is time for Japan, too, to transcend the short-term targets of the Kyoto Protocol and to address longer-term issues, pursuing strategic uniformity in its climate change policy. An emissions trading scheme should be viewed as a centerpiece of such a "post-Kyoto" policy.

2.1.2.2 Establishing a cap and initial allowances

Given the above considerations, determining caps for the various sectors targeted in an emissions trading scheme requires, first, the establishment of a cap for Japan as a whole. A ceiling on emissions must then be set for each sector within that framework, a task that involves spreading the responsibility for emission reductions equitably among the sectors in an emissions trading scheme and those outside of it.

This report positions Japan's reduction target in the Kyoto Protocol as a milestone toward a long-term goal and considers the design of a trading scheme from the viewpoint of achieving, for the time being, the short-term target. The emission cap would consequently conform to the Kyoto Protocol Target Achievement Plan. The emission levels used in the discussions below should be understood to be the figures referred to in adopting the Plan. The establishment of caps requires the following steps.

(1) Establishing a greenhouse gas emissions cap for Japan as a whole

The emissions allowed for Japan correspond to the reduction obligations prescribed in the Kyoto Protocol. Thus a 6% reduction from 1990 levels means a cap of 1.163 billion tons (CO_2 equivalent).

(2) Establishing a cap on CO_2 emissions

While the Kyoto Protocol's targets are for six greenhouse gases, we seek an emissions trading scheme covering just CO_2 for the time being, just as is the case in Europe. This is because coverage of all six gases would require great accuracy in monitoring efforts and because an overwhelming share of the greenhouse gases emitted is claimed by CO_2. Indeed, Table 1-1 and Figure 1-1 show that CO_2's percentage of total greenhouse gas emissions in fiscal 2005 was 95%; unlike methane, nitrogen oxide, and the three groups of fluorinated gases, whose emissions are declining, moreover, CO_2 emissions are on the rise. This is not to exclude the other greenhouse gases from emissions trading, though; once the accuracy of monitoring technologies are improved, they should also be included in the scheme.

The Target Achievement Plan seeks to reduce CO_2 emissions to 1.126 billion tons (energy-originated emissions accounting for 1.056 billion tons and nonenergy-originated emissions for 70 million tons) by 2010. This report, too, will consider these figures to be the targets to be achieved in setting a cap for an emissions trading scheme.

(3) Establishing a CO_2 cap for each sector

Once a cap for Japan as a whole is established, there is a need to set a cap for the sectors covered by an emissions trading scheme. Properly speaking, an overall cap for CO_2 should be considered with the potential for reducing non-CO_2 greenhouse gases and the use of carbon sinks and Kyoto mechanisms. Particularly with regard to sinks, the Target Achievement Plan's call for 3.9% absorption through such sinks (3.8% following an August 30, 2006, data revision) is thought difficult to attain. These details are beyond the scope of this report, however, so as a provisional measure, the arguments below will be premised on the CO_2 reductions assumed under the Target Achievement Plan. Should the absorption of CO_2 turn out to be lower than assumed, the cap may have to be more stringently set (that is, lowered). Even in such a scenario, though, the principles used in establishing the cap will remain unchanged, so it should not significantly influence the gist of our proposal.

In the light of the above, there is a need to set caps on the sectors covered by the emissions trading scheme — namely, the industrial, energy — conversion, and industrial process sectors-and also consider how the other sectors should be made to share in the emissions-reducing efforts. The following discussions focus on how this may be accomplished.

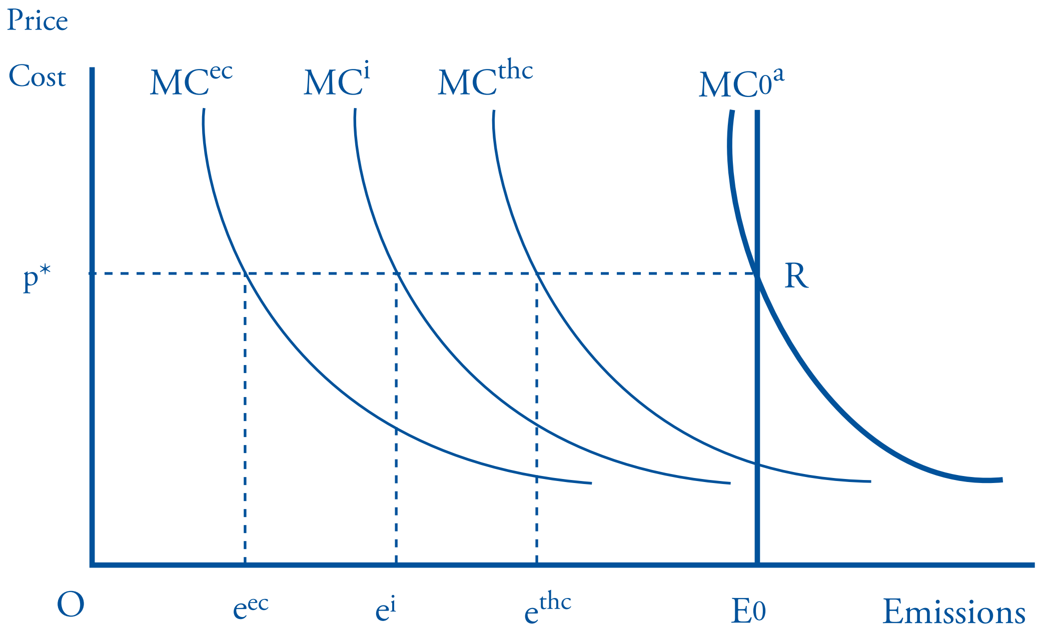
Sharing emission reduction efforts between sectors

The principles that climate change policies should incorporate are, as described in Chapter 1, certainty as an environment policy, cost-effectiveness, and incentives for technological innovation. Another important factor is a standard for fairness. The merits of the initial allowance method adopted can be gauged by the extent to which they conform to these principles. As noted above, the first step in allocating emission allowances is to divide the emission — reducing efforts between the participating sectors — the industrial, energy-conversion, and industrial process sectors-and the nonparticipating ones, including the household, transport, and commercial sectors. Discussions on this point will begin with how the efforts can be shared so as to meet the needs for certainty as an environment policy and cost-effectiveness.

Figure 2-2 indicates the methods by which emission-reducing efforts can be shared to meet the emission caps at least cost. The "MC" in the graph refers to marginal cost. The superscript letters correspond to the respective sectors: "ec" for energy-conversion, "i" for industrial, and "thc" for transport-household-commercial. The marginal cost for all sectors is indicated with an "a." If E_0 is taken as the CO_2 emission cap for the country as a whole, then we can assume that the government of Japan would allocate allowances whose total equals E_0. Because the supply of allowances is fixed at E_0, regardless of the price, the supply curve can be expressed as a vertical line. By contrast, MC_0^a is an expression of the demand for allowances in the economy as a whole, and its price is determined by the equilibrium of supply and demand, shown as p*. Under such a system, emissions in each sector can most appropriately be set at the level where the marginal cost equals the price of emission allowances. Emission levels can thus be set at e^{ec} for the energy-conversion sector, e^i for the industrial sector, and at e^{thc} for the other sectors, and this will dictate the allowances provided. At this point, the marginal emission-reduction cost would be balanced among the various sectors, thus attaining the E_0 emission cap at least cost.

In actual practice, however, the transport, household, and commercial sectors will not participate in the scheme, so a cost-effective, market-dictated allocation of allowances will not be achieved automatically. Thus, if the government can ascertain the value of p* (equilibrium emission price) based on estimates of marginal emission-reduction costs MC^{ec}, MC^{i}, MC^{thc}, and M_0^a, optimum emissions for each sector can be established as eec, ei, and ethc, and these figures can be regarded as the reduction targets for the respective sectors. The problem with this approach, though, is that the marginal cost to individual economic entities must be collected and aggregated in order to obtain the marginal cost curves of Figure 2-2; collecting such data in any suitable manner, unfortunately, is a highly daunting task. Even if the MC curves in Figure 2-2 were to be obtained, moreover, they would be nothing more than rough estimates, and the values they represent would lack the certainty of hard data. Asking participants to agree on the allocation of allowances based on imprecise estimates would prove to be quite difficult.

Figure 2-2: Sharing Emission Reduction Efforts between Sectors



Source: Author

Methods for allocating initial allowances

If a cost-effective approach to sharing reduction efforts among the various sectors remains elusive, the next best choice would be to adopt the grandfathering method, which would ensure effectiveness as an environmental policy and maintain a degree of fairness, facilitating its acceptance among participants. This method allocates allowances according to past levels of emissions, specifically, the average emissions over several years prior to the introduction of an emissions trading scheme. Because it is based on past performance, the grandfathering method does not induce changes to existing vested interests and is quite likely to gain social consensus. This method also allows for methodological consistency in basing all allocations-from the macro-level among the various sectors to the micro-level of individual facilities-on averages of past performance. It is not, however, the only approach in initial allocations. In fact, there are many problems associated with grandfathering as well, and we believe that the method of allocations will need to be switched at a future date.

Before discussing specific allocation methods under the grandfathering approach, we wish to relativize this approach by reviewing the various ways that initial allowances may be allocated. First of all, allocations can be done either for a charge or for free. The former refers to the use of auctions to allocate allowances, and it is perhaps the best format from a theoretical viewpoint. There are various ways of conducting auctions, moreover, but a common advantage is that this approach enables cost-efficient allocations. Furthermore, it can be implemented even when the government does not have full access to information, and it does not allow room for arbitrary, political intervention.

In the above section, it was shown that Figure 2-2 could, in theory, be used to divide reduction efforts among various sectors in a cost-effective way but that it would be difficult to do so in practice due to information constraints. If auctions could be held, though, in which all sectors participated, this difficulty would be eliminated. The government need merely supply E_0 worth of allowances and invite bids for them. Appropriate emission allowances would then be sold for price p*. This is the first advantage of the auction method. The second advantage is that the government need not possess information on marginal costs in each sector, for the bidding process would automatically lead to the optimum allocation of emission allowances. Our emissions trading proposal targets the industrial, industrial-process, and energy-conversion sectors, so it does not anticipate utilizing the auction method for allocating allowances for sectors included in the emissions trading scheme nor for those that are excluded, such as household, commercial, and transport. The strength of this method would be most pronounced when allocating initial allowances for the sectors covered by the emissions trading scheme.

By aptly designing the auction method, there would be no need for political intervention in allowance allocation. This constitutes the third advantage of this approach. As the emissions trading schemes implemented to date indicate, free allocations give rise to a conflict of interests over allocation rules and invite heavy lobbying. As a result, the allocations are made in neither a cost-effective nor equitable manner, and groups with the biggest voices frequently wind up reaping the biggest benefits. An auction approach is desirable as a means of preventing such fighting over the spoils.

The only problem is that this would impose a heavy financial burden on the participants. This is why few emissions trading schemes implemented thus far have embraced this approach. There is thus a need to consider how an auction system can be introduced so that it would gain social approval.

The other method of initial allocation is to provide allowances free of charge. Grandfathering is not the only choice under such an approach. An alternative is the "benchmark method." This involves establishing baseline emissions under standard production methods for each industry and allocating allowances based on these baselines. When actual emissions are higher than the benchmark, this would exceed the allocated allowances, while emissions that are lower than the benchmark would result in a surplus of allowances. One characteristic of the benchmark method is that it rewards companies that reduce emissions beyond average levels, thus providing them incentives to pursue above-average reductions. Under the grandfathering method, by contrast, companies with large emissions in the past will be allocated bigger allowances, thus actually dampening the desire to lower emissions. This is the biggest difference between the two formats and the point on which the benchmark approach is superior to grandfathering.

The benchmark method has the drawback of not being ready for immediate implementation, however, for the core element of this approach — the establishment of benchmarks — would be quite difficult at this time. In order to establish benchmarks, each industry must first agree on what constitutes "standard production levels." Conducting surveys to ascertain such standards would be highly time consuming and would require massive volumes of information. An additional issue is the extent to which the benchmarks should apply, whether they need only be established for such large industrial groupings as steel, chemicals, and shipbuilding or whether they should be more finely tuned, say, to cover different areas of the steel industry that use basically different technologies. On the other hand, if the benchmarks are defined too narrowly, there would be too few entities to compare, and they would cease to function as comparative standards. Before a benchmark approach can be adopted, therefore, prior agreements would be needed on many items, and great volumes of information would have to be collected, so this method is not ready for implementation. Its adoption should be considered at a future date.

For the reasons outlined above, we believe that there is no alternative to the grandfathering method in making initial allocations, even if it is desirable to shift to the auction or benchmark approaches at a later point in time. We will thus premise all subsequent discussions on this approach, ranging from the allocation of macro-level emission reductions among the various sectors to the micro-level allowances for individual facilities.

Initial allowances under the grandfathering method

Table 2-1 describes the process leading to the derivation of emission caps. This report positions the emissions trading scheme as a policy instrument enabling the fulfillment of the Target Achievement Plan, thus it takes the CO_2 emissions prescribed in the Plan as a point of departure in designing a trading scheme. The target date is 2010. As the table shows, the combined energy and nonenergy CO_2 emissions are 1.126 billion tons ("A-3" in Table 2-1).

The next process in the derivation of emissions caps is to allot the 1.126 billion tons between the sectors participating in the trading scheme and those that are not. The Target Achievement Plan shows "indicative targets" for each sector, as shown in Table 1-2. The allocations may follow these targets, but this will not be adopted in this proposal. The reason for this is that there are no clear indications of the process by which the "indicative targets" were determined, and the Target Achievement Plan does not cite any rules on their allotment. Even if there were fixed rules, the Plan is unclear about how fairness was maintained in arriving at the figures.

Table 2-1: Establishing the Cap (1)

A. Emission targets (2010) as set out in the Kyoto Protocol Target Achievement Plan	
(1) Energy source CO_2 emissions	1,056
(2) Non-energy source CO_2 emissions	70
(3) Total [(1)+(2)]	1,126
B. Cap for the energy conversion, industry and industrial process sectors	710
C. Exemptions from the cap	
(4) Auction reserve (5%)	35.5
(5) New entrants reserve (NER) (5%)	35.5
(6) Cut off criteria of SMEs (not considered here)	0
D. Final Cap [B-(4)-(5)-(6)]	639

Source: Author

There are various approaches to cost-free allocation. The grandfathering method adopted here can be considered fair in that it attaches value to past emission performance and allots allowances in proportion to those results. There is a need to determine the base years in calculating past results. While any single year may be used, there is the possibility of emissions being influenced by the business cycle or contingent factors, so longer spans are desirable. The National Allocation Plan (NAP) of the EU's emissions trading scheme (EU ETS) uses a span of three to five years. This proposal envisions a domestic trading scheme being introduced in 2008, and the five years through 2012 — corresponding to the Kyoto Protocol's commitment period — being the first trading period. The emission targets, though, are based on levels in 2010. If a trading scheme is to be launched in 2008, actual emissions during the five years between 2002 and 2006 — or at least the three years between 2004 and 2006 — should be regarded as the benchmark on which to base the allocation of allowances.

Based on the preliminary emission statistics for 2005, the base years can be set at 2000 to 2004. The reason a comparatively longer span of five years has been adopted, rather than three years, is to reward "early action" regarding emission reductions. If a too recent and short span is used as the base years, the efforts made to reduce emissions in earlier years would be ignored, as emitters who had taken no action at all would be allocated higher allowances. The National Allocation Plan adopted in Germany used a relatively short period of 2000 to 2002 as the base years and was thus unable to reward early action. As an alternative, it incorporated an early action provision in its initial allocations. This, unfortunately, led to greater arbitrariness and a sense of unfairness. Drawing a lesson from this experience, Germany, in its second NAP, was expected to eliminate the special early action clause. The UK, by contrast, adopted 1998 to 2003 as the base years in its NAP, a relatively long span of six years. This in itself took early action into consideration, and thus there was no need for a special provision. The UK's approach does not complicate the rules for initial allocation, and it can be regarded as being more desirable.

Table 2-2 explains how allocations can be made to the various sectors under the grandfathering method, using 2000 to 2004 as the base years. First, the average emissions for each sector during the base years must be derived. For example, in the energy-conversion sector, the average was 365 million tons. Second, the average for all sectors is calculated (1.28 billion tons). This will give each sector's share of total emissions during the base period. The figure for the energy-conversion sector, for instance, is 29%. This will be perceived as the past performance for this sector, which will be entitled to allowances corresponding to this share. Japan's emissions target for 2010 is 1.126 billion tons; thus 327 million tons, or 29% of the total figure, will be allocated to the energy-conversion sector.

The sum of the emission allowances for the energy-conversion (327 million tons), industrial (338 million tons), and the industrial-process (45 million tons) sectors, as shown in Table 2-2, will be the maximum permitted emissions for the participating sectors in the domestic emissions trading scheme. This sum is 710 million tons, as indicated in line B of Table 2-1 giving the emissions volume for the industrial, energy-conversion, and industrial-process sectors. Strictly speaking, though, at this stage this volume is not yet a "cap," since various emissions need to be deducted from this figure.

Table 2-2: Establishing the Cap (2)

Sector	1990	2000	2001	2002	2003	2004	Average Emissions (2000-04)	Share (%)	Allocated Emissions	Allocated Allowances (Share)
Energy Conversion	318	348	340	371	385	382	365	29	327	294 (46%)
Industry	390	387	377	384	384	389	384	30	338	307 (48%)
Transport	211	259	262	257	255	254	257	20	225	
Commercial and others	84	101	107	111	108	106	107	9	101	
Residential	57	69	66	68	65	65	67	5	56	
Industrial Process	62	57	55	53	52	53	54	4	45	38 (6%)
Waste	23	33	3	33	36	36	34	3	34	
Others	0	0	0	0	0	0	0	0	0	
Total	1,144	1,255	1,239	1,277	1,284	1,268	100	1,126	639 (100%)	

Source: Author

Auctions and new emission sources

The first will be the allowances to be allotted through auctions. As described earlier, allowances will, as a rule, be made on a grandfathering basis. We believe, though, that of the 710 million tons allotted to the industrial, energy-conversion, and industrial-process sectors, 5% (35.5 million tons) should be distributed through auctions. The EU emissions trading scheme allowed for the auctioning of 5% or less of allowances during the first trading period (2005 to 2007) and 10% or less during the second period (2008 to 2010). Although most countries never actually used the auction option during the first period, many EU officials have an increasingly positive view of auctions based on their grandfathering experience. A proposal has been made in the UK to sell off 7% of allowances during the second trading period. The reason for the higher assessment is due to the many problems with the grandfathering approach. EU officials and researchers are increasingly of the opinion that the grandfathering method should be switched to either the auction or benchmark approach. Their views are based on their awareness of the negative aspects of the grandfathering format.

If this lesson is to be put to good use, one should not allocate all allowances through grandfathering but, in the first trading period, reserve some to be auctioned off. In the second and subsequent periods, the share can be gradually raised. If the initial share is just 5%, costs for the participants should not become prohibitive. From the viewpoint of building an optimum auction system, allotments through auctions should be included in the emissions trading scheme from the first trading period on an "experimental" basis. For the above reasons, 5% of emissions allotted to the participating sectors should be subtracted and offered for a charge ("C-4" in Table 2-1).

The next problem is the treatment of new emission sources. In a nutshell, a new entrants reserve (NER) must be set aside from the caps allocated to each sector. Such reserves would enable the equal treatment of existing and new market players and prevent the emissions trading scheme from becoming an obstacle to market entry. Such reserves would be unnecessary if allocations are offered for a charge, since new entrants can purchase the allocations at market prices in the same manner as other companies. But when the allocations are free, however, forcing only new market entrants to purchase allocations would give a competitive advantage to the existing companies. This, in effect, would turn the emissions trading scheme into an obstacle to market entry. In order to resolve this problem, there is a need to provide allocations for free not only to existing emitters but new sources of emissions as well.

Simply allocating more allowances would cause total emission levels to exceed the cap, however. Therefore, we propose that a certain percentage of the cap be held in reserve in advance for new entrants. This would balance out the conditions for competition between existing and new companies, while making sure that the cap is observed.

The problem is determining the proper size of such reserves. There is no single answer to this question. Germany sets aside just 0.6% for new entrants, while the UK maintains a 6.3% reserve. The amount differs according to conditions prevailing in each country and to differences in opinion on initial allowances. Deciding on an NER requires projections about economic growth rates and future industrial trends which are beyond the scope of this proposal. As an ad hoc measure, we propose to set aside 5% from each sector's maximum emissions for new market entrants ("C-5" in Table 2-1).

It is certainly possible, of course, that an NER would later be found to be either inadequate or excessive. Any remaining allocations can be sold on the market. In case of a shortage, on the other hand, the government can purchase and then allocate additional allowances for free to the new entrants if there is some surplus in the government's budget. If such a surplus does not exist, though, the only alternative is to allocate the allowances on a "first come, first served" basis, with allocations coming to an end as soon as there are no more to be distributed. Germany follows the former approach, while the UK employs the latter. This choice is evident from the respective reserves they initially set aside; Germany assumed that the reserves would be used up quickly, and thus had readied additional allowances, while the UK adopted the "first come, first served" rule based on projections of a surplus.

Determining the cap

The final step in determining the cap is to deduct from the trading scheme those emissions of the energy-conversion and industrial sectors that, by rule, are excluded from the scheme. The EU excludes certain industries, such as aluminum, from its scheme for industrial policy and other reasons. There is thus a need to subtract the projected emissions by these industries from the cap. Such deductions will not be included in this proposal, however, for it is premised on the participation of all industries in the energy-conversion and industrial sectors.

There is, though, a need to establish cutoff criteria for smaller emitters. As already noted, the inclusion of innumerable small emitters in the scheme would push up administrative costs, so companies emitting less than a certain cutoff point should be excluded from the scheme. This standard, as earlier noted, can be premised on the Revised Energy Conservation Law, covering up to Type 2 designated factories that use up to 1,500 kl coe of energy per year. Because data on how much emissions this would actually eliminate is currently unavailable, we would cite here only that smaller factories would need to be excluded from the scheme. For the time being our calculations of a cap (setting "C-6" to zero in Table 2-1) would cover all emitters in the relevant sectors.

Having followed the above process, we can finally determine the cap. As Table 2-1 shows, of the 710 million tons ("B" in Table 2-1) in maximum permitted emissions for the industrial, energy-conversion, and industrial-process sectors, deductions for auctions, an NER, and smaller emitters would result in a cap of 629 million tons ("D" in Table 2-1).

2.1.2.3 Allocations to each sub-sector

Once the cap is determined according to the procedures described above, the next step is to allocate allowances to the various sub-sectors in each sector. If the cap of 639 million tons is to be allocated to the energy-conversion, industrial, and industrial-process sectors based on the respective component ratios, the cap for the industrial sector would be 307 million tons, as shown in the second row of the right-hand column in Table 2-2. This cap would further need to be allocated to the steel, chemicals, petroleum and other sub-sectors according to past emission levels. The method for this would basically be the same as that used to allocate initial allowances among the various sectors. In other words, the average emissions for the five years covering 2000 to 2004 would be calculated for each sub-sector, and the share for each within the industrial sector would be derived. Finally, allowances for each sub-sector would be allocated according to the respective shares.

Steel, for instance, had average emissions of 152 million tons over the past five years, according to Table 2-3. This is 40% of emissions of the industrial sector as a whole, so the sub-sector's allowance would be 40% of the sector's 370 million tons. As Table 2-3 shows, steel would be allocated an allowance of 123 million tons.

This is the allocation process that is called the "top-down approach" under the EU ETS and the "macroallocation plan" in Germany, which was adopted in Germany's initial National Allocation Plan (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety 2004). This approach is thoroughly consistent from a methodological viewpoint in that allowances are allocated based on average past emissions. It satisfies the need for fairness, making it likely to gain social consensus, and this is why it has been adopted by many countries within the EU ETS. But there are drawbacks to this method as well, such as the fact that it allocates allowances on the assumption that past emission shares will continue into the future in a similar manner. In reality, however, growth rates and future developments are likely to differ according to industry.

Table 2-3: Allocation of allowances to each sub-sector within ndustry sector

Sector	1990	2000	2001	2002	2003	2004	Average Emissions	Share (%)	Allocated Emissions
Agriculture & Forestry	6	8	9	9	9	10	9	2	6
Fishery	15	8	7	7	6	6	7	2	6
Mining	1	1	1	1	1	1	1	0	0
Construction	13	14	13	12	12	12	13	3	10
Food	13	13	13	12	12	12	12	3	10
Pulp & Paper	26	29	28	28	27	27	28	7	21
Chemical Textiles	10	10	10	10	10	10	10	3	10
Oil Products	11	15	15	15	18	20	16	4	12
Chemical	55	57	55	53	52	52	54	14	43
Glass Wares	3	2	2	2	2	2	2	1	3
Cement & Ceramics	41	38	36	36	38	37	37	10	31
Iron & Steel	150	150	148	153	155	155	152	40	123
Non Ferrous metal	6	3	3	3	3	3	3	1	3
Machinery	18	9	8	8	8	8	8	2	6
Other Industries & SMEs	51	48	47	51	50	53	50	13	40
Duplication Adjustment	-29	-18	-18	-18	-19	-19	-18	-5	-17
Total	390	387	377	384	384	389	384	100	307

Unit: Mt-CO_2

Source: Greenhouse Gas Inventory Office of Japan [August 30, 2006]

There may be a need, therefore, to account for differences in growth rates among various industries when calculating allocations, as the UK did in its National Allocation Plan. This means allocating greater allowances to growth industries than under a simple grandfathering approach. Indeed, the UK projected future emissions levels for each industry according to a model calculation and made allocations accordingly. This, interestingly, is in contrast to the method adopted by Germany. The NAPs of European countries, including those of the UK and Germany, generally also include the impact of existing energy policies and climate change policies. The UK also takes note of the international competition each industry is exposed to and how much further emission reductions can be expected from each in assessing the allocations. Table 2-4 shows the industrial sector's allocations under the UK's initial NAP by sub-sector. The right-hand column shows the reductions the NAP calls for compared to 2003 emission levels as a result of the allocations. This, like the figures in Table 3-3, shows that not all sub-sectors are being asked to make reductions at a uniform rate. In fact, while quite a number of sub-sectors are allowed to actually increase their emissions, "power stations" are asked to make a hefty 21% reduction. The reasons cited for this are that the power sector is not exposed to international competition and that there is much greater room for further reductions in comparison with other sub-sectors (the UK Government 2005, p. 21).

Even though the UK's NAP is based on objective projections of emission trends, there is still considerable room for arbitrary judgment by the government, and questions remain whether it really ensures fairness. The allocation is most likely the result of an amalgamation of both industrial and climate change policies

Table 2-4: Allocation in the industry sector in the Natioal Allocation Plan of UK

	Annual allocation before subtracting NER	% of sector total allocated to New Entrant Reserve (NER)	Annual allocation to existing installations (i.e. after NER)	Average annual emissions (1998-2003)	Annual emissions (2003)	% change between annual emission in 2003 and total allocation
	MtCO2	%	MtCO2	MtCO2	MtCO2	%
Power Stations	136.9	4.6%	130.6	155.01	174.37	-21.5%
Refineries	19.8	2.0%	19.4	17.74	18.03	9.8%
Offshore	19.1	8.1%	17.5	17.72	17.47	9.1%
Iron & Steel	23.7	15.6%	20.0	18.33	19.85	19.4%
Cement	11.2	14.3%	9.6	8.84	9.71	15.7%
Chemicals	10.4	8.8%	9.4	9.02	9.41	10.0%
Pulp & Paper	5.1	2.2%	4.9	3.66	4.53	11.6%
Food, Drink & Tobacco	3.9	3.7%	3.8	3.08	3.95	-1.3%
Non-Ferrous	3.1	2.1%	3.0	2.72	2.80	9.1%
Lime	2.7	1.4%	2.6	2.29	2.22	20.3%
Glass	2.2	7.9%	2.0	1.72	1.92	13.9%
Services	2.1	2.9%	2.0	1.78	2.03	1.6%
Other Oil & gas	1.9	18.3%	1.6	1.42	1.92	1.5%
Ceramics	1.8	4.3%	1.8	1.73	1.79	3.4%
Engineering & Vehicles	1.3	2.7%	1.3	1.08	1.19	8.6%
Other	0.4	10.5%	0.4	0.34	0.38	4.7%
TOTAL	245.43	6.3%	229.85	245.37	271.55	-9.6%

Source: The UK Government (2005), p. 20, Table 1

2.1.2.4 Allocations to individual facilities

Implementing an emissions trading system requires the allocation of allowances not just to the sub-sectors but also to individual facilities. How should this be carried out? The sum of the allowances allocated to such facilities must match the cap allocated to that industry. How should this be ensured? This, needless to say, requires the conformity of the top-down and bottom-up approaches. Under Germany's NAP, this would be described as the conformity of the macroallocation and microallocation plans.

Determining the allowances at the level of individual facilities, first of all, requires a bottom-up approach, as described below. Allowances for individual facilities are calculated according to the average emissions over the five-year period from 2000 to 2004, corresponding to the top-down approach. The difference with the top-down approach is that individual facilities are initially awarded allocations matching past emission levels. These allocations for all facilities in the same sub-sector are then added together. Naturally, this sum will exceed the cap for that sub-sector, as indicated in Table 2-1, since it is simply the sum of the average emissions levels over the past five years. To eliminate this discrepancy between the bottom-up and top-down approaches, a "compliance factor" is applied.

This is defined as the ratio of the cap for a particular sub-sector to average emission levels for the past five years in that sub-sector. For example, if the cap for a certain sub-sector is 90 and the average emissions over the past five years is 100, the compliance factor is 0.9. Once this factor for each industry is established, it is then multiplied against the average emissions over the past five years for each facility to obtain that facility's actual emission allowance in a bottom-up approach. By applying the compliance factor to each sub-sector, the top-down and bottom-up approaches can be made to conform to one another. The above discussions may be summarized in the following equations:

*Allowances provided to facility = average emissions of that facility over the past five years * compliance factor*

Compliance factor = cap for sub-sector / average emissions of the sub-sector over the past five years

The remaining consideration regarding allocations at the individual facility level is how to address the expansion or closure of facilities. So far, allocations had been considered from the viewpoint of allocating initial allowances to existing emission sources. Once an emissions trading scheme gets underway, though, facilities will be expanded or closed down with the passage of time, and the allowances initially allocated will have to be adjusted. The following rules may be useful in dealing with this issue.

(1) Rules for new entrants

As noted above, new companies that are not initially part of an emissions trading scheme will be allocated allowances from the new entrants reserve (NER) when they join the system. There are also bound to be companies that are not part of the scheme when it is launched but later become participants. These new entrants will be allocated allowances according to a benchmark calculated according to the "best available technology" within each sub-sector. There are two reasons for applying the best-available-technology standard under a benchmark approach.

The first is that in the case of new entrants, data on past emission levels is unavailable. For this reason, the grandfathering method cannot be adopted. It is possible to utilize the auction method, but because existing companies had been allocated allowances for free, the need to purchase allowances when they join an emissions trading scheme could become a obstacle to market entry. In order to circumvent this problem, allowances should preferably be allocated for free to new entrants as well under the benchmark approach.

The second reason is that if a benchmark approach is adopted for new entrants, the most advanced and best available technology in that sub-sector should be regarded as the benchmark, rather than standard technologies. Standard, average technologies can be used as benchmarks when both existing and new companies in a sub-sector are being targeted. But when the benchmark approach is being applied only to new entrants, the best available technologies should be adopted.

(2) Rules for transfers and closures

There is a need, moreover, to consider how to deal with the allowances allocated to factories and other facilities that are closed down (closure rule). There are two basic ways of dealing with this situation, the first being that the allowance initially allocated to a facility is left in the hands of that facility during the current and next trading period (when a company shuts down a factory during the first trading period, for instance, the allowances for that factory would be held by the company until the second trading period). The company would be free to transfer that allowance to another facility (transfer rule). The other approach is to require companies that shut down factories to return the remaining allowances at the end of the current trading period.

For companies to shut down old, inefficient production facilities and build new, highly efficient ones is in keeping with the goal of reducing emissions via an emissions trading scheme. So the former approach, which can encourage such activities, is essentially more desirable. If the latter is adopted, moreover, companies may be tempted to keep old factories running at very low rates of capacity utilization — depending on how "closure" is defined — either because they hope to expand those facilities at a later date or because they want to sell off allowances when they will fetch a higher price. This is an issue called "cold reserve." In order to address this problem, the German government established what is known as a "capacity utilization adjustment rule" under which plants operating at very low capacity utilization rates (less than 20%) are effectively regarded as being "closed." But as with the rule for new entrants, the Germany government and the European Commission are involved in a dispute over the appropriateness of this rule. To avoid such disputes, the former transfer rule is probably a more desirable methodology.

There is a need to take note of the following two points, though, even if companies are permitted to maintain their allowances after closure and to transfer their allowances to other plants.

The first point involves the destination of the transferred allowances. In case the allowance of a closed-down plant is maintained and transferred, it may be transferred to either to another existing plant or a newly built one. If they are transferred to a new, more efficient plant, this matches the desired direction of the emissions trading scheme, and there would be no problems. If transfers to existing facilities are to be recognized, however, there is a chance that this would encourage emissions leakage outside Japan. A company that transfers the allowance of a shut-down plant to another plant in Japan, for example, would actually be able to expand emissions if that company were to build an offshore plant using the production facilities of the plant that was closed down. Thus, in order for companies to transfer an allowance to an existing plant, they should be made to prove that the production facilities of the shut-down plant have also been moved to that plant.

The second point is the need to strike a balance with the system governing new entrants, as described above. If new emission sources are to be allocated allowances for free (under the benchmark method), the provision of additional allowances in accordance with the transfer rule could raise questions of fairness vis-á-vis existing sources. Transfers of allowances to new plants must thus be discounted by a certain percentage. While encouraging switchovers to more efficient facilities, the trading scheme must be careful not to allocate excessive allowances.

Considerations like the allocation rules for new entrants and rules for closure and transfer tend to be regarded as minor details of an emissions trading scheme, but they can be of enormous importance from the viewpoint of providing incentives for emissions reduction. The interaction of these rules must be thus carefully considered in designing an emissions trading scheme.

The above explanation covers allocations to individual facilities. All major points regarding the initial allocation of allowances under an emissions trading scheme have been covered. The following section will therefore address the main aspects of a trading scheme's operation except for the initial allocation of allowances.

2.1.2.5 Banking, borrowing, penalties, and the maximum price system

Banking refers to the rule whereby the allowances that can be shown to be in excess of actual emissions at the end of a trading period can be carried over and used in addition to the allowances allocated during the ensuing trading period. Borrowing, on the other hand, is a rule enabling trading scheme participants to borrow allocations from the next trading period when their emissions exceed current allowances, rather than applying penalties for noncompliance. These rules can accommodate temporary and incidental factors, like those resulting from the business cycle or climate change, and are thus quite convenient from the participants' point of view. There may also be cases where investments in emission-reduction technologies are best made not during the current trading period but in the ensuing one. If an emitter is flexibly allowed to compensate for excess emissions during the current period by borrowing allowances from the next period-when emissions must be curtailed by the amount borrowed-the cap covering the two trading periods can be maintained while evening out the financial burden for the emitters.

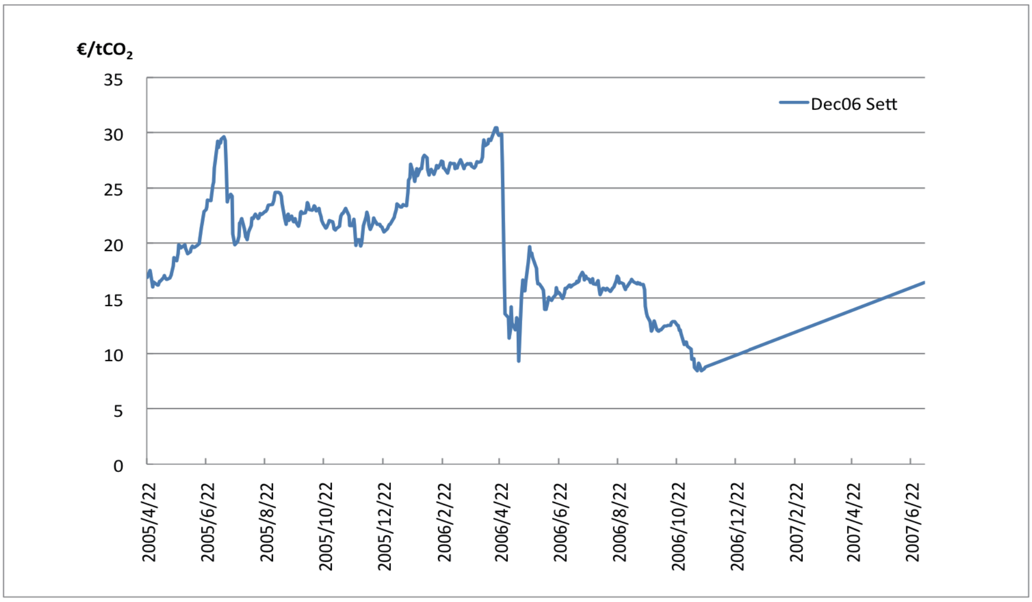
Banking and borrowing are thus desirable from the viewpoint of ensuring the "efficiency of diachronic resource allocation," but they should be avoided if they jeopardize the effectiveness of a trading scheme as an environmental policy. Granting emitters unlimited borrowing privileges, for instance, would rob all meaning of establishing a cap. And a time limit on the "repayment" of allowances would have to be set. In terms of banking, too, companies should not be allowed to claim any remaining allowances from the initial trading period as a vested right that they can automatically carry over to the next trading period. Since the allowances granted in the first trading period are based on past emission records, the initial allocations in the second period should — even when the grandfathering approach is maintained — be properly based on a more recent span of years. The vested rights awarded in the first trading period, after all, dissipate at the end of that period. As a matter of fact, the initial allocations for the second period may not adopt the grandfathering method; there is a possibility that the auction or benchmark approach may be used instead. For these reasons, it is natural to assume that the allowances allocated in the first trading period are valid only for that period, and that this vested right dissipates with the start of the second period.

As a rule, then, both banking and borrowing shall not be permitted across different trading periods. Participants will be free to conduct banking and borrowing transactions within a single trading period, but surplus allowances may not be carried over from the current to the next trading period, and allowances may not be borrowed in advance from the next period.

Even with the enactment of the above rules, it is still necessary to establish penalty provisions for cases when emission levels do not match the allowances. There are two types penalties, the first being administered when emission records have been falsified, and the second being meted out when emissions exceed allowances. Here, we will discuss the measures that should be taken in the latter case of noncompliance. Under the EU ETS, emissions exceeding allowances were penalized at a rate of 40 euros per ton of CO_2 in the first trading period and of 100 euros per ton in the second period. What is the significance of these two rates?

Figure 2-3 shows the changes in the price of allowances under the EU ETS. While price fluctuations are quite volatile, they generally ranged between 10 and 30 euros. In this light, the price of 40 euros as a penalty in the first trading period was not excessively high. There was even the potential of the market price exceeding the penalty price. In such a case, the penalty would serve as a de facto "ceiling," and the likelihood of actual emissions exceeding the cap would become high. This is because paying penalties for excess emissions may be cheaper than purchasing allowances under the trading scheme.

Figure 2-3: Trend in the Price of EU Allowance



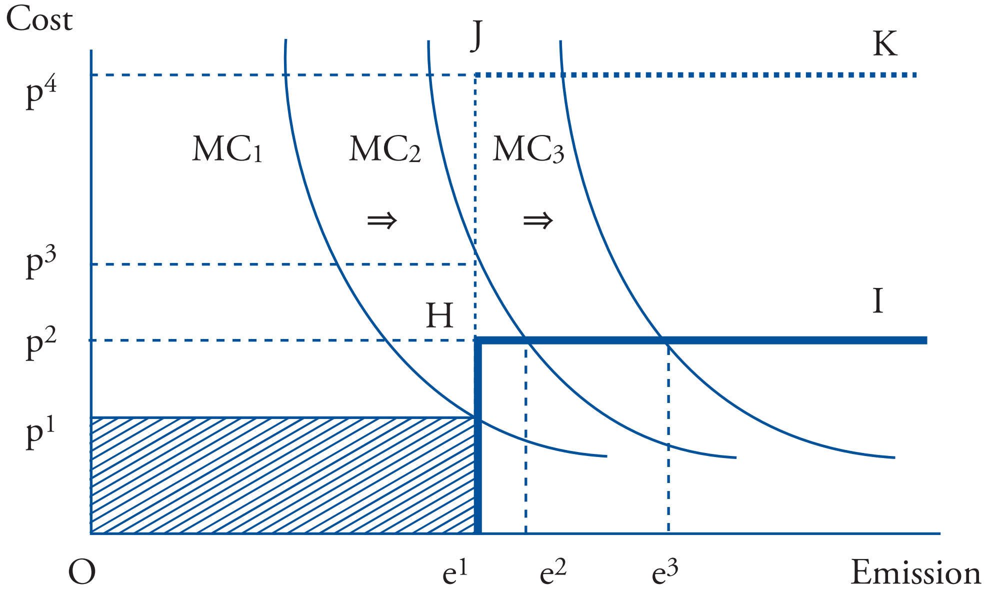
Source: FCX CFI Features Contracts: Historic Data 2005&2006

Figure 2-4, meanwhile, shows the relationship between the market price and the penalty. Currently, the cap is established at level e^1, with the supply curve for allowances being shown as perpendicular line e^1J. Assuming that the marginal emissions reduction cost for the economy as a whole (= supply-demand curve for allowances) stands at MC_1. In such a case, the market price at which the supply and demand for allowances reaches equilibrium will be p^1. From the EU ETS's experience, p^1 can vary between 10 euros and 30 euros. p^2, meanwhile, indicates the penalty, which during the first trading period was set at 40 euros. If, for some reason, demand for allowances suddenly shot up, and the supply-demand curve shifted from MC_1 to MC_2, the price would also shift from p^1 to p^3, exceeding the 40-euro mark. In such a case, it would make more economic sense for an emitter to pay the penalty than purchase allowances on the market. Emission levels would then reach e^2, the point where p^2 (40 euros) meets MC_2, and emissions would burst through the cap.

The high price for the penalty in the second trading period was probably intended — based on past price movements — to ensure that the equilibrium price would not rise above it. In Figure 2-4, p^4 corresponds to 100 euros. Under these conditions, the equilibrium price would be set at p^3 while keeping cap e^1 intact. To make sure the cap functions effectively, the penalty should be set at a level around four to five times the expected market price of the emission allowances. In case emissions exceed allowances, there is the option of deducting that volume from the initial allocations in the ensuing trading period, like in the EU ETS. This would ensure that the cap is maintained, even if at a belated date.

In the United States, meanwhile, there was great concern about an escalation of prices; in order to keep prices down, the penalty was regarded positively as offering a "safety valve" (Kopp, Morgenstern, Pizer, and Toman 1999). Although the United States has withdrawn from the Kyoto Protocol, the biggest initial worry among US officials was that the cost of clearing a numerical emissions reduction target would be staggering if the United States were required to comply with such a target. As the "safety valve" label attests, one objective of setting a price for noncompliance was to set a limit on the cost of global warming countermeasures, which threatened to rise uncontrollably.

Figure 2-4: Penalty and the market price



Source:: Author

If the "safety valve" concept is applied to Figure 2-4, p^2 would be established as a ceiling to prevent allowance prices from skyrocketing once a limit is set on the total volume of emissions. This, in effect, enables emitters to purchase an unlimited volume of allowances at this price. In practical terms, this means that the curb on emissions volume disappears should the market price rise above p^2, and total emissions will climb to e^2, where p^2 and the supply-demand curve MC_2 converge. Should demand expand further, pushing the supply-demand curve to MC_3, emissions volume, too, will increase to e^3. In other words, this proposal works as a cap-and-trade model as long as market prices remain within a range of tolerance. When the price moves beyond the ceiling, the cap will automatically be abandoned, and the price of allowances will become fixed at the level of the ceiling. It is a policy mix involving restrictions on price and emissions volume, but it is plagued by the fact that controls on emissions will disappear when the traded price moves above the ceiling.

From such a "safety valve" point of view, the ceiling should not be set high at p^3, which is intended enforce compliance with the cap, but at p^2, which is a more reasonable level for the price of allowances. The penalty for noncompliance, then, will be determined by the meaning ascribed to this price. Our proposal for an emissions trading scheme attaches great importance to its certainty as an environment policy, so we advocate setting the penalty at p^3 levels, which would guarantee that the cap on total emissions is observed.

2.1.2.6 Interlinking emissions trading schemes and the formation of a global carbon market

Emissions trading schemes for greenhouse gases have been proliferating around the world in recent years. The first such scheme was a short-term system launched in 2000 in Denmark targeting the country's electric power sector. This was followed by the UK ETS, implemented in 2002 in the UK, and the EU ETS, begun in

2005. Emissions trading schemes have been introduced in Australia and the United States as well at the local government level, and their geographical scope appears to be expanding. Many more countries and regions are expected to introduce similar schemes in the coming years.

One issue raised by these trends is the treatment of credits created by the Clean Development Mechanism (called Certified Emission Reduction units, or CERs) implemented in developing countries and the Joint Implementation scheme executed among the countries that have ratified the Kyoto Protocol (called Emission Reduction Units, or ERUs). These systems differ from emissions trading schemes in that they are baseline-and-credit systems, rather than being cap and trade. But they are part of the Kyoto Mechanisms, and the credits earned thereby have already been assigned prices as objects of trading. How should these project-based credits be incorporated into the framework is a major consideration in designing an emissions trading scheme.

The various emissions trading schemes around the world may one day become interlinked, giving rise to a global carbon market. Connecting different schemes raises the possibility of diluting their effectiveness as an environmental policy, reducing cost-effectiveness, and sacrificing fairness, and so a close examination is required. Priority is currently being given to creating emissions trading schemes within each country, so the issue of interlinkage is not an immediate concern. But thought should nonetheless be given to how a global carbon market may one day take shape, and issues of linkage to such a market will be examined below.

Problems concerning links to a global scheme can be categorized in the following ways.

(1) Links among countries that have ratified the Kyoto Protocol

  A. Linking to the EU ETS and similar cap-and-trade schemes
  B. Linking to baseline-and-credit schemes

(2) Handling of the Clean Development Mechanism (CDM) and Joint Implementation (JI)

(3) Links with countries that have not ratified the Kyoto Protocol

First of all, the credits emerging from the emissions trading schemes of Kyoto-ratifying countries are backed as "Assigned Amount Units" (AAUs), so there should be few problems. The EU ETS and the similar scheme in Norway are cap-and-trade varieties, and they can be deemed as being compatible with the scheme being proposed here. Links are possible with baseline-and-credit systems as well, moreover, if the credits engendered thereby are backed as AAUs.

The second consideration is the handling of credits earned through CDM and JI projects. Generally speaking, it would be desirable for such credits to be traded in a domestic emissions trading scheme, since this would open the door to less expensive emissions-reduction opportunities and enable cuts in the total cost of curbing emissions. But while AAUs are based on the reductions targets prescribed by the Kyoto Protocol to each country and are clearly defined in terms of volume, the significance of the credits earned through project-based reduction activities can vary widely depending on how the baselines are set. It should also be remembered that the Kyoto Protocol assigns only a subsidiary role to the CDM and JI. What subsidiary role they should actually play should be determined in discussions from now on. If the CDM and JI credits are to be used, consideration must also be given to the "quality" of such credits. In this proposal, we recommend that the Gold Standard be given priority in assessing the level of contributions made by CDM and JI projects (WWF Japan 2005).

As a point of reference, the EU ETS treats this issue in the following ways. This issue is governed by the EU's "linking directive" (European Parliament and the Council 2004). This directive, first of all, sets a ceiling on the share of CERs and ERUs that may be used, based on the subsidiary nature of these credits. The actual percentages for the CERs and ERUs are expected to be established by member states and not by the European Commission. Secondly, credits earned from nuclear power are not to be used (in accordance with the 2001 Marrakech Accords). Thirdly, credits from afforestation and reforestation, which were not recognized thus far would be considered for utilizations in the EU ETS starting in the second trading period beginning in 2008. Fourthly, to use credits accruing from 20-MW-plus hydroelectric-generation projects, member states are required to demonstrate that the project has been certified to be in conformity with the international standards of the World Commission on Dams.

In third-category cases of linking to the emissions trading schemes of nonratifying countries — specifically the Regional Greenhouse Gas Initiative (RGGI) of the United States — the conclusion of this proposal is that links with nonratifying countries should be avoided. The first reason for this is that the credits earned through the RGGI are not coupled with AAUs. And the second is that the RGGI is not, in the strict sense of the word, a cap-and-trade scheme. It is, rather, a scheme that incorporates safety valves, granting participants unlimited emissions should the price of allowances rise above a threshold. Links with such a scheme could undermine the gist of this current proposal, which is to control greenhouse gas emissions through an emissions trading scheme, so there is no need to seek out links with schemes like the RGGI.

2.2 Proposal for Designing a Scheme That Reflects Lessons Learned from the EU ETS

The discussions above describe the core aspects of our proposal for a domestic emissions trading scheme. This design proposal was based on the targets outlined in the Japanese government's Target Achievement Plan and indicated the basic principles to be followed in designing a scheme. It also made rough estimates of the initial allocations that should be made and how systems of compliance may be created to ensure the effectiveness of the scheme from an environmental-policy perspective. In making this proposal, we drew many lessons from the European Union's experience with its emissions trading scheme. An effort was made to incorporate the redeeming points of the EU ETS and to avoid its pitfalls. The following are recommendations that are designed to promote awareness of some of the anticipated problems in the light of the European experience and to prevent their recurrence in Japan.

The first of the lessons was that the EU ETS was overly lenient in setting the cap during initial allocations. Indeed, even in The UK's highly esteemed National Allocation Plan, emission increases were permitted for all industries excluding power stations, foods, beverages, and tobacco. In other countries as well, the caps were generally set at levels not requiring much change from existing emission patterns. As a result, allowances were often in excess of actual emissions, and only a few participants needed to purchase allowances from other companies. It was revealed at the end of fiscal 2005 that there would be an oversupply of allowances, and this resulted in a crash of market prices in April 2006. While trading is still continuing, only a small share of the transactions is thought to be based on actual demand. If the cap for the sectors covered in an emissions trading scheme is overly lenient, the sectors not covered by the scheme would have to be slashed in order to meet the Kyoto Protocol reduction targets. No additional policy steps have been introduced for the transport, commercial, and household sectors, however, and as things stand, emissions for the country as a whole will expand, rather than being reduced. This problem also applies to the second National Allocation Plans that have been submitted by the major countries (WWF 2006).

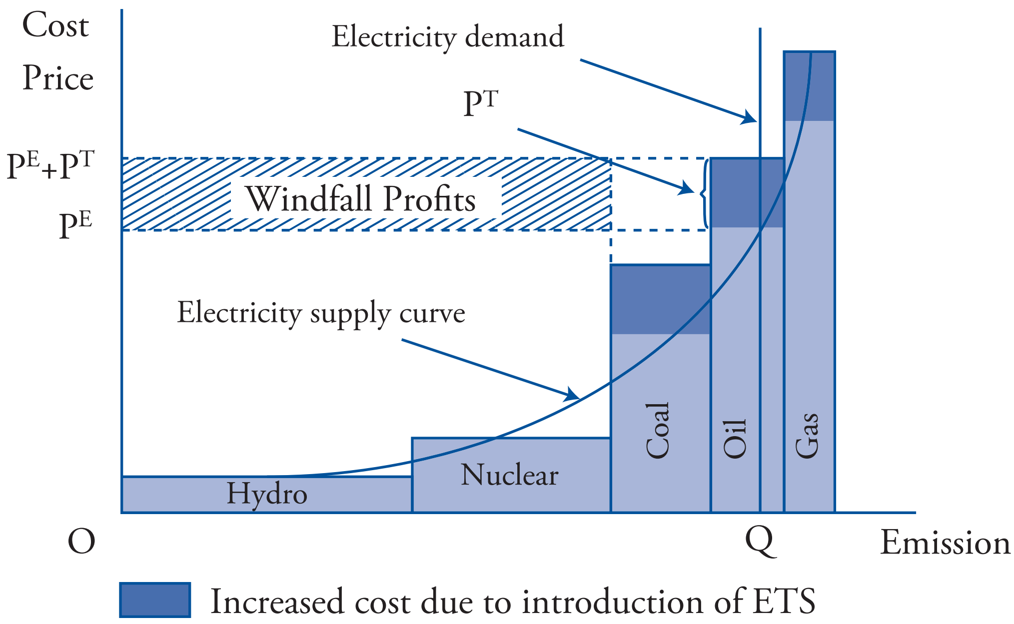
In any event, overly lenient caps will not only undermine a trading scheme's effectiveness as an environmental policy but will also destroy the balance in the supply and demand for emission allowances, force transactions to remain flat, and cause prices to fall to unnecessarily low levels. This could have a disruptive impact on the formation of an emissions market itself. As such there is a need for stringency in establishing a cap, not only to ensure the effectiveness of the trading scheme as an environmental policy but also to enable the formation of a sound market environment.

The second lesson is related to the grandfathering method. This method recognizes past emissions performance and allocates allowances accordingly. This is likely to gain the approval of participants since it is considered fair, acknowledges their vested rights, and allocates allowances free of charge. If past performance is taken as the basis for future allowances, though, this could give participants the wrong incentive. That is, if they reduce their emissions so that they have surplus allowances at the end of the trading period, they would have their allowances in the ensuing period deducted; they would then feel it is more to their advantage to use up all their allowances, i.e. emitting CO_2 to the maximum level, and make certain that their next allocations would not be curtailed. Such "gaming" strategies among participants can be discouraged by maintaining the same benchmark years across trading periods. This is because this problem would occur only when the base years are periodically updated to reflect the most recent emission levels.

To circumvent this problem, most European experts are of the opinion that the grandfathering method, while unavoidable when making initial allocations, should gradually be replaced with the auction and benchmark approaches, eventually completely moving over to either of these methods or a combination of the two.

The third lesson is how to deal with "windfall profits" in the electricity sector, resulting from the higher prices power companies will be allowed to charge to shift the costs resulting from the introduction of an emissions trading scheme. This can be explained using Figure 2-5.

Figure 2-5: Windfall profits in power sector



Source: Author

The figure is a model for determining prices following the liberalization of the electric power market in Europe. Following liberalization, prices have been determined through bids in the electricity market. The figure, though, is based on the UK's "pool system" that was used for 11 years after 1990. While this was replaced in 2001 by the New Electricity Trading Arrangements, it is nonetheless of great importance inasmuch as it widely influenced the formation of electricity markets worldwide (Nambu and Nishimura 2002, chap. 7).

The vertical axis in the graph shows the average power generation costs and the price charged for electricity by energy source. The horizontal axis indicates the volume of electricity generated. In placing a bid, the purchaser (power distribution company) indicates only the volume required. The sum of such volumes is indicated as the perpendicular line Q, a curve expressing electricity demand. (Under the Scandinavian pool system, the bidder indicates not only the volume but also the price they are willing to pay, so the demand curve would slope downward.)

The sellers, or the power producers, meanwhile, submit tenders showing how much they will sell at what price. The pool operators open the tenders and place them in ascending order of prices (merit order). The price at which the volume of supply converges with the sum of demand (line Q) becomes the market price for electricity during that particular term. As the graph shows, the convergence of the supply curve that approximates the merit order and the vertical demand curve determines the price of electricity at P^E. In such a market, the prices bid for marginal energy sources determines the price of electricity.

In the light of the above description, how would the introduction of an emissions trading scheme affect this arrangement? The scheme would engender additional costs (P^T) for electricity producers using fossil fuels, such as those to reduce greenhouse gas emissions and, when necessary, to purchase allowances. Because such costs would be added to the producers' tender price, the price of fossil-fuel-generated electricity would rise by P^T, as shown in the graph. Because the increase in the price of marginal energy sources would become reflected in the price of electricity, the resulting price would rise from P^E to $P^E + P^T$.

Such price increases are designed to cover for the higher cost of fossil fuel power generation with the introduction of an emissions trading scheme, and they are not intended to generate any special profits. But because an emissions trading scheme does not push up costs for hydroelectric and nuclear power, the general rise in the price of electricity would generate special windfalls for energy produced with nonfossil fuels-the area in the graph marked with diagonal lines.

This is not a product of an inherent shortcoming in the emissions trading scheme per se. It is not something that could jeopardize the effectiveness of the scheme as an environmental policy or create distortions in the allocationof resources but essentially a distribution problem. This is the reason that the European Commission, while giving attention to the problem, has taken the stance that the issue is not such as to require any changes to the basic design.

Be that as it may, the problem cannot be neglected for several reasons. The first is the impact on the competitiveness of European industries. Because the EU employs a downstream scheme, the industrial sector must bear the costs — corresponding to the dark blue part ("Increased cost...") in Figure 2-5 — of maintaining compliance with the cap. In addition, it must also pay higher prices for electricity-equivalent to P^T in Figure 2-5 that the electric power sector charge, meaning that the financial burden for the industrial sector, the biggest consumers of electricity, becomes higher than anticipated, resulting in a decline in the sector's international competitiveness.

The second reason is related to the issue of fairness. Both the industrial and the electricity sectors are subject to restrictions as direct emitters under the emissions trading scheme. There are no problems as long as they share the cost of emission reductions. But the windfall profit issue shows that income is being transferred from the former to the latter as higher electricity bills. This income transfer is the result of having introduced an emissions trading scheme designed to meet the public goal of reducing CO_2 emissions. There is no rationale for enabling the electricity sector to siphon off income from the industrial sector in the form of higher electricity rates, particularly as a result of regulations designed to meet a public goal. The distribution problem resulting from such a state of affairs cannot be said to fair, either.

The emergence of windfall profits is related to the liberalization of the electric power market and the determination of the market price based on the principle of marginal cost pricing formation. Under the rules of liberalization, not even the government can intervene to restrain price-forming principles and correct such mechanisms. On the other hand, perfect competition will elude the electric power market even after liberalization; in Germany, for instance, a small number of electric power companies has a dominant, oligopolistic control of the market. As such, even if they pass on higher costs to customers, including that portion that results in a windfall for the power companies, there is no danger of losing those customers to a competitor offering lower prices. These profits are sustained by the dual factors of nonintervention by the government and oligopolistic control of the market by a handful of power companies.

In Japan's case, the liberalization of the retail market for electricity has been introduced in phases, starting with commercial-scale customers contracting for 2,000 kW or more in 2000, 500 kW or more in 2004, and 50 kW or more in 2005. Full liberalization, including sales to individual households, though, has been postponed. And while negotiation transactions had been predominant in the wholesale market, a wholesale electricity market finally opened in April 2005, and market-determined wholesale prices for electricity came into being. The extent of electric power liberalization in Japan is quite limited compared to Europe, and it is not enough to induce market-sensitive behavior among the power companies.

This being the case, there is little likelihood of windfall profits becoming a problem in Japan, as it has in Europe. Be that as it may, it remains a fact that liberalization is being advanced in the electricity market. Should there be signs of emerging windfalls, there would be a need to design a scheme so that such possibilities can be nipped in the bud. There is a need to consider two separate approaches to dealing with this issue. The first would be for cases where the government is in a position to regulate electricity prices. In this case, the price would be determined on the traditional, fully distributed cost pricing basis as the sum of the various power-generating costs. The government can check whether the computation of costs is appropriate before approving rate hikes. If the power companies are found to be passing on fees in excess of the costs directly related to the introduction of an emissions trading scheme, the government can prevent windfalls by rejecting the request for higher rates.

The second approach would be in case the government no longer has the right to regulate prices owing to the liberalization of the electric power market. In this case, the government is not in a position to prevent the emergence of a windfall. As such, there is no choice but to control the situation indirectly, on the premise that a windfall would occur. One way to do this would be on an ex-ante basis, implementing adjustments during the process of initial allocations. More specifically, this would entail reducing the allocations to the electricity sector under the grandfathering approach so that it would be allocated a lower level of allowances than under normal circumstances. This is the method employed by the UK government for its first National Allocation Plan under the EU ETS. A second way would be on an ex-post basis. In concrete terms, this entails levying taxes on the windfalls so that they would be absorbed by the government. Of course this raises such questions as whether such windfalls would justify levying taxes that target only the electricity sector and, even if justified, whether the government can accurately ascertain the size of the windfalls to properly determine the taxation base. In the light of these points, the former approach of adjusting allocations would appear to be a more feasible way of coping with the issue than the latter method of taxing the windfall profits.

Finally, there is a need to address the economic impact caused by an emissions trading scheme. A detailed description of how the scheme could impact on the economy will be dealt with in Chapter 4, so here we will take just a quick glance at the impact of the EU ETS on employment and industrial competitiveness. A review of existing research reveals that the impact of an emissions trading scheme on both of these factors have been negligible, compared to a situation in which the scheme had not been introduced (Oberndorfer et al. 2006). Costs are lower, moreover, than when other policy instruments are used, since the emissions trading scheme is a mechanism for achieving targets in a cost-effective way. A major factor behind these findings is the fact that the initial allowances were allocated free of charge. As long as initial allocations continue to be made basically for free, an emissions trading scheme should not have a major, adverse impact on the economy, and it should be regarded as a highly effective policy instrument in achieving the objectives of an environmental policy. There are, as noted above, many problems with the grandfathering approach to free allocations, and its extended continuation would have side effects. It would be desirable for the scheme to shift gradually to an auction approach or, if free allocations are to be continued, to a benchmark format.

The four points touched upon above are the lessons that can be drawn from the EU ETS in designing an emissions trading scheme for Japan on the EU model. The roots of these various problems can ultimately be traced to initial allocations. The merits and drawbacks of the design for initial allocations, in other words, will have a major bearing on the success or failure of the emissions trading scheme as a whole. In this proposal, we recommend initially adopting the grandfathering approach, partly to facilitate the scheme's acceptance, and encourage its shift to the benchmark or auction method with the deepening of the scheme design.

Chapter 3 A Policy Mix Targeting the Transport, Commercial, Household, and SME Sectors

3.1 Proposal for a Policy Mix

The emissions trading scheme proposed in Chapter 2 is a downstream scheme targeting "direct emissions." It thus covers the industrial, energy-conversion, and the industrial-process sectors and excludes the locomotive emissions of the transport sector and the "indirect emissions" of the household and commercial sectors, over half of whose emissions are in the form of electricity use. In terms of growth rates, though, emissions are expanding more rapidly in the latter three sectors than in the former three, as touched upon in Chapter 1. Even within the targeted sectors, small facilities (SMEs) have been excluded in view of high monitoring costs. A climate change policy that does not provide these sectors incentive to reduce emissions cannot be called an effective policy system. Moreover, because downstream schemes have a lower coverage rate than upstream systems, there is a need to incorporate the latter three sectors and SMEs into a policy framework. In the following, we will consider what measures should be introduced for the transport, household, and commercial sectors and SMEs and how such measures can be linked — where possible — to an emissions trading scheme.

The biggest emitters in the household and commercial sectors are "appliances," which includes lighting and office automation equipment and household appliances, following by hot water supply, heating, and cooling. For this reason, discussions concerning the commercial and household sectors were focused on improving the energy efficiency of various appliances and on buildings. For the transport sector and SMEs, consideration was given to providing additional incentives to reduce emissions.

Where there are innumerable emission sources, like in the commercial, household, and transport sectors, regulatory and information methods can sometimes be effective. Discussion of these points inevitably involves the creation of a policy mix of various policy instruments. In this section, therefore, we will explore the possibilities of a policy mix centered on an emissions trading scheme.

A "policy mix" is an environmental policy option that involves the effective combination of economic, regulatory, and information measures, voluntary efforts, and other methods. By taking advantage of the features of the diverse measures, it can simultaneously promote a number of policy objectives, such as environmental conservation and economic development, and help achieve optimum results.

Here, we will consider what emission-reducing incentives centered on the emissions trading scheme discussed in Chapter 2 can be applied to the transport, household, and commercial sectors as well as SMEs, which are not targeted in the scheme. We will separately discuss economic measures and other (regulatory and information) measures.

3.2 A Policy Mix of an Emissions Trading Scheme and Economic Measures

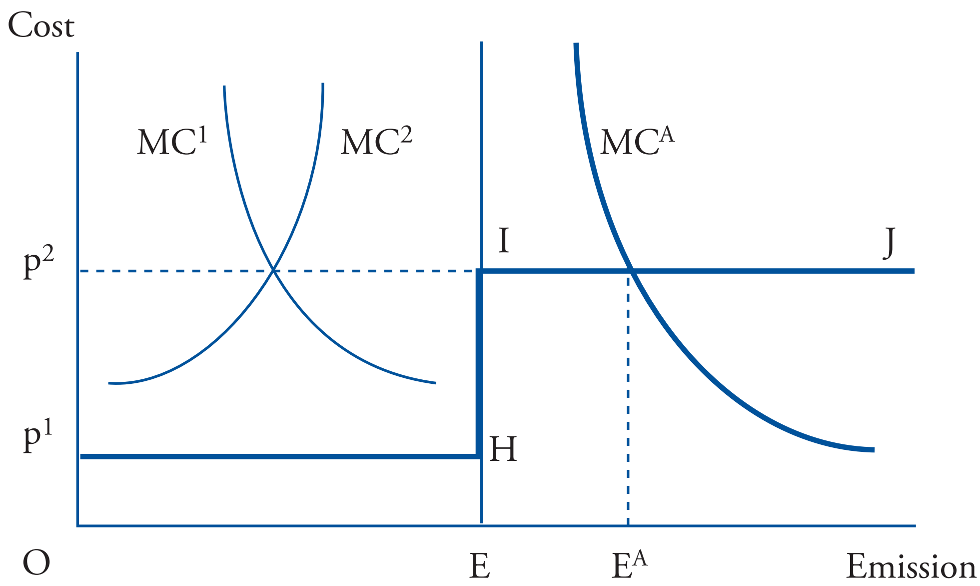
3.2.1 A Policy Mix Consisting of an Emissions Trading Scheme and a Tax on Emissions

This section will first discuss the combination of two policy instruments, namely, an emissions trading scheme and an emissions tax. These two policy tools had frequently been addressed separately here, partly to enable in-depth analyses of their respective economic properties. Recent climate change policies, though, have increasingly been combining these two instruments. The UK, for instance, employs a three-pronged policy mix consisting of a "climate change levy," "climate change agreements," and an "emissions trading scheme" (Morotomi 2001). Scandinavian countries and Germany already had an environment tax, and with the launch of the EU ETS in 2005, these countries now have a policy mix of these two policy instruments.

The combination of an emissions trading scheme and a tax has the following advantages. The first is that the coverage rate of a climate change policy can be expanded by taking advantage of the strengths of both policy tools, with a downstream emissions trading scheme being applied to the industry, energy-conversion, and industrial-process sectors and a tax covering the sectors that are excluded from the scheme. The second is that by applying a lower tax rate for the sectors covered by an emissions trading scheme, steps can be taken to avoid levying an overly heavy burden on those sectors. Many companies in these sectors are subject to intense international competition, and a flexible tax rate would be needed so as not to weaken their competitiveness. This, in fact, is how the climate change levy in the UK has been designed; after first introducing a downstream emissions trading scheme, the British government slashed the emissions tax rate by 80% for those companies that entered into an agreement with it, and permitted those companies to trade allowances among each other. It thus uses a combination of three policy tools.

An explanation of how an emissions trading scheme can be combined with an environment tax can be made using Figure 3-1. The curve expressed as MC^A indicates the marginal emission reduction costs for Japan as a whole. When an environment tax is introduced at rate p^2, Japan's total emissions can be expressed as E^A. The rate p^2 should be set at a level so that E^A matches the country's reduction target as prescribed by the Kyoto Protocol. Next, when an emissions trading scheme is introduced to create a policy mix, the industrial, energy-conversion, and industrial-process sectors will be covered by the scheme, and cap E will be established for these sectors. All facilities that consume 1,500 kl of energy per year or more-the cutoff point for so-called Type 2 factories within those sectors will participate in the scheme. The line connecting points O and E represents the sum of the emissions from the industry, energy-conversion, and industrial-process sectors, while the line linking E and E^A represents total emissions from the household, transport, and commercial sectors.

Figure 3-1: Policy Mix of Tax and Emissions Trading



Source: Author

In exchange for accepting a cap on emissions, the former sectors will be entitled to a lower rate (p^1) for an environment tax, which can be set at 25% of p^2. The latter sectors, meanwhile, will be levied the tax at the full p^2 rate. The rate for an environment tax would thus describe an inflected curve p^1HIJ. As described in Chapter 2, the initial allocation of allowances will follow the grandfathering approach. As such, even those sectors that are covered by an emissions trading scheme should be subject to taxation, if at a reduced rate. This is because, for one thing, the external costs of CO_2 emissions should, from both an environmental-policy and resource-allocation viewpoint, be borne by all emitters, if only in part. And for another, if the targets of an emissions trading scheme were completely exempt from the tax, the difference in the tax burden with the household, transport, and commercial sectors would become too great. A reduced rate would therefore be preferable from the viewpoint of ensuring the fairness of the cost burden between the two groups.

This is not the place to make an in-depth study of how an environment tax should be designed, but there is a need, at the least, to consider whether the tax should be applied at the upstream or downstream stage. Optimally, an environment tax should maximize a climate change policy's coverage while entailing minimum costs, yet being free of double taxation or tax leakage. The stage of taxation has a big bearing on these considerations. The simplest and least expensive form of tax collection would be to first levy a tax at the upstream stage of fossil fuel consumption (at the import or refining stage) so that the carbon content of all fossil fuels would be covered. At the downstream stage, the companies participating in an emissions trading scheme — the so-called Type 1 and Type 2 factories under the Revised Energy Conservation Law — would be entitled to a refund corresponding to 75% of the tax rate. Without such a refund, both the sectors participating in the scheme and those that are not — namely, the household, transport, and commercial sectors — would have to bear the same tax burden. While a refunding mechanism is necessary, the question is how it should be designed.

The best approach would be to use the CO_2 emission levels ascertained in the "GHG Calculation, Reporting, and Public Disclosure System" as a basis for refunding decisions. The actual amount refunded to each facility can be calculated by applying the tax rate (p^2) to the emission levels identified in the disclosure system and then multiplying this figure by 0.75. Doubts have been raised thus far on whether companies would really be willing to accurately compile and disclose their emission records. This is rooted in the belief that companies would be motivated to underreport their emissions. If this system is linked to a tax refund, though, they would have greater incentive to accurately disclose their emission levels so that they would be entitled to larger refunds.

A tax system can be introduced at the downstream stage as well. In this case, the companies in the emissions trading scheme would be taxed for emissions based on the "GHG Calculation, Reporting, and Public Disclosure System" at a rate that is 25% of the normal rate. Companies with emissions above a certain threshold in the industry, industrial-process, and energy-conversion sectors, in other words, would be subject to taxation under this system. The household, transport, and commercial sectors, meanwhile, would be subject to the full tax. The problem is that there would be too many emission sources and would push up tax collection expenses, which makes the downstream approach unrealistic.

A more desirable approach would be to introduce an upstream tax for these sectors so that tax collection expenses can be held down. A combination of a downstream tax for the industry, energy-conversion, and industrial-process sectors and an upstream levy for the household, transport, and commercial sectors would result in a "hybrid" tax structure. To avoid the double taxation of fossil fuels for the industry, energy-conversion, and industrial-process sectors, which are subject to a 25% downstream levy, these sectors should be exempt from paying the tax upstream. This would require that the tax be levied not at the uppermost, crude oil stage of fossil fuels but at the stage following refinement into various petroleum products. Fossil fuels mainly for household consumption can then be taxed separately from those fuels that are primarily used by industry. Specifically, coal, heavy oil, natural gas, and jet fuel, which are used in the industry, energy-conversion, and industrial-process sectors, can be taxed downstream, while gasoline, kerosene, light oil, and liquefied petroleum gas, used by the household, transport, and commercial sectors, can be taxed upstream.

One advantage of this taxation formula is that complex refunding procedures can be simplified. Because both the stage of taxation and that of refunding are downstream, there is no need to actually collect taxes and then make refunds; those entitled to refunds simply pay just 25% of the normal tax rate. One disadvantage of this arrangement, though, is that it is difficult to prevent tax leakage. This applies to smaller companies (energy consumption of less than 1,500 kl coe per year) in the sectors included in the emissions trading scheme. They are exempt from the scheme owing to their size, so they are not subject to the downstream 25% tax. And they may also avoid the upstream tax if they rely on coal, heavy oil, or natural gas, which are not taxed upstream. As a result they would be able to avoid both the upstream and downstream levies.

In the light of the respective merits and drawbacks, an upstream tax should be levied on all fossil fuels, and participants of the emissions trading scheme should be rewarded with a refund at the downstream stage. This would avoid double taxation or tax leakage and enable the unfailing provision of refunds, to ensure effectiveness as an environmental policy, minimize tax collection expenses, and guarantee fairness of taxation.

3.2.2 Introducing a baseline-and-credit system to be linked to the emissions trading scheme

The next proposal concerns the introduction of a policy mix which makes use of a baseline-and-credit-type emissions trading scheme, to be linked to the cap-and-trade scheme originally proposed. To begin with, for the commercial sector, a scheme should be set up where businesses that carry out emission reduction activities in their buildings and commercial facilities are allowed to use the resulting reductions in emissions as credits to be sold to sectors covered by ETS. An important part of realising this scheme is establishing a baseline; this would require developing and utilising methodologies that conforms to the Clean Development Mechanism (CDM). In order to make sure that credits resulting from reductions in electricity and heat consumption are not double counted, a "baseline and credit reserve" should be established. This means that, out of the cap allocated to the energy conversion sector under the emissions trading scheme, 1% will be put aside in advance as a "baseline and credit reserve". This would prevent the credits from being double counted, and ensure that the cap is not exceeded.

We also propose that such a baseline-and-credit system be introduced in the logistics sector as well. A scheme should be set up where consignors and carriers carrying out greenhouse gas reduction activities can use the resulting emissions reductions as credits and sell them to other businesses. In order to prevent an overlap with emission allowances in the industrial and energy sectors, a baseline and credit reserve should also be established in this sector. In addition, with regard to SMEs, which do not come under the target of the emissions trading scheme proposed in this report, a similar scheme should be introduced where such facilities can carry out emission reduction activities and use the resulting reductions as credits to sell to sectors covered by ETS.

The greatest setback, however, for SMEs in undertaking greenhouse effect reduction projects is the difficulty of securing funding. Replacing and introducing new equipment to improve energy efficiency require large investments; therefore, we propose a policy to support and attract financing, specifically for SMEs. To start, in order to make financing appraisals by financial institutions less stringent, the government should establish a harmonized guideline for the environmental ranking of projects. Greenhouse gas reduction activities should also be added to the areas covered by the Credit Guarantee Association, which was established to facilitate financing for SMEs. Guaranteeing that a public body would take the final risk in providing funding to SMEs should make it easier for commercial financial institutions to finance them as well

3.2.3 Introducing a specific policy objective-oriented trading scheme which will not be linked to the emissions trading scheme

Another proposal we would like to make is a separate trading scheme, which would not necessarily be linked to the domestic emissions trading scheme we have proposed earlier. This would be a "energy saving trading" scheme to be implemented among indirect emitters. The difference between this scheme and the baseline-and-credit scheme described in the previous section is that, under this scheme, it is the energy reduction amount, rather than CO_2 emission reduction credits, that is traded.

More specifically, we propose that the target goals of "reducing energy consumption per unit of production by an average of 1% per year" under the Revised Energy Conservation Law be made compulsory for factories designated under the Law as Type 1 factories (including large-scale factories and consignors), and that this goal be made a numerical target. These Type 1 factories, which have an obligation to meet the target, will then become buyers of "Energy Savings Certificates", while, out of the factories classified as Type 2 , which have no target obligations, and those facilities and consignors, whose energy use is less than 1,500 kl crude oil equivalent (coe) /year become sellers of these certificates. In this way, by introducing an element of "trade" in the obligations to reduce energy consumption, the energy reduction goals of "reducing energy consumption per unit of production by an average of 1% per year" can be met in a more flexible manner.

In addition to the above, for the transport sector, we propose a new scheme based on the highly evaluated existing Top Runner Programme, which will be based on the 2015 standards yet to be established, aiming to provide even more incentive to meet the Top Runner Standards. Under this scheme, targets are set according to car type (passenger or fleet vehicle) and converted into CO_2 emission levels per km of travel (CO_2/km). Then, the average CO_2 emission efficiency (CO_2/km) for the types of cars currently being sold is calculated for each company manufacturing or domestically selling automobiles. Each company whose CO_2 emission efficiency exceeds the standards can sell the excess to the government for a fixed price. Companies failing to meet their targets are not given a penalty, but will continue to be regulated as before under the Top Runner Programme.

One other alternative policy instrument we would like to propose is regulatory measures for buildings. This scheme takes the Comprehensive Assessment System for Building Environmental Efficiency (CASBEE) one step further and evaluates buildings from the perspective of preventing global warming based on two criteria, “environmental load” and “energy”, and ranks them into 5 categories (A-E). Detailed evaluation and ranking are carried out at the planning and designing stage, and building permits (building confirmation) are issued only for buildings ranked A, B, or C. For buildings ranked D or E, however, an improvement order is issued and the design must be reviewed. If the re-submitted design specification is ranked A, B, or C, a building permit (building confirmation) can be issued at this stage. With this system, it will be possible to gradually reduce the number of high energy-consuming buildings.

It is also necessary to make effective use of informational methods of providing consumers with environmental and energy information about particular products, which influence their decision-making with regard to purchases. Some concrete examples of this are the equipment labelling system based on Top Runner Standards, and the automobile labelling system indicating carbon emission levels per km of travel.

Chapter 4 Effects on the Economy and on Energy Supply and Demand Resulting from the Emissions Trading Scheme and Other Domestic Measures

Some have asserted that implementing measures to combat global warming in Japan entails a high cost so that it is better to meet the Kyoto targets by purchasing emission reduction credits from other countries through the CDM or the International Emissions Trading, than to implement additional measures. However, based on the view that the world market for renewable energy, especially in Europe and the US, is certain to grow (the global market for renewable energy alone is estimated by some to reach 22 trillion yen by 2015), the idea that a domestic market should be nurtured in advance is also considered to be a sensible proposition. The former UK Prime Minister Blair has talked of the "Green Industrial Revolution," and in the state of California, it is known as the "Cleantech Revolution." In terms of theory, the "Porter Hypothesis" proposed by Professor Porter of Harvard University is quite well known. Using data from 71 countries around the world, Professor Porter has proven that the stricter a country's environmental regulations are, the more efficient its production becomes, with the result that it achieves higher industrial competitiveness (Porter 1995, Esty and Porter 2001).

In our analysis, we have not only made traditional cost comparisons between (1) the cost of purchasing emission reduction credits from abroad, and (2) cost of domestic measures, but have also looked at (3) decreased import of energy and (4) increase in GDP due to the nurturing of "green industries" or "clean technology" industries, and have considered two possible scenarios: one where no additional measures are implemented (Business as Usual: BAU) and one where the Kyoto Targets (CO_2 emission to decrease to 1990 levels) are achieved through the implementation of domestic measures (Emissions Trading Scheme: ETS). In doing so, we have compared costs, and have quantitatively measured the resulting energy supply and demand structure, as well as the impact on the economy and employment.

Our conclusion is that, in 2010, the costs of implementing domestic measures will be slightly higher than the positive effects of nurturing the industry, and Japan will have to bear an economic burden of 3.2 billion yen per year. However, by 2015, the positive effects of nurturing the industry will have led to a GDP growth of 19 trillion yen, bringing an economic merit of 14 trillion yen after deducting the costs for implementing domestic measures. In addition to revitalizing the economy, this will result in Japan's shifting to an industrial structure with higher concentrated added value, so that the number of employees will grow to 280,000 in 2010 and 1.4 million in 2015. The unemployment rate, which, in the BAU scenario will be 5.3% in 2010 and 6.3% in 2015, will decline in the ETS scenario to as low as 4.9% in 2010 and 4.0% in 2015.

Furthermore, in the ETS scenario, which will reach the 1990 level-targets by 2010 and achieve a level of -5% over 1990 levels by 2015, the costs of implementing domestic measures would be approximately 1.8% of the GDP in both 2010 and 2015. Normally, these costs would have to be compared with the costs of damage due to global warming (according to the Stern Report, 5-20% of the GDP); however, in this report we have limited our observation to short-term cost and benefit to the economy.

The degree of dependence on import for primary energy was, in the BAU scenario 84% in 2010 and 82% in 2015, while in the ETS scenario, figures went down to 76% in 2010 and 73% in 2015. In the ETS scenario, the marginal costs for reducing carbon dioxide emission to 1990 levels by 2010 was 24,000 yen/tonnes C.

Ratio of renewable energy was, for BAU 2% for both 2010 and 2015, but in the ETS scenario was 3% in 2010 and 7% in 2015. Costs also decreased, and solar energy generation capacity in the BAU scenario only went as low as 500,000 yen/kW in 2015 (in the case of a service life of 20 years with a utilisation factor 12%: 24 yen/kWh), but in the ETS scenario decreased to 220,000 yen/kW (same conditions: 10 yen/kWh). For solar water heaters, which currently suffer from decreasing domestic installation capacity, the costs in the ETS scenario decrease from the current 300,000 yen/unit in 2006 to 150,000 yen/unit in 2015.

It has become clear from our analysis that implementing domestic measures would appear to be more costly in the short term but would nurture export industries in the mid- to long term and cause the industrial structure to have higher concentrated added value, leading to increased employment. In addition, due to drop in dependence on imports for energy by approximately 8% points, as well as lower renewable energy technology costs, such measures could lead to expectations of even higher increases in energy self-sufficiency beyond 2015.

Chapter 5 Summary of a Domestic Emissions Trading Scheme Proposal and Future Issues

The above represents our institutional design proposal for decarbonizing Japan. It not only seeks to introduce an emissions trading scheme for the biggest emitters — the industry, industrial-process, and energy conversion sectors —but also incorporates measures for the transport, commercial, household, and SME sectors into a comprehensive policy mix.

Our design proposal for an emissions trading scheme, comprising the core of this report, calls for a cap-and-trade scheme covering large-scale emission sources that emphasizes the effective control of emission volume. This scheme, in summary, should be implemented at the downstream stage of fossil fuels to maximize its environmental impact. The drawback of this approach is that its coverage rate — 64% of all CO_2 emissions — is lower than for an upstream scheme. We thus proposed, in Chapter 3, a policy mix to raise the coverage rate consisting of new policy instruments for the transport, commercial, household, and SME sectors. Inasmuch as our emissions trading scheme proposal targets "direct emissions," including those by the electric power companies and heat suppliers in the energy-conversion sector, the users of electricity and heat in the transport, commercial, household, and SME categories are indirectly covered by the scheme.

For the time being, this trading scheme includes only CO_2 among the six greenhouse gases and seeks to meet the emissions reduction target prescribed in the Kyoto Protocol Target Achievement Plan through efforts in the industry, industrial-process, and the energy-conversion sectors. The grandfathering method will be chiefly employed to allocate allowances to existing emission sources, to be augmented by the auction method. A reserve will be set aside for new entrants, which will be allocated allowances free of charge under a benchmark arrangement. Banking and borrowing will be permitted within a trading period but will not be recognized across different periods. Companies whose emissions exceed their allowances will be penalized for noncompliance at a rate four to five times the market price for each ton of CO_2. They will also have their initial allowances for the ensuing trading period deducted by the exceeded amount, so the cap on overall CO_2 emissions can, albeit belatedly, be maintained.

There are several points that should be kept in mind when implementing the emissions trading scheme. The first is the need for stringency in setting a cap when making initial allocations. When a cap is too lenient, the volume of emissions will not be reduced, and an emissions trading scheme would in effect become meaningless. The second is to initially use the grandfathering method despite its limitations and to gradually raise the share of allowances allocated through auctions and the benchmark approach, eventually shifting to one or both of these methods. The third is to be alert to the emergence of windfall profits in the electricity sector and to prepare preventive measures.

The transport, commercial, household, and SME sectors that are not covered by the scheme should be addressed through a policy mix of various instruments. There are two ways of doing this. The first is to combine the emissions trading scheme with an environment tax, and the second is to combine it with a separate baseline-and-credit scheme. Two problems must be cleared, though, to implement a baseline-and-credit scheme within these sectors. The baseline must be firmly established, and a framework must be created to verify and certify that reductions have actually been made beyond the baseline. Attention must also be paid to prevent the double counting of credits in these sectors so that the cap does not swell. For this reason, a reserve should be set aside within the cap for the baseline-and-credit scheme, enabling it to be linked smoothly to the main cap-and-trade scheme. Other tools considered effective in inducing emission reductions in specific sectors are an "energy saving trading" scheme that would not be linked to the main scheme; an initiative based on the Top Runner Program under which companies in the transport sector can sell excess allowances to the government for a fixed price; regulatory measures for buildings based on the Comprehensive Assessment System for Building Environmental Efficiency (CASBEE); and an equipment labeling system based on Top Runner standards.

There are several issues that could not be adequately addressed in this report and others requiring further study, the three most prominent among them being the following:

(1) Policy impact assessments based on more stringent quantitative analyses

Chapter 4 of this report includes a quantitative analysis of the economic impact an emissions trading scheme is likely to have. There is a need for more stringent assessments, however, on what the equilibrium market prices for allowances might become and on the extent of their microeconomic and macroeconomic impact. On the question of penalties alone, a figure "four to five times the market price" cannot be set without advance information on the expected market prices. A better idea of a trading scheme's impact on industry would also enable further discussions on measures to mitigate such impact or on ways to improve allocation methods. Further studies on the design of an emissions trading scheme and on the quantitative analyses of such schemes would together serve to advance policy debate. A general assessment is made in Chapter 4, but a more detailed analysis remains as a future issue.

(2) Alternative approaches to initial allocations

This proposal is premised on the grandfathering approach to initial allocations. There are other methodologies, however, such as the auction and benchmark formats, and we believe, as stateed above, in gradually shifting to these approaches at a future date. There are many ways of adopting the auction method, moreover, and further studies on their relative merits and drawbacks are needed to identify the best approach. Much remains to be explored with regard to the benchmark method as well, such as what standards should be adopted for comparison purposes and to what extent benchmarks should be established for industries, production processes, and technologies. Further research on alternative allocation methods must be pursued so as to identify the format that is most desirable in relative terms.

(3) Relationship between an emissions trading scheme and the electricity market

As was discussed in connection to windfall profits, an emissions trading scheme will have a significant impact on the electricity sector. Drafting an effective policy requires close consideration of how environmental regulations affect the behavior of electric power companies. The introduction of an emissions trading scheme will no doubt influence their decisions regarding energy sources and could lead to the expansion of the natural energy market. As the liberalization of the electric power market proceeds, moreover, the same environmental regulations could have a different impact on those companies before and after liberalization.

To gain a better idea of the possibilities of a windfall for the electricity sector and how it should be addressed, a closer analysis of the interplay of regulations and liberalization in this sector is required. For this reason, considerable research resources in Europe have been directed at how the electricity sector and electricity market are affected by an emissions trading scheme, particularly following the introduction of the EU ETS, and it has emerged as a theme of considerable interest. Such an analysis, unfortunately, is beyond the scope of this report, but we would point out that it will henceforth emerge as a leading topic of research.

Finally, we would like to conclude with a discussion of several issues that have been a constant theme in thinking about the design of an emissions trading scheme. The first of these is the importance of a long-term perspective. Here, the chief objective of our policy mix proposal has been meeting the emission reduction target of the Kyoto Protocol. This is essentially a short-term target, though, to be achieved during the first commitment between 2008 and 2012. As we emphasized repeatedly in this report, the problem of global warming caused by the emission of greenhouse gases is growing increasingly serious year by year. There will no doubt about a need to make much deeper cuts during the first half of this century. Achieving such reductions in emissions will lead to what we called the "decarbonizing of society." We thus regard the emissions trading scheme as a policy instrument to enable Japan to not only meet its Kyoto Protocol commitments but also make a long-term transition to a decarbonized society.

The second issue is the importance of a global perspective. It goes without saying that reducing the emission of greenhouse gases on a global scale requires the participation of countries around the world. This requires a global policy framework transcending national borders. One valuable suggestion in this regard was that of a global carbon tax advocated by Nobel Economics Prize recipient and Columbia University professor George Stiglitz ("Keizai kyoshitsu" column in the July 4, 2006, issue of the Nihon Keizai Shimbun). However, levying a cross-border environment tax would be extremely difficult today. Even within the EU, approximately 10 years were required to enforce a directive on the expanded harmonization of an energy tax, but this is not intended to achieve an equalized carbon price at the EU-wide level. An international environment tax remains a daunting challenge because taxation is a core aspect of a nation's sovereignty. In the EU, for instance, taxation and other fiscal-related issues belong to a policy domain requiring the unanimous approval of all members. If even one member dissents, the motion is rejected.

An emissions trading scheme, on the other hand, does not face such hurdles. The creation of the EU ETS demonstrated that a cross-border policy framework could be built without threatening the sovereignty of the participating countries. An emissions trading scheme is global by nature, and it should attract increasing attention as an effective policy tool capable of dealing promptly with issues requiring a global response, such as climate change.

Japan should first launch a domestic emissions trading scheme and gain familiarity with its operations. A global carbon market is likely to emerge in the future, at which time Japan would then be in a position to contribute actively to its formation and the building of the necessary infrastructure. Thus an emissions trading scheme should be regarded not just as a regulatory instrument in itself but also as a step toward building a global market by shoring up the infrastructure in Japan.

The third important issue is to perceive the emissions trading scheme as a new set of rules for fair competition in a market economy. For industry, an emissions trading scheme is a policy instrument necessitating added costs, and it is not something that most companies would welcome. It is interesting, therefore, that even in the United States, members of industry have themselves begun calling for a cap-and-trade scheme (Joint statement of the United States Climate Action Partnership, issued on January 19, 2007). This is an expression of the rapidly growing perception among business leaders that reductions of greenhouse gas emissions will soon become inevitable; such efforts, they feel, should be made under a policy framework with clear and fair rules. Leaving emission-reduction decisions to the discretion of individual companies may appear to be free, but since such efforts entail costs, none would voluntarily take the trouble to take action that would make give their competitors a market advantage. The reason industry is seeking a cap-and-trade scheme is because this would guarantee clear and fair rules for the curtailing of greenhouse gas emissions, which it will not be able to avoid for long.

The introduction of such a scheme would change the rules of the market so that the most active emission reducers would reap the greatest rewards. Companies that reduce their emissions would be left with surplus allowances that they can either apply to new business areas or sell on the market for cash income. Rather than giving an edge to their rivals, reduction efforts would now mean gaining a competitive edge over them. The profit motive had long been at odds with the desire to contribute to environmental conservation; an emissions trading scheme would finally reconcile the two. This, in the parlance of economics, is called incentive compatibility. An emissions trading scheme represents an incentive compatible approach to advancing climate change policy objectives under a new set of market rules for fair competition.

Japanese References

* Only the names of authors are shown in English.

Agency for Natural Resources and Energy (2006): 資源エネルギー庁長官官房総合政策課編（2006），『総合エネルギー統計平成16年度版』通商産業研究社.

Amano, Akihiro (1997): 天野明弘『地球温暖化の経済学』日本経済新聞社.

Amano, Akihiro (1999): 天野明弘「京都議定書における伸縮的手法と国内排出削減制度の構築」『総合政策研究』第8巻，pp.1-19.

Amano, Akihiro (2000): 天野明弘（2000），「二酸化炭素国内排出削減メカニズムの確立に向けて」『総合政策研究』第9巻，pp.1-16.

Amano, Akihiro (2003): 天野明弘（2003），『環境経済研究 - 環境と経済の統合に向けて - 』有斐閣.

Arimura, Toshihide (2005): 有村俊秀（2005），「米国の二酸化硫黄承認証市場の実証研究：報酬率規制の影響」『國民經濟雜誌』第191巻第1号，pp.17-29.

Global Warming Prevention Headquarters (2005): 地球温暖化対策推進本部（2005），「京都議定書目標達成計画」.（http://www.env.go.jp/houdou/gazou/5937/6699/2278.pdf）.

Global Warming Prevention Headquarters (2005): 地球温暖化対策推進本部事務局（2006），『京都議定書目標達成計画の全容：チームマイナス6％』小学館クリエイティブ.

Greenhouse Gas Inventory Office of Japan (2006): 温室効果ガスインベントリオフィス（2006），「日本の温室効果ガス排出量データ（1990-2004）」.（http://www-gio.nies.go.jp/aboutghg/nir/nir-j.html）.

Greenhouse Gas Inventory Office of Japan ed. (2006): 温室効果ガスインベントリオフィス編・環境省地球環境局地球温暖化対策課監修（2006），「日本国温室効果ガスインベントリ報告書」.（http://www-gio.nies.go.jp/aboutghg/nir/nir-j.html）.

Hamamoto, Mitsuaki (2001): 浜本光紹（2001），「米国二酸化硫黄排出許可証取引の機能とその評価（I）」『独協経済』第74号.

Hamamoto, Mitsuaki (2002a): 浜本光紹（2002a），「米国二酸化硫黄排出許可証取引の機能とその評価（II）」『独協経済』第75号.

Hamamoto, Mitsuaki (2002b): 浜本光紹（2002b），「米国二酸化硫黄排出許可証取引の導入をめぐる政策形成過程」『計画行政』第25巻第2号.

Hamamoto, Mitsuaki (2002c): 浜本光紹（2002c），「米国における排出権取引と衡平性」『エコノミア』第53巻第1号.

Hamamoto, Mitsuaki (2002d): 浜本光紹（2002d），「アメリカ合衆国における二酸化硫黄排出許可証取引ー政策形成過程および成果に関する暫定的評価ー」『季刊環境研究』No.124.

Harasawa, Hideo (2005): 原沢英夫（2005），「地球温暖化がもたらす危険なレベルに関する考察」『環境研究』No.138，pp.47-58.

Hijioka, Yasuaki (2005): 肱岡靖明（2005），「地球温暖化抑制のための温室効果ガス安定化レベルの検討」『環境研究』No.138，pp.67-76.

Ida, Hitoshi (2004): 井田均（1994），『カリフォルニアに発電風車が多い理由』公人社.

Institute for Building Environment and Energy Conservation (IBEC) (2006): 建築環境・省エネルギー機構（2006），「CASBEEー新築（簡易版）2006年版」.（http://www.ibec.or.jp/CASBEE/about_cas.htm）

Institute for Energy Economics Japan (IEEJ): 日本エネルギー経済研究所計量分析ユニット編（2006），『エネルギー・経済統計要覧』省エネルギーセンター

Institute for Global Environmental Strategies-Center for Sustainability (IGES-CFS): 財団法人地球環境戦略研究機関持続センター（IGES-CFS），「エコアクション21」.（http://www.ea21.jp/eco21/eco01.html）.

Ito, Yasushi (2005): 伊藤康（2005），「環境技術開発に対する助成措置の役割 - 日本における脱硫技術開発の経

験から - 」寺尾忠能・大塚健司編『アジアにおける環境政策と社会変動 - 産業化・民主化・グローバル化 - 』研究双書No.531 アジア経済研究所，pp.243-272.

Kanie, Norichika (2005): 蟹江憲史（2005），「中長期目標設定とその国際的最下に関する課題 - グローバルな温室効果ガス排出削減と日本の目標 - 」『環境研究』No.138，pp.84-92.

Kiko Network ed. (2005): 気候ネットワーク編（2005），『地球温暖化防止の市民戦略』中央法規出版.

Kiko Network (2006): 気候ネットワーク（2006），『2020年の30％削減社会ビジョンを描く』気候ネットワーク.

Kim, Seong-Hee (2005): 金星姫（2005），「酸性雨プログラム導入の政治経済的背景」『財政と公共政策』第27巻第1号（通号37），pp.90-103.

Kim, Seong-Hee (2006): 金星姫（2006），「酸性雨プログラムにおける州政策および報酬率規制の排出権取引への影響分析（１）」『経済論叢』第177巻第4号，pp.54-68.

Lovins, Amory et al. (1998): エイモリー・ロビンス他（1998），『ファクター4』省エネルギーセンター.

Maruyama, Koki (2005): 丸山康樹（2005），「Overshootシナリオと環境変化のヒステリシス」『環境研究』No.138，pp.37-46.

Masataka, Shimizu (2007): 清水雅貴（2007），「排出許可証取引と地方政府の役割 - 米国酸性雨プログラム下の州政府による個別規制を中心に-」『地方財政学会研究叢書』勁草書房，発刊予定.

Matsuoka, Yuzuru (2005): 松岡譲（2005），「危険な気候変化のレベルと気候変動政策の長期目標」『環境研究』No.138，pp.7-16.

Ministry of the Environment (2005): 環境省（2005），「京都議定書目標達成計画」.（http://www.env.go.jp/houdou/gazou/5937/6699/2278.pdf）.

Ministry of the Environment (2005): 環境省（2006），「2005年度（平成17年度）の温室効果ガス排出量速報値について」.（http://www.env.go.jp/press/file_view.php?serial=8616&hou_id=7603）.

Ministry of Environment: 環境省・経済産業省，「温室効果ガス排出量算定・報告・公表制度について」.（http://www.env.go.jp/earth/ghg-santeikohyo/）.

Ministry of Finance (2006): 財務省（2006），「貿易統計・統計品別表」.（http://www.customs.go.jp/toukei/info/index.htm）.

Ministry of Trade, Economy and Industry (METI) (2006): 経済産業省（2006），「新・国家エネルギー戦略」.（http://www.meti.go.jp/press/20060531004/senryaku-houkokushoset.pdf）.

Ministry of Trade, Economy and Industry (METI) (2006): 経済産業省（2006），「平成17年簡易延長産業連関表（186部門取引額表[固定価格評価]【H18.12.27修正】）」.（http://www.meti.go.jp/statistics/）.

Ministry of Trade, Economy and Industry (METI) ed. (2006): 経済産業省編（2006），『エネルギー白書　2006年版』ぎょうせい..

Morotomi, Toru (2000): 諸富徹（2000），『環境税の理論と実際』有斐閣.

Morotomi, Toru (2001): 諸富徹（2001），「環境税を中心とするポリシー・ミックスの構築 - 地球温暖化防止のための国内政策手段 - 」，『エコノミア』第52巻第1号，pp.97-119.

Morotomi, Toru (2005): 諸富徹（2005），「気候変動政策とポリシー・ミックス論」『経済分析』第175号，pp.140-166.

Murota, Yasuhiro, Ito, Koukichi and Koshikuni, Machiko (2005): 室田泰弘、伊藤浩吉、越国麻知子（2005），『パソコンによる経済予測入門』東洋経済新報社.

Murota, Yasuhiro, Takase, Kae (2001): 室田泰弘、高瀬香絵（2001），「京都議定書離脱は経済的損失をもたらすか」WWF International温暖化防止キャンペーン.（http://www.wwf.or.jp/activity/climate/lib/index.htm）.

Nambu, Tsuruhiko, Nishimura, Kiyoshi (2002): 南部鶴彦・西村陽（2002），『エナジー・エコノミクス - 電力・ガス・石油：理論・政策融合の視点 - 』日本評論社.

New Energy and Industrial Technology Development Organization (NEDO) (2006): 新エネルギー・産業技術総合開発機構（NEDO）（2006），「米国北東部7州のCO2排出枠取引-7州間合意文書」『NEDO海外レポート』974号.

New Energy Committee of the Council for Comprehensive Research on Resources and Energy. (2001). 総合資源エネルギー調査会新エネルギー部会（2001），「新エネルギー部会報告書」.（http://www.meti.go.jp/report/downloadfiles/g10705bj.pdf）.

Niizawa, Hidenori (1992): 新澤秀則（1992），「アメリカにおける排出権取引プログラムの導入と成果」『神戸商科大学経済研究所研究資料』第134号.

Niizawa, Hidenori (1992): 新澤秀則（2003a），「排出権取引の経済学（7）上流型排出権取引」『経済セミナー』第585号，pp.75-79.

Niizawa, Hidenori (1992): 新澤秀則（2003b），「排出権取引の経済学（8）欧州連合とイギリスの排出権取引」『経済セミナー』第586号，pp.84-89.

Nippon Keidanren (2005): 日本経済団体連合会（2005），「温暖化対策　環境自主行動計画　2005年度フォローアップ結果　概要版」.（http://www.keidanren.or.jp/japanese/policy/2005/086/honbun.pdf）.

Nishimura, Kiyohiko (2004): 西村清彦（2004），『日本経済　見えざる構造転換』日本経済新聞社.

Oil Information Center (2006): 石油情報センター（2006），「価格情報」.（http://oil-info.ieej.or.jp/cgi-bin/index.cgi）.

Okamura, Lila et al. (2006): 岡村りら・外純子・大塚直（2006），「ドイツ温室効果ガス排出権取引法（TEHG）」『環境研究』No.140，pp.135-143.

Saijo, Tatsuyoshi (2006): 西條辰義（2006），『地球温暖化対策 - 排出権取引の制度設計 - 』日本経済新聞社.

Shigeto, Yukari (2005): 重頭ゆかり（2005），「オランダにおける環境保全側プロジェクトへの資金供与」『調査と情報』3月号.

Sub-Committee on Scenarios to Achieve the Target, the Central Environmental Council. (2001): 中央環境審議会目標達成シナリオ小委員会（2001），「目標達成シナリオ小委員会中間取りまとめ（案）」.（http://www.env.go.jp/council/06earth/y061-07/ref01-02.pdf）.

Tokyo Commodity Exchange (TOCOM) (2004): 東京工業品取引所（2004），「エネルギー使用合理化取引市場設計関連調査（排出削減量取引市場効率化実証等調査）」.（http://www.tocom.or.jp/rims/03/03a.html）.

Tokyo Commodity Exchange (TOCOM) (2005): 東京工業品取引所（2005），「エネルギー使用合理化取引市場設計関連調査（排出削減量取引市場効率化実証等調査）」.（http://www.tocom.or.jp/rims/03/03a.html）.

Tokyo Gurantee: 東京信用保証協会，「その他の保障制度」.（http://www.cgc-tokyo.or.jp/business/gendo.html）.

Tsuchiya, Haruki (1999): 槌屋治紀（1999），「学習曲線による新エネルギーのコスト分析」『太陽エネルギー』25-6，pp.37-41.

Ueta, Kazuhiro (1996): 植田和弘（1996），『環境経済学』岩波書店.

Ueta, Kazuhiro, Oka, Toshihiro and Nizawa, Hidenori (1997): 植田和弘・岡敏弘・新澤秀則（1997），『環境政策の経済学　理論と実際』日
本評論社.

Watanabe, Rie (2004a): 渡邉理絵（2004a），「EU排出枠取引導入におけるドイツの経験 - 自主的取組みから排出枠取引へ」『環境研究』No.133，pp.73-85.

Watanabe, Rie (2004b): 渡邉理絵（2004b），「京都議定書遵守に向けてのEU排出枠取引制定とその形成過程」『環境科学会誌』第17巻第3号，pp.233-238.

Watanabe, Rie (2006): 渡邉理絵（2006），「EU排出枠取引指令の国内法化 - ドイツ」『環境研究』No.40，pp.144-155.

WWF Japan (2005): WWFジャパン（2005），「ゴールド・スタンダードについて」.（http://www.wwf.or.jp/activity/climate/kyoto/goldstnd.htm）.

WWF Japan (2006): WWF ジャパン（2006），「アメリカ東部7州の取り組み（第3回排出量取引セミナー）」.（http://www.wwf.or.jp/activity/climate/torihiki/index.htm）.

English References

Austin, Duncan., Niki Rosinski, Amand Sauer and Colin le Duc. (2003), "Changing Drivers: The Impact of Climate Change on Competitiveness and Value Creation in the Automotive Industry", Sustainable AssetManagement [SAM] and World Resources Institute [WRI]. (http://climate.wri.org/changingdrivers-pub-3873.html).

Baron, R. and S. Bygrave. (2002), Towards International Emissions Trading: Design Implications for Linkages, OECD and IEA Information Paper.

Bohringer, C., T. Hoffman, A. Lange, A. Loschel, and U. Moslener. (2005), "Assessing Emissions Regulation in Europe: An Interactive Simulation Approach", *Energy Journal*, 26.

Burtraw, Dallas., Kahn, Danny, and Palmer, Karen L. (2005), "CO_2 AllowanceAllocation in the Regional Greenhouse Gas Initiative and the Effect on Electricity Investors", RFF Discussion Papers, 05-55. (http://www.rff.org/rff/Publications/Discussion_Papers.cfm).

Burtraw, Dallas., Palmer, Karen L., and Kahn, Danny. (2005), "Allocation of CO_2 Emissions Allowances in the Regional Greenhouse Gas Cap-and-Trade Program", RFF Discussion Papers, 05-25. (http://www.rff.org/rff/Publications/Discussion_Papers.cfm).

Climate Action Network [CAN]. (2006), Europe response to public consultation on green paper on energy efficiency, January 27.

CAN. (2002), "Avoiding Dangerous Climate Change", CAN Position Paper.

Christiansen, Atle Christer. (2003), "Convergence or divergence? Status and prospects for US climate strategy", *Climate Policy*, 3.

Council on Foreign Relations. (2006), "Climate Security: Risks and Opportunities for the Global Economy," Speech by the Rt Hon Margaret Beckett, MP [September, 2006]. (http://www.cfr.org/).

Dales, J.H. (1968a), *Pollution, Property and Prices*, University of Toronto Press.

Dales, J.H. (1968b), "Land, Water, and Ownership", *Canadian Journal of Economics,* (4), pp.791-804.

Defra (2006), Evaluation of the Energy Efficiency Commitment 2002-05 by Eoin Lees Energy, 28 th February.

den Elzen, M.G.J. and Mainshausen, M. (2005), "Meeting the EU 2 ˚C Climate Target: Global and Regional Emission Implications", Netherlands Environmental Assessment Agency. (http://www.gci.org.uk/briefings/rivm.pdf).

den Elzen, Michel. and Meinshausen, Malte. (2006), "Multi-Gas Emission Pathways for Meeting the EU 2 degree C Climate Target", *Avoiding Dangerous Climate Change*, Cambridge University Press. DETR (2000), Energy Efficiency Commitment 2002-2005, November.

Ellerman, A.D. (2000), *Markets for Clean Air: The U.S. Acid Rain Program,* Cambridge University Press.

Esty, D.C. and Porter, M.E. (2002), "Ranking National Environmental Regulation and Performance: A Leading Indicator of Future Competitiveness?", World Economic Forum, *The Global Competitiveness Report 2001-2002*, Oxford Univ. Press.

European Commission. (2005), Doing More with Less - Green Paper on Energy Efficiency, June 22.

European Commission. (2006), Report on the Analysis of the Debate of the Green Paper on Energy Efficiency, May 29.

European Parliament and the Council. (2004), Directive 2004/101/EC of the European Parliament and of the Council of 27 October 2004, amending directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading with the Community, in respect of the Kyoto Protocol's project mechanisms, *Official Journal of the European Union*.

Euro White Cert project (2005), Open Workshop, Interaction and integration of white certificate schemes with other policy tools for sustainable energy, Milan, April, 2005. (http://www.eurowhitecert.org).

Euro White Cert project. (2006), Workshop on white certificate trading systems in the European Union, Budapest, January, 2006. (http://www.eurowhitecert.org).

Euro White Cert project (2006), White Certificates: concept and market experience. (http://www.eurowhitecert.org).

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2004), National Allocation Plan for the Federal Republic of Germany 2005-2007. (http://www.bmu.de/files/pdfs/allgemein/application/pdf/nap_kabi_en.pdf).

German, John. (2006), "American Honda Motor's submission to the United States Committee on Energy and Natural Resources on the paper prepared by Senator Pete V. Domenici and Senator Jeff Bingaman". (http://energy.senate.gov/public/index.cfm?FuseAction=IssueItems.View&IssueItem_ID=38).

Hansen, James et al. (2005), Earth's energy imbalance: confirmation and implications. *Science,* 308, pp. 1431-1435.

Hargrave, Tim. (2000), "An Upstream/Downstream Hybrid Approach to Greenhouse Gas Emissions Trading", Center for Clean Air Policy [CCAP].

Helmut Kaiser Consultancy, Clean Energy and Renewable Energy Market Worldwide 2007-2010-2015. (http://www.hkc22.com/renewableenergy.html)

Regional Greenhouse Gas Initiative [RGGI], RGGI Model Rule. (http://www.rggi.org/index.htm).

Sorrell, Steve. and Skea, Jim. (1999), *Pollution for Sale*, Edward Elgar.

Sterk, W. et al. (2006), Ready to link up? : Implications of Design Differences for Linking Domestic Emissions Trading Schemes, Joint Emissions Trading as a Socio-Ecological Transformation[JET-SET] Working Paper I/06.

Stern, Nicholas. (2007), *Economics of Climate Change: The Stern Review,* Cambridge University Press.

UK Government. (2005), EU Emissions Trading Scheme: Approved National Allocation Plan 2005-2007. (http://www.defra.gov.uk/environment/climatechange/trading/eu/nap/pdf/0505nap.pdf).

US Environmental Protection Agency [EPA] (2006), U.S. Greenhouse Gas Inventory Reports. (http://www.epa.gov/climatechange/emissions/index.html).

Weyant, John P. and Hill, Jennifer. (1999), "Introduction and Overview", *The Energy Journal*, Kyoto Special Issue, vii-xliv.

Winkelman, Steve., Tim Hargrave and Christine Vanderlan. (2000), "Transportation and Domestic Greenhouse Gas Emissions Trading", Center for Clean Air Policy [CCAP].

The World Council for Renewable Energy [WCRE] (2006), The Challenge of Renewable Energy Market Deployment, [Article published by Wolfgang Palz, WCRE Chairman]. (http://www.wcre.de/)

World Wide Fund for Nature [WWF] European Policy Office. (2005), WWF's Contribution to the Green Paper on Energy Efficiency, December.

WWF. (2006), WWF's Assessment: Key National Allocation Plans for Phase II of the EU Emissions Trading Scheme. (http://assets.panda.org/downloads/naps.pdf)

WWF Japan
6th Floor, Nihonseimei-Akabanebashi Building
Shiba, Minato-ku, Tokyo 105-0014 Japan
Tel: +81 3 3769 3509 Email: climate@wwf.or.jp
Fax: +81 3 3769 1717 URL: http://www.wwf.or.jp/climate/