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Enhancing the Environmental Cooperation in Northeast Asia in a New Dimension: Regional Cooperation on the Kyoto Mechanisms (CDM/JI)

Economic Research Institute for Northeast Asia

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Enhancing the Environmental Cooperation in Northeast Asia in a New Dimension: Regional Cooperation on the Kyoto Mechanisms (CDM/JI)

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Edited by Toshihiko Nakamura
Director, Research Division, ERINA
Shagdar Enkhbayar
Associate Senior Researcher, Research Division, ERINA
Shoichi Itoh
Researcher, Research Division, ERINA

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Economic Research Institute for Northeast Asia (ERINA)
13th Fl., Bandaijima Bldg., Bandaijima 5-1, Niigata, 650-0078, Japan
Phone: 81-25-290-5545
Fax: 81-25-249-7550
Http://www.erina.or.jp

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I. ERINA Concept Paper*

A New Dimension in Enhancing Environmental Cooperation in Northeast Asia: Regional Cooperation Focused on the Kyoto Mechanisms (CDM/JI)

1.1 Introduction

Making up over a quarter of the world's population, the Northeast Asian subregion (hereafter referred to as "the region") covers a vast, diverse area comprising six countries: China, the Democratic People's Republic of Korea, Japan, Mongolia, the Republic of Korea and the Russian Federation. The global nature of climate change, along with rapid population growth and urbanization in Northeast Asia, calls for the widest possible cooperation and participation by all countries in the region, undertaking concrete cooperative actions in accordance with their common but differentiated responsibilities, respective capabilities, and socioeconomic conditions.

The environmental conservation and economic development issues in the region have been addressed at the annual Northeast Asia Economic Conference (hereafter referred to as "NAEC") since 1998. At NAEC, the problem of global warming in the region was raised and the necessity of addressing it through a comprehensive approach to sustainable economic development was emphasized. A properly established information exchange and dissemination mechanism was pointed out as being the key to launching and developing regional cooperative initiatives. It was stressed that cooperative action is desirable in Northeast Asia, with a view to promoting effective regional cooperation in the environmental field, inspired by sustainable development[1].

While the world's climate has always varied naturally, the vast majority of scientists now believe that rising concentrations of "greenhouse gases (GHGs)" in the earth's atmosphere, resulting from economic and demographic growth over the two centuries since the industrial revolution, are overriding this natural variability and leading to potentially irreversible climate change. The 1992 United Nations Framework Convention on Climate Change (UNFCCC) provides the foundation for intergovernmental efforts to address this problem. The Kyoto Protocol supplements and strengthens the Convention. At the heart of the Kyoto Protocol lies a set of legally binding emissions targets for industrialized countries, under which they will reduce their combined GHG emissions by at least 5% from 1990 levels in the ***commitment period*** of 2008-2012. Having been adopted in 1997, the Kyoto Protocol entered into force on February 16, 2005 and 165 countries have ratified the Protocol to date. Although the non-annex parties do not currently have specific numerical targets for their GHG reductions, such issues are expected to be addressed during further negotiations.

With the diversities and complementarities of the region, one example of such

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[1] According to the most widely used definition of sustainable development, it is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

* Written by Dr. Enkhbayar Shagdar, Associate Senior Researcher, ERINA.

cooperative activities could be based on the promotion of synergies between different initiatives aimed at the mitigation of greenhouse gas (GHG) emissions and investment in the best available clean technologies in the region. Aiming to map out further actions on effective regional cooperation in applying international policy instruments, such as the Clean Development Mechanism and Joint Implementation (CDM/JI) elements of the Kyoto Protocol, workshops on CDM/JI cooperation in Northeast Asia were organized as part of NAEC and meetings of the NAEC organizing committee during the period 2004-2006, bringing together a group of policymakers and experts in the fields of the environment, energy and finance from both the countries of the region and international organizations. Based on various discussions, views expressed at these meetings and reviews of the environmental and development challenges facing the countries of the region, this paper intends to map out a scheme for further regional cooperative initiatives aimed at the simultaneous pursuit of economic development and environmental protection by the countries of Northeast Asia. It places particular emphasis on the prospects for utilizing the Kyoto Mechanisms in the region, which would enhance environmental cooperation in Northeast Asia, while taking it into a new dimension.

1.2 Overview of Environmental Problems in Northeast Asia

Northeast Asian countries have diverse characters in terms of economic development and industrial structures, and thus face different challenges for economic growth and environmental conservation. However, a common picture is observable in the region's socioeconomic and environmental trends. Studies indicate that despite improving trends in socioeconomic development, and environmental policies and actions, the state of the region's environment is tending to deteriorate further in terms of both resources and pollution. For instance, land degradation, desertification, deforestation, loss of biodiversity, water and air pollution, GHG emissions, solid waste generation, and industrial and vehicular pollutions have been increasing, with this trend likely to continue. Inefficiency in resource use and over-reliance on coal for power generation, and excessive agricultural development and forestry exploitation are considered to be the major causes of environmental degradation in the region (Table 1.1).

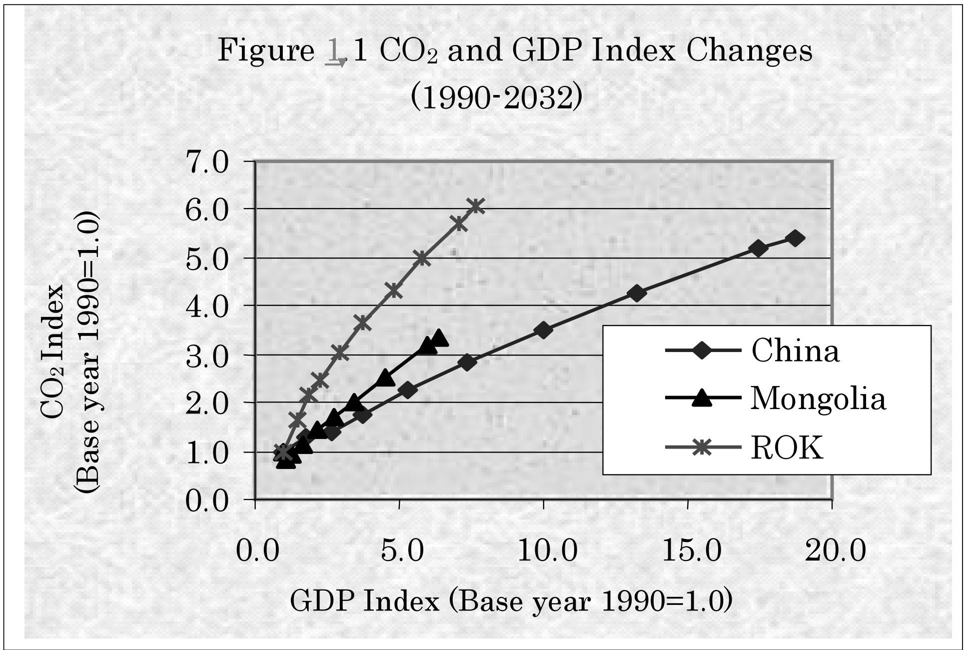
Forecasts of major economic development and environmental variables of Northeast Asian countries strongly indicate tradeoffs between economic development and environmental degradation, despite some positive trends in socioeconomic development. According to the simulation results of the AIM[2]-Trend model, there are remarkable tradeoffs between economic growth and environmental conservation for countries in the region. For example, the positive relationship between the CO_2 and GDP indices compared with 1990 implies that the amount of carbon dioxide rises proportional to GDP growth. In particular, the ROK is expected to see greater CO_2 increases compared with GDP growth than are Mongolia and China (Figure 1.1).

[2] Asia-Pacific Integrated Model

Table 1.1 Major Environmental Problems and Their Causes in Northeast Asian Countries

Country	Major Problems	Major Causes
China	• Acidification of inland waterways and acid deposition • Degradation of water supply • Land degradation and loss of agricultural land • Urban air pollution in major cities • Biodiversity loss • Vulnerability to natural disasters (esp. drought and flooding)	• Over-reliance on low grade coal for power generation • Inadequate infrastructure for the management of municipal effluent • Deforestation and soil erosion • Poverty
Japan	• Excess volumes of industrial and municipal waste • Pollution from dioxins, endocrine disrupters and other industrial hazards • Increasing GHG emissions • Vehicle emissions • Biodiversity loss	• Unsustainable consumption patterns • Lack of emission control in waste incineration and industrial processes (national and cross-border) • Increasing vehicle ownership • Habitat destruction due to development projects and invasion of alien species
Russia	• Air pollution in hot spots and major cities • Inland and marine water pollution • Deforestation • Biodiversity loss • Soil erosion and contamination • Radioactivity	• Inefficient heavy industry and reliance on coal for power generation • Unmanaged industrial and municipal wastes • Urban congestion and inefficient vehicles • Unsustainable agricultural practices, and excessive application of chemicals • Sites where nuclear weapons were previously tested
ROK	• Limited access to drinkable water • Urban air pollution • Environmental contamination • Acidification of inland waterways and acid deposition	• High level of uncontrolled atmospheric releases from industry • Release of dioxins, endocrine disrupters and other industrial hazards • Transboundary air pollution from neighboring countries
DPRK	• Localized air pollution • Water pollution and limited access to drinkable supplies • Vulnerability to natural disasters (esp. drought and flooding)	• High levels of uncontrolled atmospheric releases • Deficiencies in urban infrastructure: industrial and municipal effluent • Poverty
Mongolia	• Localized air pollution • Soil erosion and desertification • Biodiversity loss • Water pollution and limited access to drinkable supplies • Vulnerability to natural disasters (esp. drought and harsh winters (Dzud)	• Overgrazing • Deforestation • Reliance on low-grade coal for power generation

Source: ESCAP & ADB, *State of the Environment in Asia and the Pacific 2000.*



Note: Base year for Mongolia is 1992.

1.3 Northeast Asian Economy and Emissions: An Overview

Home to 26.2% of the world's population and producing more than 20% of global GDP, the region's economies are at different stages of their development, representing a range of income levels. For example, per capita income, measured at PPP, in Japan is in the tens of thousands ($29,814.10), while in Mongolia it is just a few thousands ($2,041.60). In 2004, per capita income at current prices in the ROK was $20,526.20, while it was $5,885.40 in China. Russia's GNI per capita was recorded as $9,683.70, slightly higher than the global average. In terms of growth, Mongolia and China experience the highest growth of all the countries of the region in 2004, achieving rates of 10.7% and 10.1% respectively (Table 1.2).

Regarding anthropogenic GHG emissions, which are believed to be main cause of climate change and global warming, the region's countries account for almost one-third of the global total. Carbon dioxide (CO_2) emissions in the region accounted for 30.3% of the global total in 2004, totaling 8,053 million tons of CO_2. This was an increase of 40.5% on the 1990 level, while total global emissions increased by 27.9%. China was the largest emitter in 2004, due to its rapid economic growth over the past several decades. The next largest emitter was Russia, though its emissions were lower than the 1990 level. This decline was mainly associated with its economic slowdown in the 1990s.

However, in terms of the carbon intensity of the economies, i.e. how much CO_2 one country emits in producing $1 of GDP, Mongolia and DPRK are the highest polluters in the region. At the same time, the data indicates that carbon intensities in all the countries of the region had decreased in 2002, compared with their 1990 levels (Figure 1.2).

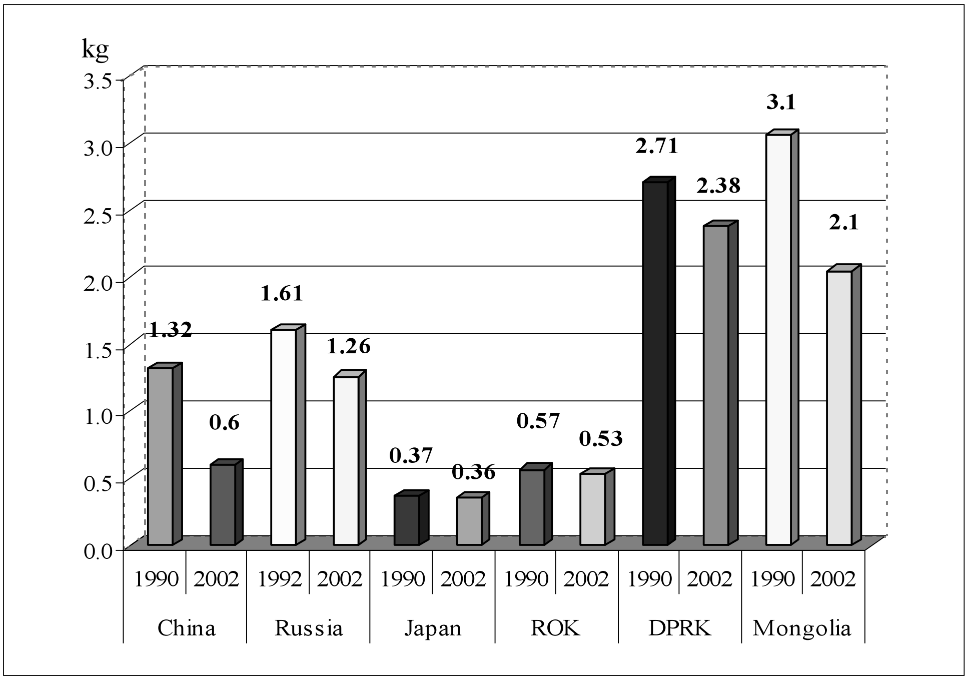
Table 1.2 Northeast Asia in 2004: Population and Economy

Countries and Regions	Total Population, million	Urban Population (% of total)	GDP ($1 billion)	GDP Growth (Annual, %)	Per Capita GNI, PPP (current international $)
China	1,296.2	39.6	1,931.7	10.1	5,885.4
DPRK	22.4	61.4	208.0	2.2	914**
Japan	127.8	65.6	4,622.8	2.7	29,814.1
Mongolia	2.5	56.9	1.6	10.7	2,041.6
ROK	48.1	80.5	679.7	4.6	20,526.2
Russia	143.8	73.3	581.4	7.1	9,683.7
Northeast Asia*	1,640.8	62.9	8,025.4	6.2	n/a
World	6,365.0	48.8	41,290.4	4.1	8,843.5

Notes: *- Values are given as total for GDP and averages for GDP growth and GNI per capita; **-GDP per capita.

Sources: World Bank, World Development Indicators, 2006; Data for DPRK: Bank of Korea.

Figure 1.2 Carbon Intensity of the NEA Economies
(kg CO2 per 2000 PPP $ of GDP)



Note: DPRK data is kg of CO2 per 1995 PPP $ of GDP.

Sources: World Bank, World Development Indicators, 2006; International Energy Agency, CO_2 Emissions from Fuel Combustion, 2004 (DPRK data).

1.4 A New Dimension in Regional Environmental Cooperation: Application of the Kyoto Mechanisms in Northeast Asia

1.4.1 Background

Although the global community does not know what the acceptable concentration of CO_2 in the atmosphere may be, it is clear that a business-as-usual attitude will not be acceptable in the near future, regardless of what level concentration targets might be. Recent studies suggest that early action to mitigate the anthropogenic load on the environment could substantially reduce environmental degradation. Earlier action, though it may entail higher costs, would reduce the risk of rapid climate disturbances and increase the demand for technological improvements. The ability of each country to tackle this alone is limited, however. Therefore, the promotion of synergies between different initiatives aimed at the mitigation of GHG emissions and the promotion of investment in clean, best-available technologies is expected to be the near-term challenge for both developed and developing countries. Developing countries have an opportunity to prevent pollution-inspired problems at lower economic and social costs than their predecessors. It is clear that the sooner society tackles environmental problems, the less costly will be environmental protection measures in future years.

However, researchers suggest that short-term measures attempting to limit emissions alone will not stabilize global CO_2 concentrations. Accordingly, the long-term challenge is the development and diffusion of technologies that will achieve this stabilization. Moreover, recognition of the benefits of pollution control by developing countries is essential as emissions from these countries are expected to surpass those from developed countries in the next two decades. Therefore, the acuteness of global environmental problems on the one hand, and the need for more rapid economic development on the other, require the formulation and immediate implementation of innovative actions that break through tradeoffs between economic development and environmental degradation in the region. However, each country is limited in the extent to which they can be adopted, due to limited financial resources, and human and institutional capacities, as well as the extent of the knowledge base on sustainable development, and access to and availability of adequate information. In particular, developing countries are reliant on foreign sources of financing for major domestic investments, but these sources are shrinking due to the current global economic slowdown and general trend towards a decrease in ODA.

Nevertheless, these shortfalls can be successfully overcome by means of effective international cooperation in innovative actions on the environment and development, in areas such as: (i) technology transfer, (ii) consumption shift, (iii) environmental industry, and (iv) expansion of green markets. Clean environmental technologies can both boost the economy and protect the environment, giving rise to a "win-win" situation. Innovations in the fields of environment and development need to be developed and adopted extensively in the region.

Among the various measures and instruments that support developing nations in catching up with developed countries, the Kyoto Protocol proposes an efficient tool for development cooperation aimed at the common goal of sustainable development through such mechanisms as the Clean Development Mechanism (CDM), Joint Implementation (JI) and emissions trading (ET), which are known as the flexibility mechanisms.

Taking advantage of the combination of both Annex I and Non-Annex I countries in the region, the Kyoto Protocol's CDM/JI mechanism could be an ideal tool for reducing GHG emissions in the region. The essential legal grounds for such cooperation are already in place, as all the countries are parties to the UNFCCC and the Kyoto Protocol. The Kyoto Protocol has been ratified by Mongolia (Dec. 1999), Japan (June 2002), China (Aug. 2002), ROK (Nov. 2002), Russia (Nov. 2004) and DPRK (Apr. 2005). Therefore, the realization of the mechanisms can take place entirely within a regional framework.

1.4.2 CDM/JI Cooperation in Northeast Asia

As mentioned earlier, in terms of sustainable development, Northeast Asia has a tremendous opportunity to benefit from the Kyoto Mechanisms by integrating their economic development and environmental conservation efforts. The following factors may justify such joint actions.

Firstly, Northeast Asia comprises both Annex I and Non-Annex I countries and, all the countries are already parties to the Kyoto Protocol, the realization of the mechanisms can take place entirely within a regional framework.

Secondly, Japan - the world's leading industrialized nation - faces immense challenges in meeting its Kyoto targets. At the same time, the industrial structure and technology in most Northeast Asian countries is still dominated by inefficient, wasteful and polluting technologies, and energy intensive machinery and equipment. Therefore, there is an exact match of "demand and supply" with regard to the Kyoto Mechanisms in the region.

Thirdly, inefficiency in resource use and over-reliance on coal for power generation, as well as excessive agricultural development and forestry exploitation, are considered to be the major causes of environmental degradation in the region. Accordingly, in order to protect the region's ecosystem while ensuring energy security and economic prosperity, Northeast Asian countries must be more active in taking comprehensive measures to reduce their energy-related greenhouse gas emissions on the one hand, and promoting sustainable land use and stepping up afforestation and reforestation activities, on the other.

To address the aforementioned issues effectively and in a concerted manner, the countries of the region may develop joint measures, such as drafting a joint strategy for the conversion of power stations from being oil-fired to running on new and renewable energies; promoting energy efficiency and conservation; carrying out more research and development into eco-friendly energy technology; reducing the use of mineral oils for heating; establishing a framework for gas-fired power plants with CO_2 processing technology; and encouraging more extensive use of waste as an alternative energy source to fossil fuels.

Such actions can be successfully implemented by means of the extensive utilization of CDM/JI project activities. However, most of the region still lacks sufficient capacity to respond to and make use of such mechanisms. Institutional capacity and policy practices in developing countries in the region may act as barriers to technology transfer for industry under CDM/JI.

This will require urgent attention to a range of capacity building measures that will identify and eventually remove barriers to the transfer of environmentally sustainable technologies. Measures are also needed to support national mechanisms for the identification and assessment of appropriate technologies, the negotiation of their transfer, and their management and absorption once transferred under CDM/JI. In addition, support for the establishment of baselines, the monitoring of CDM/JI projects and an authority certifying emission reductions are required. Accordingly, building the necessary capacity - human, institutional and legal - has become crucial.

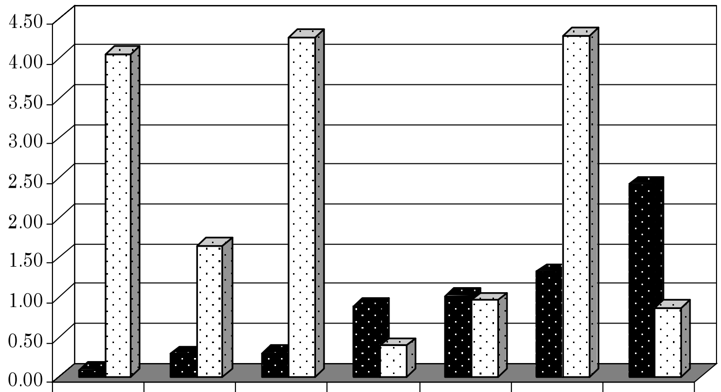
Therefore, a properly established mechanism in the region is needed in order to develop and promote joint actions, with the aim of nurturing the technical capacities of the project participants, certifiers and certifying institutions in the relevant countries, and ensuring that they are on a par with those of the leading international certification bodies and project developers in terms of technical skills and adherence to guidelines and standards. Such activities may include the organization of seminars and workshops, which would be a platform for regular information exchanges and would foster concerted measures addressing particular problems.

Energy industries remain the major sources of CO_2 emissions in NEA countries. Energy-related emissions of major GHGs account for more than 70-90% of total emissions in NEA countries. Therefore, comprehensive, proactive measures aimed at the reduction of energy-related GHG emissions are required in order to protect the region's ecosystem, while also ensuring energy security and economic prosperity.

In terms of energy use, which is the main source of GHG emissions in all countries, Russia, the ROK and Japan are the largest energy users in terms of per capita total primary energy supply (TPES). For example, in 2002, per capita TPES was over 4.0 tons of oil equivalent (toe), which is 2.5 times higher than the world average. At the same time, China, the DPRK and Mongolia have almost half the world average level of per capita TPES (ranging from 0.39 in Mongolia to 0.96 in China). However, energy use in these countries is increasing year by year, associated with rising economic growth, especially in China. Primary factors in this increase include the delay in implementing energy efficiency improvements and stagnation in the introduction of new energy sources, as well delays in the shift from coal to other energy sources.

On the other hand, in terms of energy efficiency, Japan is the leading country not only in the region, but also worldwide. Energy efficiency in Japan, measured by TPES per unit of GDP, was more than three times higher than the world average, while energy efficiency levels in all other countries in the region were three to eight times lower, except in the ROK. The ROK's energy efficiency was close to the world average. Therefore, we can assert that there is a lot of scope for energy efficiency improvement projects in the region (Figure 1.3).

Figure 1.3 Selected Energy Indicators of Northeast Asian Countries, 2002



	Japan	World	Korea	Mongolia	China	Russia	DPRK
■ TPES/GDP toe/000 95 US$)	0.09	0.29	0.30	0.89	1.02	1.32	2.42
□ TPES/POP toe/capita	4.06	1.65	4.27	0.39	0.96	4.29	0.87

Sources: International Energy Agency, CO_2 Emissions from Fuel Combustion, 2004, except Mongolia, which is the author's estimate.

1.5 Conclusion

The acuteness of the problem of climate change is coming to be of increasing concern globally. The third IPCC Assessment Report made it clear that the threat of climate change is genuine and its impact will directly affect all of humankind, owing to ecosystem vulnerability, and the fragility of economic and social systems. Thus, cooperation between developed and developing counties with the aim of achieving clean and sustainable development is indispensable. To this end, Northeast Asian countries have tremendous opportunities to cooperate in and benefit from the "win-win" situation afforded by the Clean Development Mechanism and Joint Implementation system set out in the Kyoto Protocol.

However, most of the region still lacks sufficient capacity to respond and make use of such mechanisms. Accordingly, building the necessary capacity - human, institutional and legal - is becoming crucial. Therefore, as a response to such needs, it is desirable to establish a mechanism that fosters regional cooperation aimed at extensive and effective utilization of CDM/JI projects.

2.1 Non-Annex I Countries

2.1.1 China*

A. National Responses to Climate Change

China's efforts in the field of global environmental issues are driven by the need not only for global environmental protection, but also for a more favorable international environment for China's economic and social development. Due to the close connection between climate change and the socioeconomic and energy-related development of countries, climate change has become one of the important issues in China's long-term development strategy.

The Chinese government attaches great important to the issue of global warming and regards the UNFCCC and the Kyoto Protocol (KP) as reflecting the common will and interest of the international community with regard to global climate change. However, China is still a developing country with per capita GDP of only $1000, much lower than the global average. There are 30 million people living below the poverty line (2000). Activities aimed at combating climate change should be based on this situation. China has recognized the importance of environmental protection and sustainability. Since the United Nations Conference on Environment and Development (UNCED) in 1992, China has developed a sustainable development strategy and made continuous improvements to it. Amongst other activities, efforts have been made in the following fields, which are closely related to climate change mitigation:

(1) Improving energy efficiency and promoting energy conservation

In the last 20 years, energy system efficiency has improved from around 25% to more than 34%. Energy intensity (units of energy per unit of GDP) has decreased significantly, from 13.35 tons of coal equivalent (tce) per 10,000 yuan to 4.53 tce at constant prices. The energy consumption elasticity coefficient has been maintained below 0.5 for more than 20 years.

Such improvements in energy efficiency have led to energy consumption falling by more than 1 billion tce between 1980 and 2000, equal to a reduction in carbon emissions of 750 million tons.

(2) Developing new and renewable energy

By 2000, use of newly developed renewable energy totaled 96 million tce, equal to a decrease in carbon emissions of 69 million tons. The traditional approach of biomass use in rural areas was not included.

(3) Increasing carbon sinks by means of forestation and reforestation.

It is estimated that about 120 million tons of carbon have been sequestrated through forestation and reforestation activities in China from 1980 to 2000.

(4) Family planning policy contributes to climate change mitigation

In 2000, the birth rate in China was decreased to 1.403%, while the population growth rate was only 0.758%, respectively 0.418% and 0.429% lower than the 1980 rates. The

* The original paper was prepared by Zheng Shuang, Associate Professor of Energy Research Institute, National Development and Reform Commission of P.R.of China.

lower population growth rate contributes significantly to controlling the increase in carbon emissions at present and in the future. China will continue its population control efforts in the foreseeable future.

(5) Establishing an institutional system and enhancing policy studies concerning climate change

The National Climate Change Coordination Office has been established within the Chinese government, led by the National Development and Reform Commission, which is composed of all the relevant governmental agencies. Many research entities have been established to conduct scientific and policy studies in the field of climate change.

Public education initiatives relating to climate change are also becoming popular. Conferences and workshops on climate change are frequently held by the government, academics, NGOs, and international organizations in China.

B. GHG Emissions in China

As a country with more than 1.3 billion people, China is a big emitter of greenhouse gases (GHGs), although its per capita GHG emissions are still much lower than the global average and far behind those of developed countries. In 2000, about 1.1 billion tons of carbon were emitted in China, with carbon dioxide totaling about 860 million tons and methane more than 170 million tons. Most of the carbon was generated through energy use and industrial processes, such as cement production.

In 2000, on the other hand, carbon sinks played an important role in China. About 130 million tons of carbon were sequestrated by the forestry and agriculture sectors, and there were more than 110 million tons of carbon sinks in forestation, reforestation, and forest management in China that year.

In accordance with the requirements of the guidelines for the preparation of national communications by parties not included in Annex I to the convention, the Chinese government published a national GHG inventory for 1994. The inventory covers carbon dioxide, methane and nitrous oxide emissions and sinks in five sectors, namely energy, industrial processes, agriculture, land-use changes and forestry, and waste. Nationwide carbon dioxide emissions in 1994 totaled 3,073 million tons, with carbon sinks from land-use change and forestry totaling about 407 million tons. After deducting carbon sinks, net emissions of carbon dioxide in 1994 totaled 2,666 million tons (about 727 million tons of carbon), with per capita emissions working out at about 0.6 tons of carbon per year. Total methane emissions in China in 1994 were approximately 34.29 million tons, while nitrous oxide emissions totaled about 0.85 million tons (Table 2.1.1.1).

Methane and nitrous oxide were converted into carbon dioxide equivalent using the global warming potentials (GWP) in the 100-year horizon given in the IPCC Second Assessment Report. This demonstrated that total GHGs in China in 1994 amounted to 3,650 million tons of carbon dioxide equivalent, of which carbon dioxide, methane and nitrous oxide accounted for 73.05%, 19.73%, and 7.22% respectively (Table 2.1.1.2)

In addition, it was estimated that carbon dioxide emissions from international bunker fuels (international aviation and international navigation) in China in 1994 totaled 10.85 million tons.

Table 2.1.1.1 China's National GHG Inventory for 1994 (Gigagrams)

GHG Sources & Sink Categories	Carbon dioxide	Methane	Nitrous oxide
Total (Net) National Emissions (Gigagrams per year)*	2,665,990	34,287	850
1. All energy	2,795,489	9,371	50
Fuel combustion	2,795,489		
Energy & transformation industries	961,703		50
Industry	1,,223,022		
Transport	165567		
Commercial & institutional	76,559		
Residential	271,709		
Other (building industry & agriculture)	96,929		
Biomass burned for energy		2,147	
Fugitive fuel emissions		7,224	
Oil & natural gas systems		124	
Coal mining		7,100	
2. Industrial processes	277,980		15
3. Agriculture		17,196	786
Enteric fermentation		10,182	
Rice cultivation		6,147	
Savanna burning		N/A	
Other**		867	786
4. Land-use change & forestry	-407,479		
Changes in forests & other woody biomass stock	-431,192		
Forest and grassland conservation	23,713		
Abandonment of managed land	Not estimated		
5. Others		7,720	
Waste disposal		7,720	

Notes:
*Small differences may exist between the summation of each type and the total due to rounding errors.
**The methane emission source only includes animal waste management systems. Nitrous oxide emission sources include cropland soil, animal waste management systems and agricultural residue burning in fields.

Table 2.1.1.2 1994 GHG Emissions in CO_2 Equivalent

GHGs	Total emissions (Gigagrams)	GWP	Carbon dioxide equivalent (Gigagrams)	Share (%)
Carbon dioxide	2665990	1	2,665,990	73.05
Methane	34287	21	720,027	19.73
Nitrous oxide	850	310	263,500	7.22
Total			3,649,517	100.00

Greenhouse gas emissions by source as detailed in the 1994 national inventory

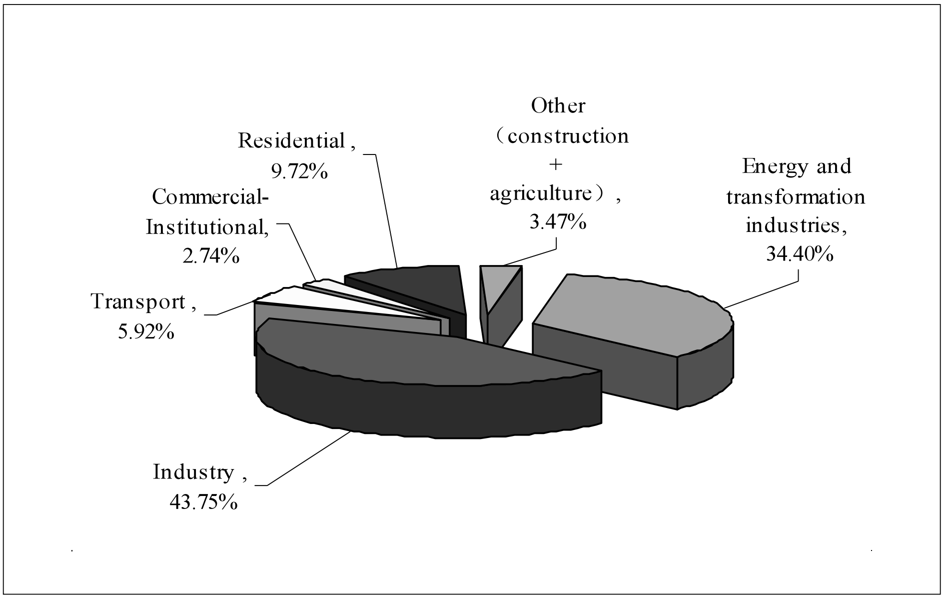
Carbon dioxide

Energy and industrial processes were the major sources of carbon dioxide emissions in China in 1994, when emissions totaled 3,074 million tons, of which 2,795 million tons were emitted from the energy sector and 278 million tons from industrial processes. Land-use change and forestry was a net sink of carbon dioxide, absorbing 407 million tons of carbon dioxide, while net emissions of carbon dioxide amounted to 2,666 million tons.

(1) Energy

According to the inventory, the energy sector was the primary source of carbon dioxide emissions in China in 1994, with carbon dioxide emissions totaling 2,795 million tons, or about 763 million tons of carbon, and accounting for 90.95% of total national carbon dioxide emissions (excluding sinks from land-use change and forestry). Carbon dioxide emissions from the energy sector were generated entirely by fossil fuel combustion, with industry emitting 1,223 million tons (43.7% of the energy sector), the energy and transformation industries 962 million tons (34.40%), the transport sector 166 million tons (5.92%), the residential sector 272 million tons (9.72%) and the commercial and institutional sector 76 million tons (2.74%) (Figure 2.1.1.1).

Figure 2.1.1.1 Carbon Dioxide Emissions by Source in China's Energy Sector in 1994



(2) Industrial processes

Carbon dioxide emissions from cement, lime, iron and steel, and calcium carbide production were estimated as part of the industrial processes sector. In 1994, China produced approximately 420 million tons of cement, about 300 million tons of clinker and about 130 million tons of lime, which were mainly used in building materials, metallurgy and the chemical industry. In addition, it produced about 92.61 million tons of steel and about 2.81 million tons of calcium carbide (converted at a standard purification of 300 liters acetylene gas per kilogram of calcium carbide).

In 1994, carbon dioxide emissions from industrial processes in China totaled about 278 million tons, accounting for 9.05% of total national carbon dioxide emissions (excluding carbon sinks from land-use change and forestry). These emissions were mainly generated by cement and lime production, which constituted about 90.42% of carbon dioxide emissions in this sector (Table 2.1.1.3).

Table 2.3 Carbon Dioxide Emissions from Industrial Processes in China in 1994

Emission source	Carbon dioxide (Gigagrams)	Share (%)
Cement	157,775	56.76
Lime	93,560	33.66
Iron & steel	22,678	8.16
Calcium carbide	3,968	1.43
Total	277,980	100.00

(3) Land-use change and forestry

In 1994, due to changes in forests and other woody biomass stocks caused by changes in the growth of standing volume, bamboo and economic forests and forest consumption were net sinks of carbon dioxide, absorbing 431 million tons of carbon dioxide (or about 118 million tons of carbon). The growth of stands absorbed 749 million tons of carbon dioxide. The growth of open forests, scattered trees and four-side trees absorbed 131 million tons, changes in economic forests absorbed 60 million tons, and changes in bamboo absorbed 24 million tons. Carbon dioxide emissions caused by the consumption of standing volume totaled 533 million tons. Carbon dioxide emissions caused by conversions of forests and grassland include those caused by the conversion of forests to un-forested land. In 1994, carbon dioxide emissions caused by the conversion of forests totaled 24 million tons (Table 2.1.1.4).

Table 2.1.1.4 1994 GHG Inventory for the Land-use Change and Forestry Sector in China

Emission source/sink	Sub-type	Carbon dioxide emissions/sinks (tons)
Changes in forests and other woody biomass stocks	Forested land	-300,365,000
	of which, Growth of stands	-748,742,000
	Consumption of forests	532,569,000
	Economic forests	-60,286,000
	Bamboo stands	-23,907,000
	Open forests, scattered trees & four-side trees	-130,827,000
	Sub-total	-431,192,000
Conversion of forests		23,713,000
Total		-407,479,000

Methane

Methane emissions in China mainly originate from the agriculture, energy and waste treatment sectors. In 1994, methane emissions totaled about 34.29 million tons, of which 17.20 million tons originated in the agricultural sector, about 9.37 million tons in the energy sector and about 7.72 million tons in the waste treatment sector . The agricultural sector was the largest source of methane emissions, accounting for 50.15%, including the emission of 10.18 million tons from the enteric fermentation of ruminants, 6.15 million tons from rice paddies and 0.87 million tons from animal manure management systems. The energy sector was the second-largest contributor, accounting for 27.33%, including the emission of 7.10 million tons from coal mining and post-mining activities, 2.15 million tons from biomass burning and 0.12 million tons of fugitive emissions from oil and natural gas systems. Methane emissions from waste treatment totaled about 7.72 million tons, accounting for 22.52% (Tables 2.1.1.5; 2.1.1.6).

Table 2.1.1.5 Methane Emissions in China in 1994

Type of emission source	Methane (tons)	Percentage (%)
Total (I+II+III)	34,287,000	100.00
I. Energy	9,371,000	27.33
Burning of biomass	2,147,000	6.26
Oil & gas system	124,000	0.36
Coal mining	7,100,000	20.71
II. Agriculture	17,196,000	50.15
Enteric fermentation	10,182,000	29.70
Rice cultivation	6,147,000	17.93
Animal manure management systems	867,000	2.53
III. Waste treatment	7,720,000	22.52

(1) Agriculture

Chinese rice paddies account for approximately 21% of the global total. The harvest area of paddy rice fields in China makes up about 25% of total national cropland, spread over 28 provinces, municipalities directly under central government control, and autonomous regions. In different areas where rice grows in paddies, the climatic and soil conditions differ and there are major differences between regions with regard to such factors as the variety of rice grown, the cropping system, the way in which irrigation is carried out, and the type of fertilizers and application regime employed. All these factors affect estimates of methane emissions from rice paddies.

China is home to a large number of animals. In 1994, China had 92.40 million non-dairy cattle, 3.84 million dairy cattle, 22.91 million buffaloes, 123.08 million goats, 117.45 million sheep and 414.62 million swine. Total methane emissions from rice paddies in 1994 were estimated to be 6.15 million tons and those from enteric fermentation amounted to 10.18 million tons, while those from animal manure management systems in 1994 totaled about 0.87 million tons (Table 2.1.1.6).

Table 2.1.1.6 Methane Emissions from the Agricultural Sector in 1994

Source of emissions	Methane (tons)	Percentage (%)
Enteric fermentation	10,182,000	59.21
Rice cultivation	6,147,000	35.75
Animal manure management systems	867,000	5.04
Total	17,196,000	100.00

(2) Energy

Methane emissions from the energy sector mainly included emissions from coal mining, fugitive emissions from oil and natural gas systems and emissions from the burning of biomass fuels. In 1994, methane emissions from the energy sector totaled 9.37 million tons; of this figure, coal mining and post-mining activities accounted for 7.10 million tons (75.76% of the total), the burning of biomass fuels for 2.15 million tons (22.91%), and oil and natural gas systems for 0.12 million tons (1.32%).

(3) Waste treatment

In 1994, the urban non-agricultural population in China was about 176.7 million. They generated 75.64 million tons of municipal solid waste, averaging out at about 1.17 kilograms of solid waste being generated per capita per day. Wastewater emissions in 1994 totaled 41.53 billion tons; industrial wastewater emissions accounted for 28.16 billion tons of this, with 16.629 million tons of chemical oxygen demand, while domestic wastewater emissions totaled 13.37 billion tons, with 6.10 million tons of chemical oxygen demand.

Methane emissions from waste treatment totaled 7.72 million tons; of this, municipal solid waste treatment accounted for 2.03 million tons and wastewater treatment for 5.69 million tons, with the latter consisting of 4.16 million tons from industrial wastewater treatment and 1.53 million tons from domestic wastewater treatment. Industrial wastewater treatment accounted for 53.89% of total emissions and municipal solid waste treatment for 26.30% (Table 2.1.1.7).

Table 2.1.1.7 Methane Emissions from the Waste Treatment Sector in China in 1994

Emission source	Methane (tons)	Percentage (%)
Treatment of municipal solid waste	2,030,000	26.30
Treatment of industrial wastewater	4,160,000	53.89
Treatment of domestic sewage	1,530,000	19.82
Total	7,720,000	100.00

Nitrous oxide

Nitrous oxide emissions in China in 1994 mainly originated from agricultural activities, with a small amount being generated from industrial processes and the energy sector. Nitrous oxide emissions totaled approximately 850,000 tons, with agriculture accounting for about 786,000 tons of this, industrial processes for about 15,000 tons and the energy sector for about 50,000 tons. Agriculture accounted for approximately 92.43% of total nitrous oxide emissions, while industrial processes and energy accounted for 1.75 % and

5.82% respectively (Table 2.1.1.8).

Table 2.1.1.8 Nitrous Oxide Emissions in China; 1994

Emission source	Nitrous oxide (tons)	Percentage (%)
Total	850,000	100.00
Energy	50,000	5.82
Industrial processes	15,000	1.75
Agriculture	786,000	92.43

(1) Agriculture

Nitrous oxide emissions from agriculture in China in 1994 were estimated at 786,000 tons, with direct emissions from cropland accounting for about 60.30%, indirect emissions from cropland for about 19.53%, grazing for about 14.03%, animal manure management systems (excluding grazing and burning of manure) for 5.56%, direct burning of crop residues in fields 0.46%, and the burning of animal waste for about 0.10% (Table 2.1.1.9).

Table 2.1.1.9 Nitrous Oxide Emissions from the Agricultural Sector in China; 1994

Emission source	Nitrous oxide emission (tons)	Percentage (%)
Direct emissions from cropland	474,000	60.30
Indirect emissions from cropland*	154,000	19.53
Grazing	110,000	14.03
Burning of manure	1,000	0.10
Animal manure management systems**	44,000	5.56
Field residue burning	4,000	0.46
Total	786,000	100.00

Notes:

* Nitrous oxide generated by atmospheric sedimentation was incorporated into estimates of direct emissions from cropland.

**Excluding nitrous oxide emissions from grazing or the burning of manure.

The application of synthetic nitrogen fertilizers was the primary source of direct emissions of nitrous oxide from croplands. In 1994, 57.8% of direct emissions of nitrous oxide from croplands in China originated from the application of synthetic nitrogen fertilizers, 22.9% from the application of organic manure, 7.9% from biological nitrogen fixation in agriculture, and 5.1% and 5.8% respectively from the direct incorporation of crop residues into soils and the atmospheric deposition of nitrogen caused by the application of fertilizers.

(2) Industrial processes

Nitrous oxide emissions from adipic acid production were estimated as part of the 1994 national GHG inventory. In 1994, a total of five enterprises in China were producing adipic acid, with a total output of about 57,000 tons. Total emissions of nitrous oxide from adipic acid production for that year were estimated at about 14,800 tons.

(3) Energy

Nitrous oxide emissions from the energy sector came mainly from thermal power generation, with emissions in 1994 totaling about 50,000 tons.

Future GHG emissions in China

Future GHG emissions will mainly depend on developments in the area of energy consumption, as this is the primary source of emissions. There is still a great deal of uncertainty with regard to the energy demand forecast for China. China is still going through the process of industrialization and urbanization and economic expansion will continue for decades, so there will be a corresponding steady increase in energy consumption. As the economic structure is changing, there are different energy demand forecasts even in the business-as-usual scenarios. Many forecasts suggest that energy consumption will be around 3 billion tce by 2020, but some estimate that it will be higher still, perhaps as high as 3.6 billion tce of primary energy. Most forecasts suggest that coal will continue to play an important role for the foreseeable future, although its share may be lower than it is today.

Analyses suggest that it could be possible for China to achieve a lower rate of increase in GHG emissions. If endeavors in the field of energy conservation and energy efficiency improvements can be enhanced and encouraged, the increase in future energy consumption may turn out to be lower than in any of the business-as-usual scenarios. Future energy conservation potential may range from a couple of hundred tce to more than 800 million tce. At the same time, a fuel shift away from coal could also play an important role in reducing GHG emissions.

Although substantial progress has been made over the last twenty years in controlling the growth in energy consumption, which has risen at about half the rate of economic growth, demand for energy to power economic growth will continue to grow in the 21st century. Increased GHG emissions associated with fossil fuel production and use are expected. It is estimated that, in a well-off society scenario, China's carbon dioxide emissions from fossil fuel combustion will reach about 1,700-1,800 million tons of carbon in 2020 (see Table 2.1.1.10).

Table 2.1.1.10 Carbon Dioxide Emissions from Fossil Fuel Combustion in China from 1990 to 2001 and Projected to 2020 (million tons of carbon)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2020
ERI	550.0	631.3	663.3	701.9	739.3	786.9	838.5	821.4	783.1	770.0	767.2	777.3	1940 1716 1437
IEA	616.9	645.8	667.9	711.9	768.0	787.7	803.2	824.3	805.2	791.0	780.4	831.7	1574 1801

Sources: Estimates from Energy Research Institute (ERI) experts; International Energy Agency (IEA) http://www.eia.doe.gov/emeu/international/total.html#Carbon.

C. CDM Policy in China

i. Introduction to domestic CDM policy

China has been consistent in dutifully implementing the UNFCCC and promoting the effectiveness of the Kyoto Protocol, which it ratified in August 2002. China is now implementing its 11th five-year national socioeconomic development plan, in which sustainable development has become an important element. In the long term, the main objectives for socioeconomic development in China are sustaining a rapid economic growth rate, transforming the economic growth pattern by reducing energy consumption, saving energy and increasing economic efficiency, opening the country up further, improving foreign capital utilization, introducing talent and technology, strengthening energy and transport infrastructure, enhancing environmental protection and ecological conservation, and accelerating economic development in rural and remote areas, especially the western regions of the country. The implementation of CDM projects can not only assist Annex I parties in achieving their emission targets at a lower cost, but also help them to meet sustainable development strategy requirements in China.

China places a great deal of emphasis on the twin purposes of CDM: assisting developing countries in achieving sustainable development and helping developed countries to meet their limitation or reduction commitments. The certified emission reductions (CERs) acquired from CDM projects will be supplemental to the domestic mitigation actions of Annex I parties. The baseline will be on a project basis. The environmental integrity of CDM projects is to be ensured through strict validation, verification, monitoring and baseline determination. CERs will not be used in emission trading and CDM projects are to be implemented bilaterally.

The *Measures for the Operation and Management of Clean Development Mechanism Projects in China* became effective on 12 October 2005. It formulates the principles, institutional framework and approval procedure for CDM implementation in China. The general principle for the implementation of CDM in China is that all projects must comply with Chinese laws and regulations and be consistent with the national sustainable development strategy and policy, as well as the general objectives of national socioeconomic development plans. The government has stipulated the following priority areas for CDM projects: energy efficiency improvements, development and utilization of new and renewable energy, and methane recovery and utilization.

The implementation of CDM projects in China must be approved by the Chinese government. Investment in CDM projects should be additional to ODA and financial obligations under the convention. The project activities should also lead to technology transfer. The operation should be transparent and highly efficient. Any organization and individual engaged in CDM-related activities must comply with Chinese laws and regulations.

China is a developing country with great mitigation potential and a sound investment environment. The prospects for CDM cooperation are regarded as highly promising by many developed countries. If properly operated, CDM could be a new channel for introducing technology and rational foreign direct investment and could therefore promote sustainable development in China. Through its accession to the WTO, China is becoming deeply integrated with global political and economic systems and engaging in a wide range of international endeavors, including efforts to combat climate change. In this context, in addition to conducting studies of CDM methodology, modality, impact and countermeasures, strengthening capacity building and preparing for the market, technology and administration are crucial in order for China to seize CDM opportunities and promote sustainable development.

ii. CDM institutional framework

In 1998, China established an inter-ministerial committee to coordinate national activities related to climate change. This committee, called the National Climate Change Coordination Committee (NCCCC), has 15 members and oversees all activities related to climate change in China (see figure 4). The National Development and Reform Commission (NDRC), which chairs the committee and acts as the secretariat to the committee, houses the NCCCC office.

China's ratification of the Kyoto Protocol in August 2002 enabled it to establish an institutional framework for implementing CDM. October 2005 saw the entry into force of the *Measures for Operation and Management of Clean Development Mechanism Projects in China*, which clearly stipulate the requirements for obtaining permission, institutional arrangements for project management and implementation, project procedures, approval, implementation and supervision. These *Measures* state that the NDRC is China's Designated National Authority (DNA) for CDM and represents China in issuing written letters of approval.

iii. CDM project procedure and evaluation criteria

The national CDM board is composed of the NDRC, the Ministry of Science and Technology (MOST), the Ministry of Foreign Affairs (MOFA), the State Environmental Protection Administration, the State Meteorological Administration, the Ministry of Finance (MOF), and the Ministry of Agriculture. The responsibilities of the board include the following: approving CDM projects; reporting to the NCCCC on CDM implementation, issues, and suggestions; proposing the modification of operational rules and procedures of national CDM activities; examining qualifications, project design documents, baseline methodology, and GHG emission reductions; examining the price of CERs; and approving the terms of capital and technology transfer and monitoring plans, etc.

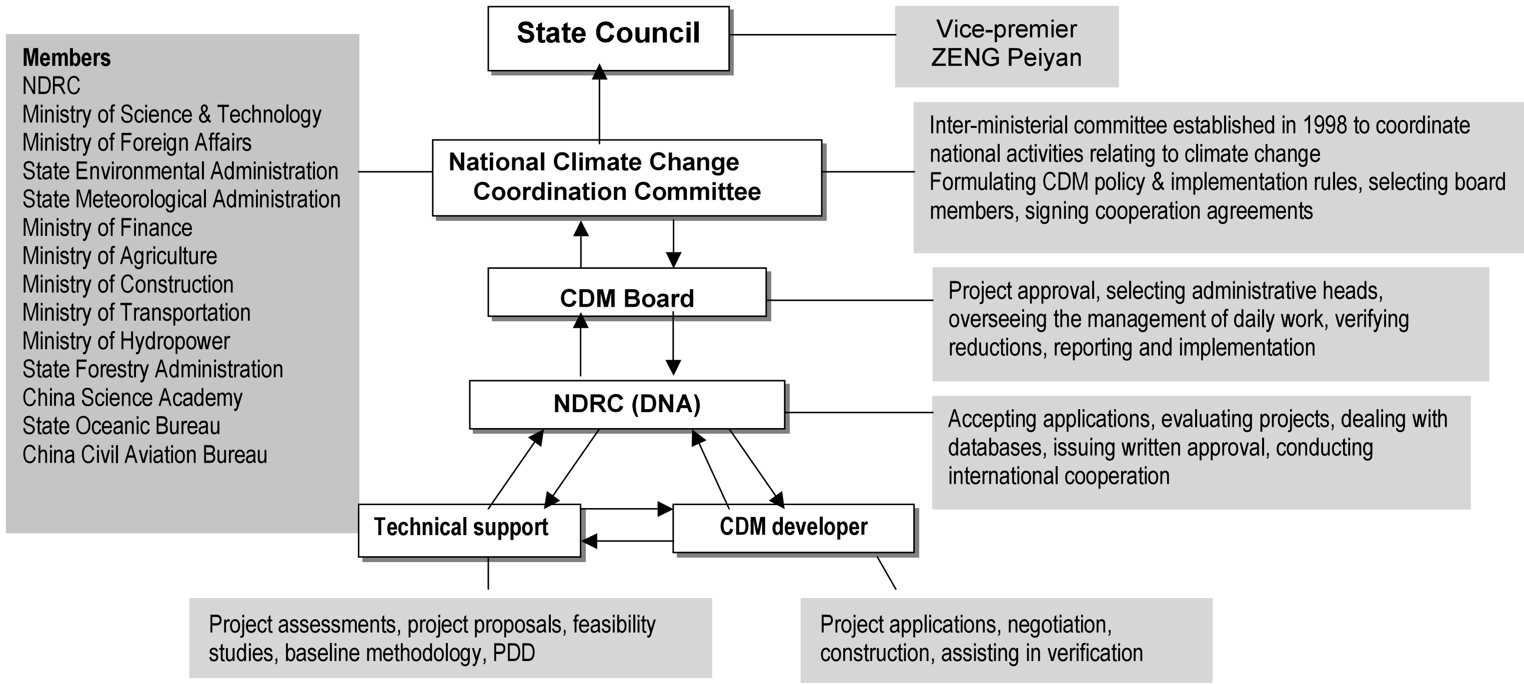
The responsibilities of the NDRC include the following: accepting project applications; granting final letters of approval for projects in collaboration with MOST, MOFA and MOF based on the results of national CDM board assessments; issuing project approval documents on behalf of the national government; monitoring and administrating CDM project implementation; and undertaking foreign communications, etc.

CDM project developers in China must be Chinese enterprises or entities, or Chinese-held joint ventures. They are required to submit the relevant project documents to the NDRC for approval.

iv. Procedure for approving domestic CDM projects

CDM projects focus on new investment and projects aimed at renovation; therefore, they should follow the relevant national and local approval procedures for such investments. The NDRC is responsible for approving domestic projects (new investment and renovation projects) involving total investment of over RMB200 million and foreign

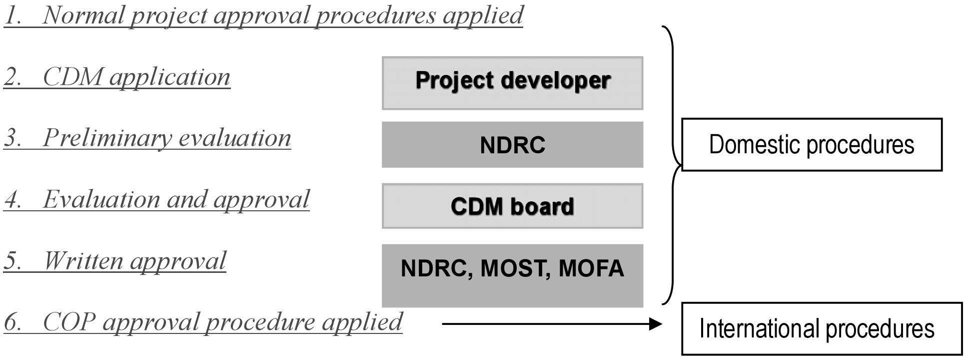
Figure 2.1.1.2 Organizational Structure of the National Climate Change Coordination Committee and Functions of Related Organizations
China's Climate Change and CDM Decision-Making Process



investment projects entailing total investment above $100 million.

The specific CDM project approval procedure is not intended to interfere with the existing normal project management procedure but, rather, is an additional component. The two can proceed in parallel, but projects normally first undergo the procedures for new or renovation investment approval and then apply for CDM approval (Figure 2.1.1.2).

Figure 2.1.1.3 Domestic CDM project approval process



Project boundaries

Rational project boundaries are essential in order to accurately measure the emission reduction benefits of a CDM project activity and to mitigate leakage. Four principles are useful in identifying emission sources and sinks that should be included in the project boundaries: 1) comprehensive definitions of the boundaries and accompanying costs; 2) control over emissions and maintenance of proper incentives; 3) avoidance of double counting; and 4) the materiality of emissions, i.e. the stipulation of a threshold beyond which emissions will be classed as being "significant".

Baseline

A balanced choice of baseline is an important prerequisite for the environmental integrity of projects. In order to select the most appropriate baseline methodology for a CDM project activity, one needs to strike a good balance between different considerations, such as the actual situation, transparency, accuracy, verifiability, and transaction costs.

National baselines are not appropriate. China is a large country with significant differences between regions, so baseline methodologies based on national average data are not an appropriate choice. If the project boundaries permit, baselines based on regional data, it could strike a good balance among different considerations as a default value.

Project-specific baselines are the best option. Most projects have adopted project-specific baselines, in part because of the lighter data collection workload compared with multi-project baselines, as well as the fact that baseline data were easier to obtain because similar projects were being constructed or designed within the same region, not to mention the low cost of data collection.

Project proponents planning to undertake CDM projects in China should take these observations into account.

Additionality assessment

Projects should meet such additionality requirements as technological additionality, financial additionality and environmental additionality. Article 9 and 10 of the Interim Measures stipulate that funding for CDM projects from the developed country parties must be additional to their current official development assistance and their financial obligations under the Convention. CDM project activities should promote the transfer of environmentally sound technology to China.

Additionality assessments are important in order to safeguard the environmental integrity of the Kyoto Protocol. Various institutions are involved in the additionality assessment process and cooperation among them is necessary to reduce costs and increase the accuracy of additionality assessments. Technically, the additionality of a CDM project activity can be demonstrated by means of various aspects, including emissions, financial aspects, investment barriers and technological barriers. Based on a methodological analysis, this study makes the following recommendations for additionality assessments:

☆ Meeting efficiency criteria. As far as possible, they should reflect the specific circumstances of the project to be assessed, and reflect to some extent the general situation in the specific sector/region where the project is to be located. In addition, they should have rational or even limited data requirements, very limited system errors, relatively low uncertainties, acceptable transaction costs, and entail very limited subjective judgment.

☆ Using integrated approaches. The results of assessments of different aspects of a single project activity could be different, so additionality should be assessed from an integrated perspective.

Sustainable development assessment

The general principle underlying the implementation of the CDM in China is that all projects must comply with Chinese laws and regulations and be consistent with the national sustainable development strategy and policy, as well as the general objectives of national socioeconomic development plans, including environmental objectives.

CDM projects implemented in China should fall into one of three categories: energy efficiency improvements, development and utilization of new and renewable energy, and methane recovery and utilization. CDM projects should lead to the transfer of environmentally friendly technologies and produce sound local and global environmental benefits. Technologies adopted under such projects should be appropriate and able to be duplicated.

Project developers or owners

Project developers or owners should be Chinese-funded or Chinese-held enterprises that are economically viable. They should submit to the NDRC the following documents: CDM design document, business license of the enterprise, general information about the project and a description of the project financing. In addition, they should submit reports to the NDRC concerning the implementation and monitoring of the project and the CERs issued.

Institutional barriers

The CDM is a new cooperation mechanism requiring government commitment and participation, so an administration system needs to be set up in order to implement it. This system requires coordination among various departments. At present, the formal CDM approval procedure and related policies are in place. A sound management system, transparent procedure and rules, and efficient administration will reduce transaction costs and attract private investment. The task now is to simplify and streamline the approval procedure and strengthen management ability.

v. Barriers to CDM Implementation in China

Capacity and awareness barriers

Implementing the CDM in China is a challenging and complicated process involving many interest groups, who have very little knowledge and understanding of the institutional, financial, technical and legislative aspects of the CDM. Local enterprises have no understanding of the potential benefits of the CDM and limited experience in project development, monitoring and implementation. Very few people in industry have heard of the CDM. In addition, those organizations that have heard of it often do not know how to go about developing a CDM project, or at best perceive it as a complex and high-risk opportunity.

There is also a lack of the skills needed to develop a CDM project. Companies do not themselves have the skills needed to submit Project Idea Notes, undertake pre-feasibility studies and write proposals for CDM projects. There are few Chinese consultancy companies offering industrial CDM services. Without the support of consultancy organizations there will be insufficient support for industry to develop CDM projects, other than turning to expensive foreign consultants.

The financial and insurance sector is a key actor in CDM implementation. However, GHG credits are not considered as an asset by insurance underwriters. The lack of understanding and awareness of the CDM in the financial sector is likely to lead to higher costs for developers.

Information barrier

There is a lack of ability to collect, analyse and disseminate CDM information. Information needs to be widely disseminated in order to mobilise the participation of potential CDM players and promote public awareness of the CDM.

Buyer's market barrier

The low demand for CERs leads to a CDM buyer's market, which places host countries at a disadvantage. Sink projects and the withdrawal of the US have resulted in an excessive supply of reduction credits and the value of CERs has been reduced.

Barriers in COP procedures and methodology

The new set of international bureaucratic regulations of which the COP CDM procedure consists involves a very complicated and time-consuming process. Chinese interest groups have little knowledge of these game rules. Moreover, the complicated methodology, difficulty in defining additionality and vague project boundaries have greatly increased uncertainty.

vi. CDM Capacity Building and Research Activities

The CDM is attracting significant attention from both developed and developing countries as a cooperation mechanism, and many national and international organizations have conducted relevant research. Given the political and economic importance of China, as well as its key role in either exacerbating or mitigating global climate change, the international community has paid close attention to CDM development in China. The country is ideal for large-scale GHG reduction projects, thus industrial countries have been eager to establish projects and have provided CDM capacity building support.

Since 2000, a number of CDM-related projects funded by international organizations or foreign governments have been carried out to strengthen China's capability such areas as methodological research, economic assessment, institutional arrangements, project development and operations.

D. Potential Areas for CDM Projects in China

Improving the low level of energy efficiency and irrational energy structure in China has great potential to reduce GHG emissions. The low efficiency of energy use in China is especially significant. The average energy intensity per unit of gross domestic product is eight times greater than the Japanese average, providing significant reduction opportunities in the industrial, residential and transportation sectors. In China, common industrial equipment, such as boilers, motors, water pumps, and fans, are designed and produced at low efficiency levels and are poorly operated. The average efficiency of industrial boilers in China is more than 10% lower than the international advanced level, as is also the case for water pumps and fans. Such equipment also consumes a great deal of energy: the coal consumption of industrial boilers accounts for one-third of total coal use. Industrial motors use more than 60% of total industrial electricity. Replacing outdated equipment will lead to increased energy efficiency, a reduction in consumption and GHG mitigation.

Average per capita energy consumption in China is much lower than in developed countries. In the long run, however, domestic energy use and GHG emissions will inevitably grow. If advanced technologies are adopted - including energy-efficient lighting and high-efficiency refrigerators and air conditioners - and direct coal burning is replaced with gas, the energy consumption growth rate will be curbed, thereby reducing GHG emissions.

In China, coal accounts for about 70% of primary energy production and consumption. If the use of low-carbon fuels such as coal bed methane, renewable energy, and natural gas is increased, then GHG emissions will be reduced and environmental, economic, and social benefits will be increased. Coal bed methane is an untraditional natural gas with a high heat value that is stored in coal reserves and released in mining activities. It is an energy source that can be comprehensively utilized in order to increase the supply of clean energy, improve mine safety, and protect the global environment.

In China, renewable energy - especially biomass, small hydropower, and solar heating - is already widely used, providing nearly 300 million tce of energy supply annually. The development and rapid commercialization of renewable energy technology is the most important measure that can be employed in order to achieve emission reductions.

Energy efficiency improvements and the optimization of the energy structure, including the development of renewable energy and the utilization of coal bed methane, will not only contribute to reducing global GHG emissions but are also consistent with China's national interests. The CDM has the potential to attract additional private and government funding from developed countries, attract domestic investment in the fields of energy and the environment, introduce highly efficient technology, and reduce environmental pollution from fossil fuel combustion. Table 2.1.1.11 shows the priority areas and technology for CDM implementation in China, as advocated by research communities.

Table 2.1.1.11 Priority CDM Areas and Mitigation Technologies

CDM priority area sector	Mitigation technology
Energy efficiency improvements	
Electricity	High-efficiency and clean coal-fired power generation and combined heat and power (CHP); a high-efficiency, low-loss transmission system; domestic garbage power generation; demand-side management
Iron and steel	Coke dry quenching (CDQ); blast furnace spent pressure recovery using topping power generation, rotary gas recovery and OG; high-temperature air combustion technology
Cement	New dry technique; combustible waste as fuel and clinker component
Residential	Residential boiler renovation; energy-saving lighting products
Common equipment	Technical renovation of coal-fired industrial boilers; varied-frequency speed-adjustment motors; high-efficiency fans and water pumps
Energy structure improvements	
Renewable energy	High-efficiency biomass conversion systems: district heating, gas and power supply demonstration projects, methane projects, and biomass gasification Wind power; solar photovoltaic; grid-connected wind power, decentralized wind power; floor heating; geothermal power generation and heat supply
Coal bed methane	Coal mine methane extraction and utilization; ground development and utilization

Source: Research reports from ERI, *China Climate Change Country Study.*

2.1.2 MONGOLIA*

A. Climate Change in Mongolia and National Responses

Climate Change in Mongolia

In terms of land area, Mongolia ranks 2nd in Asia and is among the top 18 around the world. The average height above sea level is 1,580 meters. Among the temperate zones of the Northern Hemisphere, few nations can compare to Mongolia in terms of its size and diversity, and the health of its natural ecosystems. However, as Mongolia undergoes a massive socioeconomic transformation, threats to these natural areas and its flora and fauna are rapidly mounting.

The Mongolian climate is characterized by long, cold winters, cool summers, a small amount of precipitation, large temperature fluctuations and a relatively high number of sunny days each year. July 1999 was the hottest month recorded to date.

The annual amount of precipitation is very low. Precipitation varies both in time and space. Annual mean precipitation is 300-400mm in the Khangai, Khentii and Khuvsgul mountain regions, 150-250mm on the steppe, 100-150mm in the steppe-desert area and 50-100mm in the Gobi Desert. About 85-90% of annual precipitation falls as rain in summer, of which 50-60% falls in July and August.

The effects of world climate change have recently become apparent in Mongolia. According to the latest research, some environmental changes have taken place in Mongolia, such as an increase in yearly mean temperature of 1.66ºC during the last 60 years. The winter temperature has increased by 3.61ºC and the spring-autumn temperature by 1.4-1.5ºC. However, the summer temperature has decreased by 0.3ºC. In particular, temperatures have increased rapidly in the months of March, May, September and November. Summer cooling mostly occurs in June and July (Figure 2.1.2.1).

The mountain ranges gradually turn into steppe and desert as one goes from north to south. Accordingly, heat and wind increase, while precipitation and soil moisture decrease. It has been discovered that the winter warming is more intensive than the summer warming, with the difference expected to be much more pronounced in the 2050s. Some scenarios show greater warming in high mountainous regions than in low latitudes. In general, the summer, winter and annual mean temperatures are forecast to increase by 1.0ºC-3.0ºC, 1.4ºC-3.6ºC and 1.8ºC-2.8ºC in 2040, and 2.0ºC-5.0ºC 2.2ºC-5.5ºC and 2.8ºC-4.6ºC by 2070, respectively.

This warming can be seen in winter in particular, but not so clearly in spring. One consequence of this warming process is a change in air humidity and precipitation. A decrease in annual precipitation in the Gobi Desert has led to increased dryness in its more arid areas. These climatic changes have also heightened the frequency of the occurrence of natural disasters in Mongolia, such as droughts, *dzud* (heavy snow and severe winters), forest and steppe fires and floods, which have had a negative impact on society and the economy. For example, in 1996, forest and steppe fires occurred in 13 *aimags*, with 2.4 million ha of forest burning down and damage amounting to $2.4 billion

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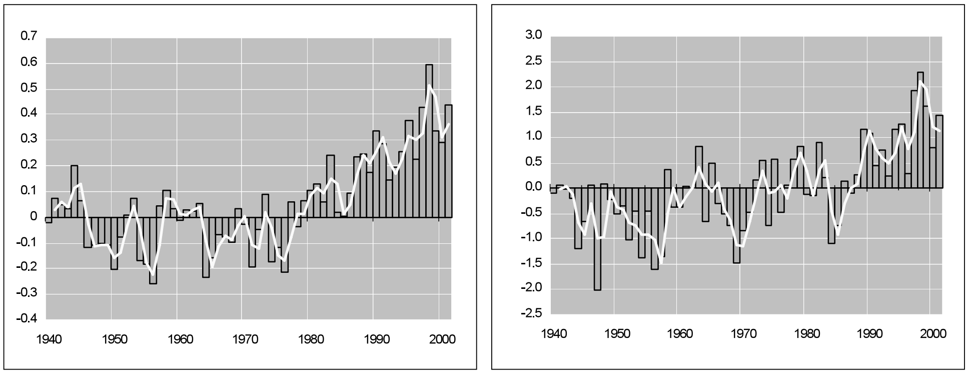
* The original paper was prepared by Dr. Dorjpurev Jargal, Chief, Renewable Energy Division of Ministry of Fuel and Energy of Mongolia;

Figure 2.1.2.1 Mean Temperature Changes (Global and Mongolia)



Global Mongolia

being caused.

Several climate change studies have been conducted in Mongolia, including the following:

- The first climate change study was carried out under the US Country Studies Program (USCSP): the first GHG inventory for 1990 was prepared and preliminary GHG mitigation analysis was conducted.
- In 1997, the Mongolia was conducted as part of the Asia Least-cost Greenhouse Gas Abatement Strategy (ALGAS), a study by 12 Asian countries of national GHG emissions and abatement options in different economic sectors.
- In 1999, Mongolia developed its National Action Program on Climate Change (NAPCC) with the assistance of the Dutch government.
- Mongolia's Initial National Communication on Climate Change was prepared in 2001.
- Potential Impacts of Climate Change and Vulnerability and Adaptation Assessment for Grassland Ecosystems and Livestock Sector in Mongolia, supported by GEF, START, TWAS, UNEP (2002).

Climate change studies conducted in Mongolia have concluded that global warming will have a significant impact on natural resources such as water resources, as well as natural rangeland, land use, snow cover, permafrost, major economic activities, i.e. arable farming and livestock farming, and Mongolian society (i.e. human health, living standards, etc.).

Natural Zones: According to the results of studies using the Holdridge life zone classification model, the current distribution of high mountain and taiga areas is projected to decrease by 0.1-5% by 2040 and by 4-14% by 2070, as the boundary of the high mountain zone shifts northward. The area of forest steppe in the Khangai, Khentii, Khuvsgul, and Altai mountain ranges is forecast to decrease by 0.1- 5.2% by 2040 and by 3.7-13.6% by 2070. The desert steppe area may decrease by 2.5-11.8% in 2040 as it is transformed into more steppe-like conditions, but this rate of change will slow by 2070. The desert region may expand into the Lakes Basin and existing desert steppe zones. The desert area is projected to increase by 6.9-23.3% of the actual area by 2040 and by 10.7-25.5% by 2070.

Water Resources: The results of an assessment of the impact of climate change on water resources indicate that if annual precipitation drops by 10% while the temperature remains constant, the average river flow might be reduced by 7.5% in the Internal Drainage Basin, by 12.4% in the Arctic Ocean Basin, and by 20.3% in the Pacific Ocean Basin. The findings of global climate module scenarios show that water resources will tend to increase in the first quarter of the century and then decrease, returning close to current levels by the mid-21st century. According to the simulation results, almost one-third of the country is defined as a very vulnerable region.

Grassland: Estimates of sensitivity analysis show that if the temperature increases by 3℃, the carbon and nitrogen in soil organic matter are projected to decrease by 10% and 3%, respectively, while peak standing biomass may be reduced by 23.5%. Soil carbon decline is expected to be more dramatic in the desert steppe and desert by 2040, falling by 14.2-48.9% in the desert steppe and 4-6% in other regions. The decline in soil carbon appears likely to continue until 2070, with soil carbon 4-26% lower than the current level. Peak standing biomass is forecast to be higher by 2040 and lower in all regions (except for the Altai Mountains) by 2070.

Forestry: Climate change is expected to have a significant effect on the re-growth and productivity of forests. The high mountains, tundra and taiga regions are expected to decrease in area by 0.1-5% in 2020 and 4-14% in 2050. The area of forest steppe may decrease by as much as 3% in the first quarter of the 21st century and by a further 7% in the second quarter. The results of simulations show that the total biomass might decrease by 27.2% in the case of larch, with birch declining by 5.1%, Siberian pine by 35.3%, and Scotch pine by 4.2%.

Animal Husbandry: In general, impact assessments indicate that the temperature increase will have a negative impact on ewe weight gain in all geographical regions because high daytime temperatures will bring about a reduction in grazing time. The expected higher summer temperatures will have a slight positive effect in the high mountain region, resulting in reduced weight loss in the winter-spring period, but because of the higher snowfall in the forest and steppe regions, grazing time will be shorter (0.2-0.4 hours less per day on average) with stronger negative consequences.

Animal productivity strongly depends on the condition of the animal's body. Therefore, it may be expected that the lower weight at the end of the winter-spring period will also negatively affect the production of milk, wool and other products. Livestock milk production is likely to be lower, because of the reduced daily intake during the hot period of the summer. A reduction in the cold period may also negatively affect both wool and cashmere production.

Arable Farming: Climate change is expected to have positive effects on crop yield in the first forty years of the 21st century. However, it should be borne in mind that, even though the crop yield will be the same or slightly more than the current yield in the Dornod (eastern) and Western regions, the crop yield in the Central region is expected to decrease under a changed climate. Because the Central region is more highly populated (50% of the total population lives in this area) and accounts for as much as 70% of total cropland area, producing 64% of grain crops and 60% of vegetables, the drop in crop yield in this region is more risky than that in the other two regions.

Snow Cover: Snow cover studies are important in the case of Mongolia because snow cover in winter has both positive and negative impacts on animal husbandry. Long-lasting thick snow cover adversely affects the raising of animals by limiting pasture size. On the other hand, the snow cover provides a water source in a season when all surface water is covered by thick ice, and in areas that cannot otherwise be used for pasture due to their distance from surface water.

Global warming scenarios indicate that this area may decrease by an average of 33.4% by 2040 and 22.6% by 2070. The number of days with stable snow cover is projected to decrease. Accordingly, in the middle of the 21st century, shortages of wintertime animal watering are expected in the Dornod steppe and the western part of the country, the Orkhon and Selenge river basins, and the Lakes basin.

Permafrost: Area of permafrost will decrease significantly if warming trends continue. Accordingly, significant changes will take place in the surface water balance, the soil moisture and temperature regimes, vegetation cover, and, consequently, in the economy of the country.

Integrated Impacts: The results of impact assessments show that climate change certainly affects both natural resources and agriculture production. These impacts are the direct effects of a changed climate on natural zones, permafrost areas, livestock, pastures and water resources, and indirect effects on the economy.

To sum up, it can be concluded that the effects of past human activities are large and are expected to increase. According to the results from all sectors, the steppe and desert steppe are more vulnerable to small changes in climate variables than other regions. The impacts upon these areas may be that water resources will decline, pastures will degrade, land use will change and animal husbandry will decline, with the economy deteriorating as a result. Thus, more attention should be paid to conserving and restoring natural resources and to ensuring the balanced management of various human activities in the light of future climate change.

National Responses to Climate Change

The Mongolian government signed the UNFCCC on June 12, 1992 at the Rio Conference and the Great Khural (Parliament) of Mongolia ratified it on September 30, 1993. The Mongolian parliament ratified the Kyoto Protocol on December 15, 1999. The Cabinet approved the "National Action Plan on Climate Change of Mongolia" in 2000.

The National Committee on Climate Change was established in 2000, chaired by the Minister of Nature & Environment, with high-level representation from several relevant ministries, as well as the Mongolian Academy of Science, the National Council for Sustainable Development, the Hydro-Meteorological Institute and various NGOs. In 2005, the Mongolian government established its designated national authority (DNA) under the auspices of the Ministry of Nature and Environment.

Due to Mongolia's high sensitivity to changes in climate, implementation policies and strategies for adaptating to potential climate change will not only be necessary to meet obligations under the UNFCCC, but will also support national sustainable development activities.

Rangeland and Livestock: The adaptation of Mongolia's native pastoral system could take place autonomously; this term usually refers to adjustments made within the system. The system could also be adapted through adjustments external to the system, initiated or promoted via state policy.

High-priority adaptation measures that could be undertaken by the government have been identified. These measures should mainly focus on: public awareness and the education of herdsman; the development of rangeland and livestock management systems based on pastoral practice and modern technology; the improvement of forage production systems; the use of modern pasture water supply systems; the establishment of an appropriate risk management system; the strengthening of the early warning system of the National Meteorological and Hydrological Services in relation to extreme climate events and weather conditions; the development of an insurance system for livestock and crops with respect to natural disasters; the improvement of the marketing system of livestock and crop products in coordination with long-term weather forecasts and market signals; and the improvement of the healthcare system for both people and animals.

Water Supply and Demand: Taking into account the scarcity of natural water resources and their anticipated decrease resulting from climate change, several adaptation measures are recommended in the field of water resources, relating to residential water supply, pasture water supply, irrigation, water quality, and socioeconomic issues.

Arable Farming: Adaptation measures taken in anticipation of adverse effects on crop yields should be focused on the improvement of land cultivation management systems, research into the development of new crop varieties that have features such as earlier maturing, higher yields, disease- and pest-tolerance and drought-resistance, and the cultivation of alternative crop species, the improvement of the infrastructure to facilitate market interactions, and the resolution of problems relating to land ownership.

Soil Degradation and Desertification. Several adaptation measures that can prevent soil erosion and degradation in pasture have been identified: the improvement of legislative mechanisms for pasture use, focusing on local communities; the establishment of a suitable farming and pasture system that can respond flexibly to climate variations; the improvement of pasture water supply in order to avoid the concentration of animals around certain water sources; the improvement of the road network; and the restoration of saxaul and other forests and the planting of woody vegetation in degraded areas and areas sensitive to soil moisture.

GHG mitigation assessments are mainly conducted in the energy sector, as this sector is the largest emitter of GHGs in Mongolia. Its share of total national emissions was 56% in 1990 and is expected to reach about 80% by 2020. The mitigation options are analyzed for both the supply and demand sides of energy, including their technical and economical feasibility, their emissions reduction potential and policy barriers to their implementation.

B. GHG Emissions in Mongolia

Emissions of CO_2 have decreased significantly since the 1990s, largely due to decreases in fossil fuel consumption associated with industrial recession as a result of the transition from a socialist economy to a market economy. Slight increases have emerged since 1996 due to the establishment of new private mining companies, which produce about 3.5-5.4% of all coal annually. Another reason for the increase is the growth in imports of liquid fuel in the last few years. Emissions of methane decreased through 1994, largely as a result of declining economic activity, but increased rapidly thereafter, as the number of livestock increased; the growth in the number of livestock was primarily due to increases in the size of goat herds to meet increased demand for cashmere.

Emissions of nitrous oxide and nitrogen oxides were relatively stable over this period, with a slight increase in emissions of carbon monoxide due to increased burning of traditional biomass fuels (Tables 2.1.2.2 & 2.1.2.3 and Figure 2.1.2.2).

The biggest source of GHGs in Mongolia is fuel combustion for the generation of power and heat, followed by livestock herding and the conversion of grassland into cropland. The smallest source is the waste sector (Figure 2.1.2.3).

Emissions of CO_2 from fossil fuel combustion account for about 60% of all emissions, while the second largest source - the conversion of grasslands into land used for the cultivation of crops account for 20-27%. Emissions from industrial processes account for less than 1% of all emissions, except for in 1990. It should be noted that, if forest fires were included as a human activity, they would be the most significant CO_2 source in Mongolia. The sectoral distribution of CO_2 for 1994 is shown in Figure 2.1.2.4.

Table 2.1.2.2 Net GHG Emissions as CO_2 Equivalent (1,000 tons)

Years	CO_2		CH_4		N_2O		Total
	CO_2 equivalent	% of total CO_2 equivalent emissions	CO_2 equivalent net emissions	% of total CO_2 equivalent emissions	CO_2 equivalent net emissions	% of total CO_2 equivalent emissions	
GWP	1		21		310		
1990	19,136	77.2	5,636.4	22.7	31.0	0.1	24,803.4
1991	15,705	73.9	5,508.3	25.9	31.0	0.2	21,244.3
1992	13,511	71.1	5,447.4	28.7	31.0	0.2	18,989.4
1993	11,990	69.3	5,277.3	30.5	31.0	0.2	17,298.3
1994	9,064	61.4	5,651.1	38.4	31.0	0.2	14,746.1
1995	7,853	56.2	6,075.3	43.6	31.0	0.2	13,959.3
1996	8,305	56.8	6,289.5	43.0	31.0	0.2	14,625.7
1997	8,527	56.3	6,583.5	43.5	31.0	0.2	15,141.1
1998	8,729	56.0	6,839.7	43.8	31.0	0.2	15,599.9

Figure 2.1.2.2 Total Net GHG Emissions as CO_2 Equivalent (1,000 tons)

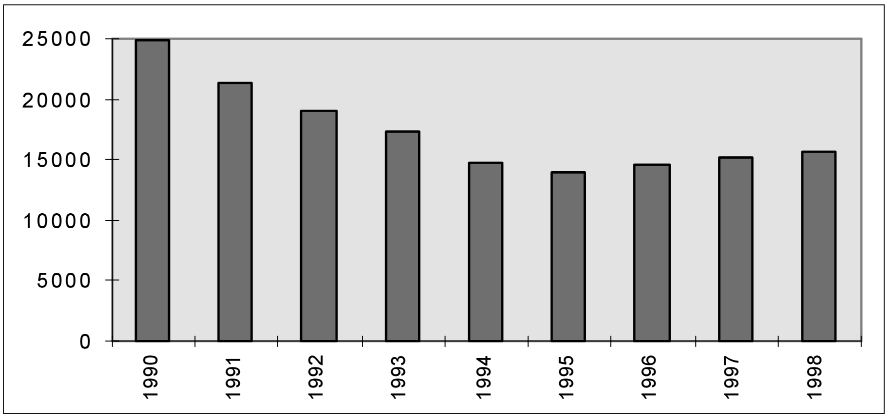


Table 2.1.2.3 Per Capita GHG Emissions, 1,000t CO_2 equivalent/person

Category	1990	1992	1994	1996	1997	1998
Population, 1,000	2,149	2,215	2,280	2,353.3	2,387	2,420.5
Emissions, gigagrams CO_2 equiv.	24,803	18,989	14,746	14,625	15,141	15,600
Per capita emissions	11.5	8.6	6.5	6.2	6.3	6.4

Figure 2.1.2.3 Ranking of GHG Emissions by Source, 1994

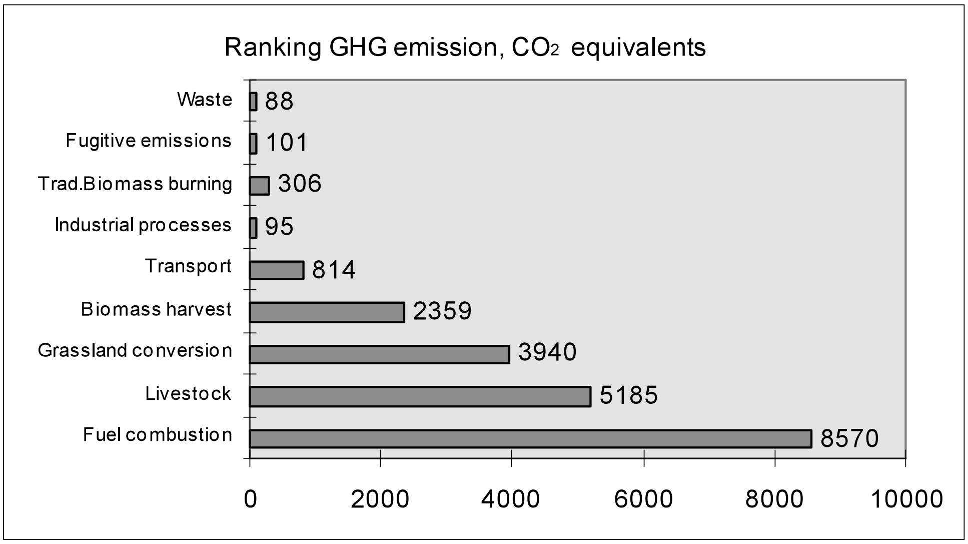
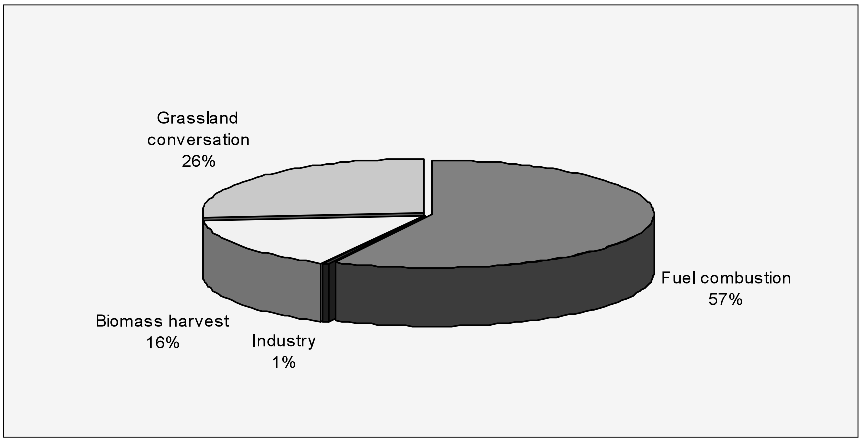


Figure 2.1.2.4 Carbon Dioxide Emissions by Sector, 1994



C. GHG Mitigation Policies and CDM Conditions in Mongolia

Mitigation Options

1) Prioritization by Emission Reduction Potential:

i. Energy Supply Sector

These mitigation options include improving the efficiency of existing technologies, the installation of new energy-efficient technologies, and the widespread introduction of renewable energy sources. The mitigation options in the supply-side sector are cost-intensive options.

The energy supply options which will potentially reduce CO_2 are:

Medium- and small-scale energy conservation

- Modernizing stoves and furnaces
- Installing newly designed high-efficiency boilers
- Converting steam boilers into low-capacity thermal power plants
- Improving coal quality
- Coal briquetting
- Applying effective mining technology and facilities, including selective mining and coal handling plants that use dewatering systems.

Renewable options and combined heat and power plant improvement options have greater potential to reduce CO_2 emissions than other mitigation options

ii. Energy Demand Sector

With regard to the energy demand sector, a number of options have been identified, aimed at reducing energy consumption in the three energy demand sectors: industrial, residential and service sectors, and transportation. In general, all demand-side options showed considerable CO_2 mitigation potential.

District heating and the built environment:

- Improving building insulation
- Improving district heating systems in buildings
- Improving lighting efficiency

Industry:

- Good housekeeping
- Improving motor efficiency
- Using the dry process in the cement industry

2) Prioritization by Cost Effectiveness:

i. Energy Supply Sector

- The following options are cost-effective:
- Installing newly designed high-efficiency boilers
- Steam-saving technology
- Installing electric boilers (4 x 1W)
- Modernizing stoves and furnaces
- Converting steam boilers into low-capacity thermal power plants (5 x 10MW)

ii. Energy Demand Sector

- Good housekeeping
- Improving building insulation
- Improving lighting efficiency
- Improving district heating systems in buildings
- Improving motor efficiency

The most cost-effective options are good housekeeping and energy management on the part of industry and other consumers. The rehabilitation and refurbishment of CHP, the improvement of coal quality, and renewable energy options are cost-intensive options.

Mongolian Conditions for CDM

Mongolia is one of the potential host countries for Clean Development Mechanism (CDM) projects. Despite its small population and economy, Mongolia's GHG emissions are relatively large, due mostly to climatic factors (cold winters). Per capita emissions total 6.05 tons per year (the global average is 3.9 tons). In particular, there is considerable scope to use renewable energy resources to replace fossil fuels; to reduce fossil fuel input by replacing outdated heating equipment with more efficient equipment; and to increase energy efficiency in industry.

CDM can play an important role in the sustainable development of Mongolia's economy, in terms of helping to reduce pollution, make the economy more competitive, create employment and reduce poverty. Given Mongolia's climatic conditions in particular, the potential benefits to Mongolia from CDM could be sizeable.

The main objective is to develop a national CDM strategy. In order to fulfill this objective, the following activities need to be implemented on the basis of close cooperation between Mongolia and other developed countries:

- Developing the capacity of policymakers to establish regulatory frameworks, define baselines and cooperate with national institutions to establish a national CDM entity.
- Building capacity within the public sector and conducting research to define CDM baselines and validate projects
- Working with the private and financial sectors to identify CDM projects, formulate business plans, attract financial support and implement project activities
- Establishing a pipeline of CDM projects based on sustainable development, especially in the energy and forestry sectors
- Increasing knowledge of carbon sequestration and the CDM
- Exploring ways of enhancing the role of forestry projects in meeting the sustainable development goals and carbon reduction obligations of Mongolia and other countries
- Strengthening linkages among researchers, policymakers, forestry developers and NGOs working on carbon sequestration and the CDM.

The basic approaches in the National CDM strategy are as follows:

1. Carbon measurement and monitoring in CDM projects
   - Field measurement of carbon stocks in above- and below-ground biomass and soil
   - The use of allometric equations to estimate biomass
   - Design sampling
   - Carbon benefit accounting

2. Socioeconomic considerations in CDM projects
   - Economic and financial analysis
   - Evaluation of benefits
   - The role of local communities
   - Stakeholder analysis
3. Policies and programs
   - National and international policy issues
   - Country initiatives and programs to promote the CDM

The main benefit of the projects is that they will enable Mongolia to participate in the CDM and will subsequently help Mongolia to reach some of its economic, social, environmental and sustainable development objectives, including cleaner air and water, improved land use, rural development, reforestation, employment, and poverty alleviation.

In addition to being a catalyst for environmentally sound investment, the CDM offers Mongolia an opportunity simultaneously to make progress on climate, development, and local environmental issues.

In order to realize the potential benefits of the CDM, Mongolia needs to attract CDM projects, in the form of either investment in projects or CER purchases. In order to realize its potential, Mongolia should establish conditions that make it an attractive place for CDM projects.

Accordingly, the Mongolian government established a DNA under the auspices of the Ministry of Nature and Environment on November 19, 2004. This was because, without a DNA, Mongolia would be unable to give formal approval for CDM projects, making the registration of CDM projects in Mongolia impossible.

The Mongolian DNA consists of representatives from the following organizations and institutions:

- Ministry for Nature & Environment
- Ministry of Fuel & Energy
- Ministry of Industry & Trade
- Ministry of Finance & Economy
- Scientific organizations
- NGOs
- Private sector

The Mongolian DNA plans to establish an Expert Group responsible for the validation and verification process. The roles of a DNA are as follows:

- To act as the national focal point for CDM
- To facilitate project development
- To provide technical guidance to companies
- To conclude bilateral agreements (so far, Mongolia's DNA has concluded agreements and MoUs with the World Bank and Austria)
- To approve projects
- To conduct market studies and identify projects
- To monitor implementation
- To raise awareness through domestic and international outreach efforts (holding meetings with relevant companies and organizations, as well as organizing workshops and conferences, and communicating relevant information to companies)

- To conduct international outreach to Annex I countries.

All companies, NGOs and government organizations operating according to the Law of Mongolia will be allowed to participate in the CDM, as long as the projects they own satisfy the appraisal criteria. There are several national policies and initiatives related to the Kyoto Mechanisms, such as the national action program on climate change, the national renewable energy program, and the liquefied gas program. Mongolia's national action program on climate change recommends GHG mitigation measures and actions that should be closely integrated into other national and sectoral development programs and plans.

The purpose of the renewable energy program is to increase the proliferation of renewable energy within Mongolia's energy system, diversify energy sources, decrease air pollution and GHG emissions, and achieve the sustainable socioeconomic development of rural areas through the introduction of reliable energy sources

Under this program, the government should organize activities to secure the active involvement of international and domestic investors, obtain support from international donors and financial organizations, and make use of the CDM. The implementation of the program will increase the share of renewable energy in total energy production, accounting for 3-5% of national energy by 2010 and 20-25% by 2020.

In order to reduce air pollution in major cities, protect public health and create a healthy environment through the use of a new source of energy, the Mongolian government approved the liquefied gas program in 2000; this program is now being implemented. The implementation of gas policy could be directly related to CDM activities.

CDM activities should be integrated with the aforementioned national policies and programs, as well as other existing initiatives.

CDM capacity building for stakeholders in host countries is essential for the development and implementation of CDM activities:

CDM capacity building should focus on the following:

- Policymakers and government officials
- CDM DNAs
- Project developers
- Project financers
- NGOs, local communities and research organizations.

Implementation Barriers

The experts who prepared this report identified the following barriers to the implementation and development of new technologies and energy sources across sectors:

- Insufficient capital for investment in the improvement and development of efficient technologies
- High capital cost of purchasing more efficient technologies
- Lack of access to efficient technologies because of an insufficient network for equipment distribution and maintenance
- Inadequate domestic supply of renewable energy and energy efficient technologies
- Lack of access to alternative fuel sources
- Lack of general education to improve public awareness and acceptance of new

appliances and resource conservation opportunities

Implementation Strategies and Recommendations

In analyzing the results of the mitigation assessment, the following recommendations are made:

- The integration of GHG mitigation measures into existing national policies
- The development of regulations for energy efficiency standards and improved enforcement of existing regulations
- The development of a National Sustainable Energy Center, the goal of which could be to protect the commercial interests of the sector; undertake research and development activities, provide development strategies and ensure the access of its members to financial and technical support
- The development of initiatives for procuring technology to support the introduction of small boilers for providing heat and hot water to households
- The development of a broad range of educational tools such as equipment efficiency labeling, information booklets and various advertisements
- The widespread installation of renewable resources for electricity generation
- The development of a favorable environment for the implementation of international GHG reduction mechanisms, such as CDM.

Several private companies and NGOs in Mongolia are working on CDM-related activities. For example, New Com Co. Ltd. is working on wind farm development activities as a potential CDM project; Erel Co. Ltd. plans to improve cement technology to be integrated with CDM activities and various other companies working on heat supply efficiency improvements as CDM projects. The NGO, such as CDM-Center, EEC Co., Ltd, and Institute for Future (IFF), provide services aimed at helping to identify potential CDM projects, preparing project information notes and project design documents for companies, and participating in climate change and CDM-related regional and international projects.

Barriers to private sector activities aimed at the implementation of the Kyoto Mechanisms are:

- Lack of knowledge about CDM procedures
- Lack of experience in Mongolia; high risks
- CDM projects usually require sizeable upfront investment
- Difficulty in finding soft loans
- No green power premium.

The implementation of potential CDM projects requires activities executed over a certain period of time as a result of government measures and/or private sector initiatives. Examples include energy efficiency upgrades, fuel switching activities, or the installation of renewable energy sources, which occur as the result of regulations, efficiency standards, and/or a grant or soft loan program. Specific to Mongolia is the fact that its GHG emission reduction potential is relatively large and the cost of emission reductions relatively low. However, the size of potential projects is comparatively small. Therefore, the various activities or projects should be integrated as a single project under the CDM program and submitted for validation and registration as a single project design document.

Barriers to Renewable Energy CDM Projects

CDM funds would be needed to make renewable energy projects an attractive proposition for investment, due to changes in the sectoral policy and investment environment for renewable energy projects in Mongolia. The power sector is undergoing restructuring with a view to developing a market-oriented economy, which means that long-term power purchase agreements with agreed prices and volumes are difficult to secure. Without such agreements and in light of the technological risk, it is difficult for financial institutions to provide project finance loans for wind farm projects. The government of Mongolia is currently considering a new Renewable Energy Promotion Law,[1] which may give specific support to wind power development in the future.

D. Potential Areas for CDM Projects in Mongolia

Mongolia is one of the potential host countries for CDM projects. Despite its small population and economy, Mongolia's GHG emissions are relatively large, due mostly to climatic factors (cold winters). Annual per capita emissions total 6.05 tons (higher than the global average of 3.9 tons). In particular, there is considerable scope to use renewable energy resources to replace fossil fuels, reduce fossil fuel input by replacing outdated heating equipment with more efficient models, and increase energy efficiency in industry.

CDM could play an important role in the sustainable development of Mongolia's economy by helping to reduce pollution, make the economy more competitive, create employment, and reduce poverty. In particular, given Mongolia's climatic conditions, the potential benefits to Mongolia from CDM could be significant.

i. Renewable Energy Use

Wind Farms

Mongolia has considerable wind energy resources that would allow the harnessing of wind energy. It has been estimated that more than 10% of the country has good-to-excellent potential for wind energy applications on a commercial scale.

Several wind farm projects with a capacity of 30-50MW in various areas of Mongolia are under discussion. The objective of these wind farm projects is to generate renewable electricity using wind power resources and to sell the output generated to Mongolia's Central Grid on the basis of a power purchase agreement. The wind farms will generate GHG emission reductions by reducing the need for electricity generation by the fossil-fuel-fired power plants that currently supply the Central Grid of Mongolia, thereby reducing CO_2 emissions. These projects will assist Mongolia in stimulating and accelerating the commercialization of grid-connected renewable energy technologies and markets. Some private companies are interested in the implementation of wind farm projects as potential CDM projects.

Hydroelectric Power Plants

- Electric power generation in Mongolia is mainly based on the combustion of coal, which leads to relatively high emissions of CO_2.
- Hydropower provides an alternative, clean source of energy with no direct GHG

[1] It was passed by the parliament in January 2007.

emissions. It contributes to reducing GHG by displacing the electric power that would otherwise have been generated by coal-fired electric power plants.
- The main impact of a hydropower project would be a reduction in CO_2 suspended particulate matter and NO_X.

The government is taking steps to promote and implement technical and economic feasibility studies of large (220MW and 100MW) hydropower station projects on rivers with significant hydropower resources, such as the Selenge, Eg and Orkhon rivers. It is also working with private companies to create CDM projects based on sizeable hydropower plant development projects.

Very Large-Scale Photovoltaic Power Generation

Very large-scale photovoltaic power generation (VLS-PV) systems should become a major energy source from a long-term perspective, given future reductions in the cost of PV systems as a result of future research and development and market growth, as well as global energy and environmental issues.

In the National Renewable Program (2005-2020), the necessity of conducting feasibility studies of VLS-PV power generation systems as part of international research activities and implementing a pilot project in the Gobi region of Mongolia was pointed out.

A comprehensive study on the feasibility of VLS-PV systems in the Gobi Desert was carried out under Task VIII of the International Energy Agency's photovoltaic power systems program. As a result of case studies of the feasibility of VLS-PV systems in the Gobi Desert, it has been concluded that significant areas of the Gobi Desert are highly promising candidate sites for the installation of VLS-PV.

Reducing Air Pollution in Ulaanbaatar

The biggest problem facing Ulaanbaatar, the capital of Mongolia, is air pollution. The main sources of pollution are household stoves in ger districts of Ulaanbaatar, vehicles, HOBs, and power plants. Inefficient coal-fired household stoves in ger districts of Ulaanbaatar are responsible for a large part of air pollution in the capital, because of winter temperature inversions combined with the city's location in a valley surrounded by mountains.

The government is introducing more efficient stoves, in order to support the production of coal briquettes. However, its efforts are not enough to reduce air pollution in the capital. The following action is required in order to tackle this problem:
- Household stoves: improve efficiency, use coal briquettes, LPG, or electric heating stoves
- HOBs: improve efficiency, switch to other fuels
- Vehicles: improve efficiency, switch to other fuels.

End-Use Energy Efficiency Improvements

The following energy efficiency activities could be undertaken as CDM activities:
- Improving district heating systems in buildings
- Improving building insulation
- Improving lighting efficiency
- Improving motor efficiency

- Improving steam supply efficiency.

Industrial Processes: Changes in Cement Production Technology

Cement production technology in Mongolia should be changed from the wet to the dry process. According to the Feasibility Study on Energy Conservation and Modernization of Erel Cement Company conducted by Japan's NEDO, energy consumption and GHG emissions would be more than halved by switching from wet to dry technology. The main problem with regard to the implementation of this project as a CDM project is the lack of initial investment.

ii. Potential Projects:

Improved Household Stoves Project

Winters in Mongolia are cold and long, with temperatures falling to -40 in January; smoke from coal stoves covers cities throughout the winter. In the capital city, one of primary sources of CO_2 is the 80,000 coal-fired urban stoves concentrated in the ger district of Ulaanbaatar. A project supported by the World Bank, the GEF, the Ministry of Nature and Environment and the Ulaanbaatar municipal government is aiming (i) to reduce coal consumption in heating stoves (and corresponding CO_2 emissions and air pollution levels) in the ger (the tents traditionally used as dwellings by Mongolian people) area of Ulaanbaatar in a sustained way; (ii) to facilitate the creation of a market-based institutional delivery system that would allow sustainable reductions in coal consumption and CO_2 emissions into the future, through the establishment of reliable manufacturers of efficient household stoves and the development of small companies to be energy service providers; and (iii) to replicate the project benefits in other areas of Mongolia. Under this project, about 10,000 efficient household stoves have been installed.

Replacement of Existing Inefficient Heating Boilers in Ulaanbaatar

The efficiency of heating in Mongolia is quite low. A typical boiler in a provincial administrative unit uses an average of 800-1,200 tons of coal a year. The maximum load of a provincial unit is 0.8-1.2 MW. The heating provided by these boilers for schools, hospitals, kindergartens and other public institutions is very low efficiency (40-50%), due to their outdated design.

Until now, the uptake of modern, energy-efficient heating-only boilers (HOBs) in Mongolia has been very slow. However, potential market opportunities for energy-efficient HOBs exist and could be facilitated through market transformation programs supported by the government of Mongolia and the donor community.

Financing is one of the most critical issues relating to the promotion of the use of energy-efficient HOBs in Mongolia. Energy-efficient, environmentally friendly options tend initially to cost significantly more than conventional alternatives. As a result, the vast majority of HOB owners, who often have very limited access to reasonably priced, long-term or, indeed, any financing at all for new energy efficiency systems and system upgrades, find it very difficult to initiate such projects. The penetration of more energy-efficient western HOBs is hampered by the varying combustion characteristics of local fuels, coal in particular, which often have a negative impact on the overall performance of energy-efficient HOBs.

The CDM could be one application that could support the replacement of inefficient boilers operated by the municipal government of Ulaanbaatar with more efficient boilers.

100MW Hydropower Station in Bulgan Aimag

The contribution to reducing GHGs by a hydropower station would take the form of the displacement of electric power that would otherwise have been generated by coal-fired electric power plants. The first action that would need to be taken to develop the 100MW hydropower project as a CDM project would be to assess the contribution that CDM could make. The main impact of the project would be a reduction in CO_2 emissions. Secondary benefits would consist of reductions in several local pollutants (such as SO_2, suspended particulate matter and nitrogen oxide)

The hydropower station has a planned capacity of 100MW. The project displaces electric power generation based on the combustion of coal, which is conservatively estimated to generate CO_2 emissions of 0.96 tons of CO_2 per 1,000 kWh.[2] Annual CO_2 reductions resulting from the project are projected to amount to approximately 209,856 tons.

50MW Wind Farm in Salkhit Hills, Tuv Province

This wind farm has a design capacity of 50MW. Annual power production is estimated at about 119 million kWh. The project would displace electric power generation through the combustion of coal. Annual CO_2 reductions resulting from the project are projected to amount to approximately 104,928 tons. These renewable energy projects could potentially be interesting if the CDM scheme could be combined with a soft loan. At present, the New Com Company is conducting a detailed wind energy survey at the Salkhit Hills site.

[2] This figure depends on coal quality and efficiency of the power stations, and may be in the range of 0.95-1.05 tons CO2 per MWh.

2.1.3 Republic of Korea*

A. National Reponses to Climate Change

Background

Climate change represents one of the greatest challenges facing the international community today. Therefore, as a non-Annex I country under the Kyoto Protocol, the ROK has actively participated in the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) since the 1992 Rio Earth Summit, making efforts to reduce greenhouse gas emissions in the context of common but differentiated responsibilities. As the first steps in its endeavors, the ROK ratified the Convention in December 1993 and the Kyoto Protocol in November 2002.

Although the ROK is classified as a non-Annex I country under the UNFCCC, it ranks as the world's tenth-largest energy consumer and ninth-largest emitter of greenhouse gases (GHGs). In addition, the economy of the ROK is extremely vulnerable to changing circumstances in the international energy market since it continues to rely heavily on energy-intensive industries and most of its energy demand must be supplied through imports.

To meet these challenges, continuing efforts have been made to promote energy conservation and the reduction of GHG emissions within a long-term policy framework that balances energy demand and supply. In this regard, the government is promoting economic growth on the one hand, while encouraging industry to take swift measures to reduce energy consumption on the other.

As a result of rapid economic growth propelled by the heavy and chemical industries, the ROK's energy consumption has increased sharply since the mid-1970s. Total primary energy consumption, which stood at 43.9 million tons of oil equivalent (TOE) in 1980, increased nearly fivefold to 229.3 million TOE in 2005, making the ROK the tenth-largest energy-consuming country in the world. Energy consumption per capita also increased rapidly from 1.1 TOE in 1980 to 4.7 TOE in 2005 (Figure 2.1.3.1).

With poor indigenous energy resources, the ROK has to rely almost entirely on imports to meet its energy needs. In 2005, the dependency rate on imported energy, including nuclear energy, was 96.4%, with the cost amounting to $66.7 billion, or 22.1% of total inbound shipments.

Despite a nationwide government-led drive to promote energy conservation and greater energy efficiency, the high rate of increase in energy demand is expected to persist in the future because of sustained economic growth.

Primary energy demand in the ROK grew sharply between 1990 and 2000 due to the rapid development of the chemical and petrochemical industries. These industries consume oil not only as an energy source, but also as a raw material in the manufacture of their products. As shown in the graph below, only about a quarter of total industrial oil consumption was used for energy purposes in 2004 (Figure 2.1.3.2).

* The original paper was prepared by Ha Gyung-Ae, Project Coordinator, Center for Climate Change Mitigation Projects of Korea Energy Management Corporation of the ROK

Figure 2.1.3.1 Primary Energy Consumption in the ROK

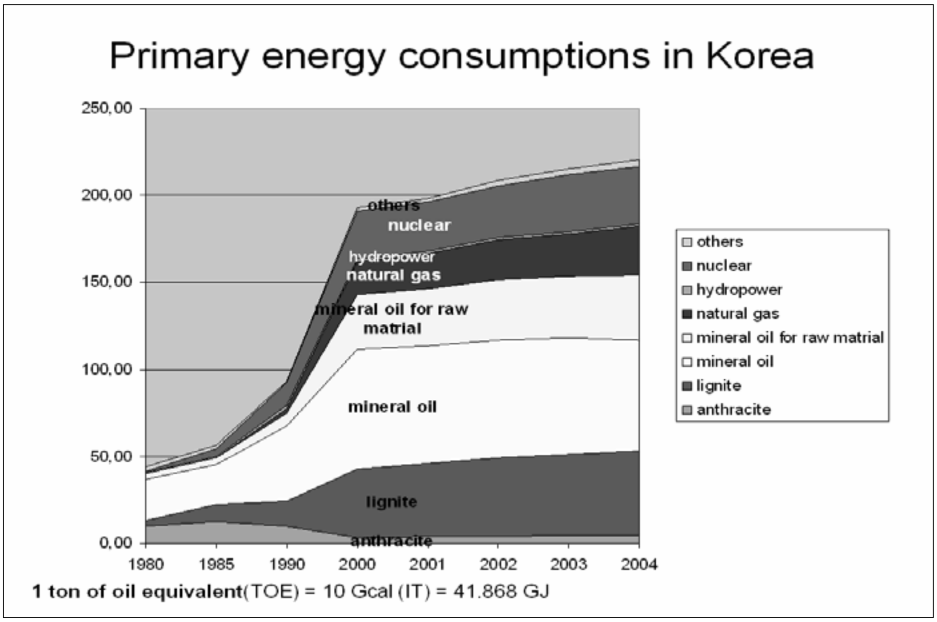
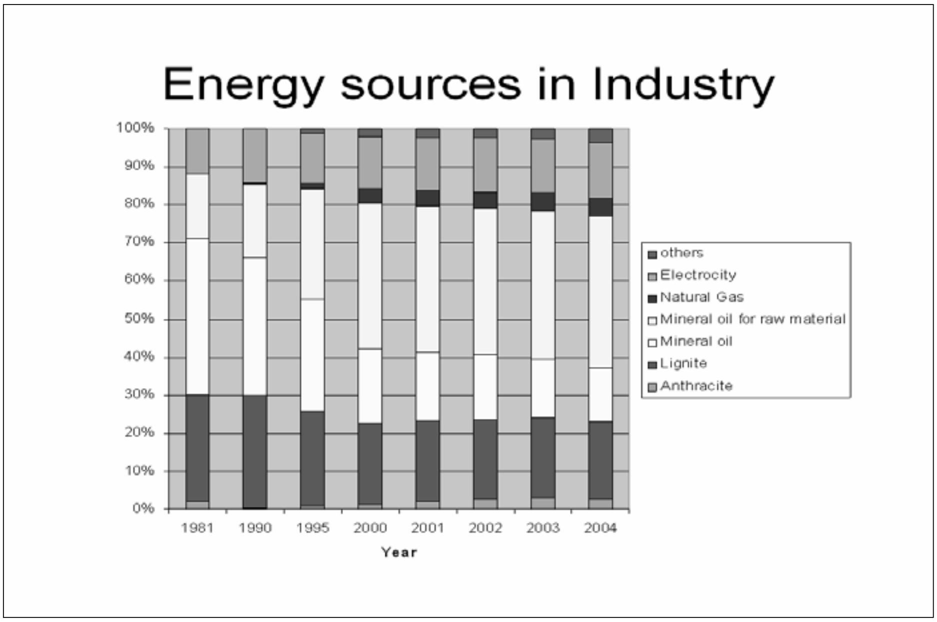


Figure 2.1.3.2 Energy Sources in Industry



While energy demand in the ROK is still high compared with demand in industrialized countries, the UNFCCC is intended to act as a considerable restraint on the tendency toward greater energy demand. Therefore, the improvement of energy efficiency should become a cost-effective measure, as well as being an option for reducing national and global GHG emissions.

Rising energy consumption is the major contributor to the increase in GHG emissions, which rose 2.6% from 144.3 million tons of carbon (MtC) in 2000 to 148 MtC in 2001. The overall trend in total greenhouse gas emissions between 1990 and 2001 indicates an annual increase of 5.2%, with per capita emissions rising by 4.3% per year since 1990, recording 3.13 tons of carbon in 2001.

National Response

Recognizing that conserving energy and reducing GHGs not only contribute to international cooperation, but are also consistent with the long-term development goals of the ROK's economy, the country has established various policies and measures related to energy conservation and the reduction of GHG emissions, as advocated by the UNFCCC.

An Inter-Ministerial Committee on the UNFCCC was established in 1998 to formulate, implement and promote comprehensive action plans relating to the UNFCCC. Led by the Prime Minister, this committee is composed of experts and representatives of various ministries and government agencies, as well as key industrial representatives.

Under the first comprehensive action plan, published in 1998 and covering the period 1999-2001, the ROK succeeded in accomplishing 27 tasks, including voluntary agreements, renewable energy development and raising sewage treatment levels, as well as 111 detailed measures, including support for energy service companies and the expansion of forestation projects. The second comprehensive action plan, published in 2001 and covering the period 2002-2004, contained various programs aimed at promoting the development of GHG-reducing technology and environmentally friendly energy sources, as well as encouraging public participation and cooperation and strengthening policies and measures targeted at reducing GHGs.

The third comprehensive plan (2005-2007) aims to facilitate the country's active participation in international efforts to combat climate change issues, establish infrastructure for switching to a low-carbon economic structure, and minimize the negative impacts of climate change. The government intends to spend about $16,602 million on 92 programs to achieve the objectives of the plan between 2005 and 2007.

Under a Prime Ministerial decree in September 2001, the inter-ministerial committee was expanded and modified. The committee consists of a vice-ministerial level working group chaired by the Deputy Minister of the Office for Government Policy Coordination, a coordination working group of directors-general chaired by the economic policy coordinator of the Office for Government Policy Coordination, six task forces for each major field, and five research teams staffed with relevant specialists.

Furthermore, the Presidential Commission on Sustainable Development was established to provide an active response to international environmental issues such as the UNFCCC. In addition, efficient measures related to the UNFCCC were devised by the National Assembly's Special Committee on Countermeasures for Climate Change in March 2001.

B. GHG Inventories in the ROK

The Parties to the UNFCCC are required to develop national inventories on national emissions and the removal of greenhouse gases using comparable methodologies. Although the ROK is not an Annex I country with GHG emission reduction targets, it has made great efforts to prepare an inventory of GHG emissions and removals, as well as endeavoring to reduce its own GHG emissions.

In 2003, GHG emissions totaled 582.2 million tons of carbon dioxide ($MtCO_2$), an increase of 187% on the 1990 level of 310.6 $MtCO_2$ in 1990. The energy sector was a major contributor to this increase.

With regard to GHG emissions in 2003 by source, energy accounted for 82.7%, industrial processes for 12%, waste for 2.7% and agriculture for 2.7%. Among the GHGs emitted, energy-related CO_2 accounted for 81% of total emissions, whereas CO_2 emissions from other sources accounted for 29%.

GHG emissions from fuel combustion in 2003 totaled 474.4 $MtCO_2$, a 1.8% increase on the previous year. GHG emissions from industrial processes increased by 7.9% on the previous year. This growth rate indicates an increase in consumption of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF6) in industrial processes (Table 2.1.3.1).

Table 2.1.3.1 Summary of Greenhouse Gas Emissions (2003)

Greenhouse gas sources & sinks	CO_2 emissions	CO_2 removal	CH_4	N_2O	HFCs	PFCs	SF_6	Net emissions
Unit	*1,000 tCO_2*		*1,000 tCH_4*	*1,000 tN_2O*	*1,000 tCO_2*			*1,000 tCO_2*
Total GHG emissions & removals	519,150	-41,804	1,228	58	7,687	2,501	14,004	545,448
Energy	474,420		282	3				481,430
Industrial processes	31,528		21	32	7,687	2,501	14,004	66,175
Solvent & other production use	NE			NE				0
Agriculture	NE	NE	476	18				15,544
LULUCF*	8,459	-41,804						-33,345
Waste	4,743		448	5				15,643

Source: MOCIE & KEEI, 2005, Study on Mid- & Long-term Strategies to Address the United Nations Framework Convention on Climate Change.

* LULUCF: Land use, land use change and forestry

C. GHG Mitigation Policies and CDM Conditions in the ROK

GHG Mitigation Policies and Measures

Various policies and measures for energy conservation and GHG reduction have been established in the ROK, with the aim of tackling climate change issues appropriately. Every three years, the inter-ministerial committee on the UNFCCC formulates such measures and policies, and reviews them regularly. The strategies underpinning relevant polices and measures in the ROK are listed in Table 2.1.3.2.

Table 2.1.3.2 Strategies Underpinning Policies and Measures on GHG Reduction in the ROK

Promoting technology to reduce GHG; promoting the development of environmentally friendly energy	- Designating GHG-reducing technology as a prospective environmental technology to promote R&D - Creating market demand for renewable energy by reinforcing efforts to develop cleaner environmentally friendly energy
Strengthening policies and measures aimed at GHG reduction	- Reinforcing energy conservation efforts through the integrated management of energy conservation policies and more efficient energy use - Fortifying energy conservation policies for the residential and commercial sectors by reinforcing energy efficiency standards for buildings and building insulation levels, and expanding the energy efficiency labeling program - Reducing vehicle fuel consumption by promoting cleaner alternative fuels and compact cars - Reinforcing the GHG reduction policy in the transport sector through the efficient management of major transportation networks and traffic demand, the establishment of a comprehensive logistics information network and the standardization of logistics equipment - Reinforcing the GHG reduction policy by improving farming and animal husbandry methods, as well as promoting recycling and minimizing waste - Conserving and expanding forest sinks through forestation and reforestation projects
Promoting public participation & cooperation	- Undertaking PR activities and strengthening partnerships with industries and NGOs - Motivating the public to participate and cooperate in efforts to reduce GHG emissions through PR activities and improved education programs for students and workers

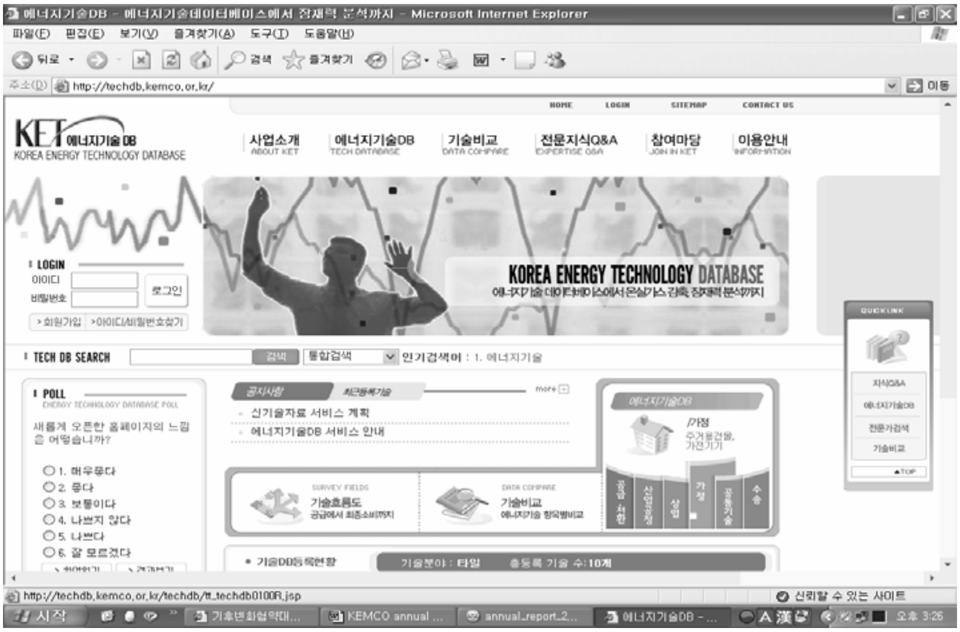
Source: Government of the Republic of Korea, 2001, 2nd National Communication of the Republic of Korea under the United Nations Framework Convention on Climate Change

Two of the programs implemented as part of these policies and measures and managed by KEMCO are described below.

i. Developing a greenhouse gas emission database via a "bottom-up" approach

Since 2001, KEMCO has built up a comprehensive technological database for each industrial sector, starting with pilot projects involving the cement industry and boiler facilities. The database system contains detailed descriptions of the status of major energy-intensive industrial technologies, including installed capacity, characteristics, efficiency (in terms of the mass/heat ratio) and associated advanced technologies. This information service is viewed as a useful tool that will not only enable businesses to maximize their profits from energy efficiency improvements, but also assist the government in allocating specific energy reduction targets to each sector.

Figure 2.1.3.3 The Korea Energy Technology Database System



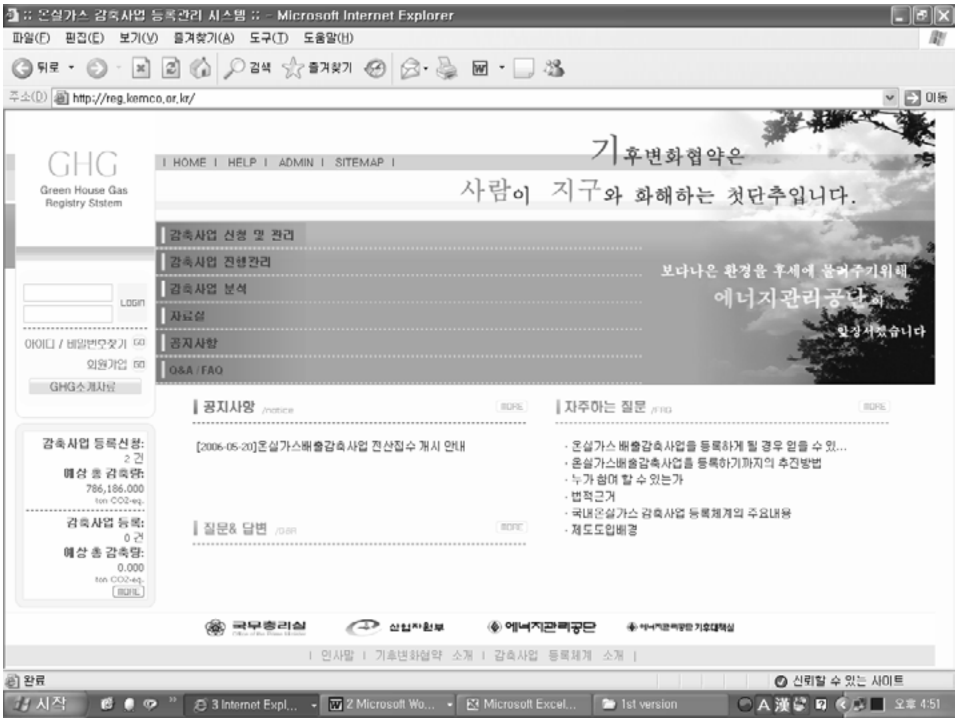
ii. The Emission Reduction Registry Center

All energy-intensive industries in the ROK are required to reduce their energy consumption and GHG emissions under the *Rational Energy Utilization* Act. Even non-energy-intensive industries, such as semiconductor and LCD manufacturers, are encouraged to participate in efforts to reduce non-CO_2 GHGs such as PFCs.

The ROK's Emission Reduction Registry Center, which was established in 2005, is the first emission reduction project of its kind implemented by a non-Annex I country. The objective of the registry center is to take the uncertainty out of measuring the results of GHG reduction efforts by systematically recording them.

GHG reduction activities are managed under an initiative by the Ministry of Commerce, Industry and Energy (MOCIE), entitled the GHG Reduction Registration and Management Project, which was launched in October 2005. The project takes a five-stage approach to GHG reduction: project planning, validation, approval, project implementation and, finally, verification of GHG reductions by a third party.

Figure 2.1.3.4 The Emission Reduction Registry System



The minimum required target of the GHG emission reduction registration program is a reduction of 500 tons of CO_2. The reductions will be achieved by a two-part strategy focused on energy efficiency improvements and increased use of renewable energy.

KEMCO undertakes a variety of activities to promote and enhance popular understanding of the GHG reduction system. As of the end of 2005, applications to register 28 GHG reduction projects had been made. These projects will be registered in phases, in order to ascertain whether or not they meet the necessary regulations and standards.

CDM Conditions in the ROK

Since the ratification of the Protocol in 2002, the ROK has cultivated an environment conducive to the implementation of CDM projects. The ROK's designated national authority (DNA) was established as part of the Prime Minister's office in 2004 and the procedure for issuing approval letters was updated in February 2006.

The investment environment for CDM projects in the ROK is improving. Internationally, the entry into force of the Kyoto Protocol has enhanced investor confidence in CDM projects. The EU Emissions Trading Market would be one of the major buyers of CERs (EU ETS Linking Directive). In addition, two recent Executive Board decisions leverage development of CDM projects in the ROK: i) a decision during the 16th Executive Board meeting enabling governmental policies that favor less carbon-intensive technology to lead to CDM projects if adopted after the adoption of the Marrakech Accords; and ii) a decision during the 18th Executive Board meeting allowing CDM projects to be registered without the written approval of Annex I parties.

The domestic carbon market is being formed with the establishment of the Korea Emission Reduction Registry Center, the primary aim of which is to encourage early action on the part of industry. In addition, consulting companies in the ROK have learned to prepare CDM Project Design Documents (PDDs) from already-developed projects. They are actively involved in identifying and designing CDM projects in the ROK. In addition to this, two domestic organizations, including KEMCO, have been designated by the UNFCCC as Designated Operational Entities (DOEs) for CDM projects. This ensures greater integrity on the part of CDM projects and reduces transaction costs.

The ROK's DNA has obtained experience in evaluating CDM projects in terms of sustainable development through the issue of six approval letters. In issuing these letters, it has established qualitative evaluation methods for the proposed CDM projects, which are required to satisfy all of the following criteria:

- Criterion 1: A CDM project shall contribute to national sustainable development;
- Criterion 2: Emission reductions attributable to a CDM project shall be additional to any that would occur in the absence of the proposed project;
- Criterion 3: A CDM project shall assess its impact on the environment, if applicable;
- Criterion 4: Environmentally sound technologies and know-how shall be transferred;
- Criterion 5: A CDM project shall comply with relevant policies and regulatory regimes.

D. Potential CDM Projects

CDM projects aim to reduce emissions of the six GHGs shown in Table 2.1.3.3. Nevertheless, it is extremely difficult to identify the potential of projects to reduce CO_2 and CH_4 emissions, due to the nature of the various emission sources, but estimates of the potential to reduce emissions of the other gases - N_2O, HFCs, PFCs and SF6 - are relatively uncomplicated because sources of such emissions are limited.

The energy sector accounts for more than 80% of total CO_2 emissions in the ROK and energy consumption can be expected to increase with economic growth. As far as energy consumption is concerned, the renewable energy sector has great potential for the application of the CDM in the ROK. The country established the target of increasing the share of renewable energy in the total energy supply to 5% by 2011 and is devoting its energies to promoting initiatives aimed at achieving this goal. In order to meet its renewable energy target, the ROK is conducting various research and development, demonstration and dissemination policy initiatives; in particular, the feed-in tariff policy is stimulating companies that are interested in this field. Moreover, the mandatory supply of renewable energy to new public facilities is also expected to be an effective policy. The ROK is concentrating on wind generation, photovoltaic systems and hydrogen/fuel cells, and the use of solar thermal energy and biomass energy is being widened. Nowadays, many companies, including some electricity utilities, are constructing or trying to find opportunities to enter the wind generation business.

Table 2.1.3.3 Estimate of Emission Reductions from Potential CDM Projects based on Types of GHG in the ROK

Greenhouse Gas	Global Warming Potential	Expected Emission Reductions from Potential CDM Projects (tCO_2/year)
CO_2	1	Difficult to identify
CH_4	21	Difficult to identify
N_2O	310	11,300,000
HFCs	140 ～ 11,700	1,400,000
PFCs	6,500 ～ 9,200	4,250,000
SF_6	23,900	25,400,000

Note: Figures in this table are estimates. The purpose of this table is merely to provide an idea of the potential reductions.

In relation to CO_2, another field with huge potential is that of energy conservation facilities and integrated energy supply systems in industry. These projects, which were mainly implemented after the second oil crisis, were financed by funds from the government's special account, which is financed by levies on oil imports. An analysis of energy efficiency improvement projects, covering more than 1,600 cases implemented since the early 1980s, was recently conducted. The results show that energy savings per $100,000 of investment totaled about 128 tons of oil equivalent, while the average payback period was 4.2 years. This indicates the huge potential for GHG reduction in this field. These projects include waste heat recovery, the renewal of boilers and furnaces, the installation of co-generation facilities and insulation, and fuel switching. Even though the main initiatives so far have been the simple installation of heat recovery equipment and the renewal of facilities, fuel switching and the installation of co-generation facilities will be a promising business area in the near future.

Identifying the sources of N_2O, HFCs, PFCs and SF_6 emissions is comparatively easier than identifying CO_2 and CH_4 emission sources. As far as the main sources of these gases in the ROK are concerned, they are mainly by-products of chemical processes, cleaning gas in the process of producing LCD monitors and semiconductors, or insulating gas in power plants. Some of the plants containing these processes are designing CDM projects with or without Annex I participants

2.2 Annex I Countries

2.2.1 Japan*

A. The Status of Japanese Measures to Combat Climate Change

Japan accepted the Framework Convention on Climate Change in May 1993 and became the host country for the Third Conference of Parties to the United Nations Framework Convention on Climate Change (COP3), which was held in December 1997 and at which the bKyoto Protocol was adopted. With its ratification of the Kyoto Protocol in June 2002, Japan, which is one of the Annex I countries, became subject to an international obligation to reduce its emissions of greenhouse gases by 6% from the 1,187.2 million tons of CO_2 emitted in the base year (1990), during the first commitment period (2008 - 2012). Today, Japan already uses some of the world's top energy- and environment-conserving technology and it is at a stage at which it is so difficult to implement further measures to reduce climate change that one could liken it to trying to wring out a cloth that is already dry. Nevertheless, the worlds of industry, government and academia are continuing to collaborate and, hand-in-hand with the public sector, the private sector is striving to ensure that Japan fulfills this obligation, as the country that hosted the birth of the Kyoto Protocol.

In December 1997, after the adoption of the Kyoto Protocol, the **Global Warming Prevention Headquarters** was established, with the Prime Minister as its chief and the Chief Cabinet Secretary, the Minister of the Environment and the Minister of Economy, Trade and Industry as deputy chiefs; the remaining members of the cabinet serve as the members of this body. The Cabinet Secretariat, the Ministry of the Environment, the Ministry of Economy, Trade and Industry, the Ministry of Foreign Affairs, the Ministry of Agriculture, Forestry and Fisheries, the Ministry of Land, Infrastructure and Transport, and the Ministry of Finance belong to the **Coordinating Committee of Ministries and Agencies Involved with Global Warming Measures.**

In March 2002, the revised version of ***Guidelines on the Promotion of Measures to Combat Global Warming*** (hereafter referred to as the *New Guidelines*) were published.[1] The reason behind the decision to revise the original version (published in June 1998) was that if the original measures had been continued, it was envisaged that the total volume of greenhouse gas emissions in 2010 would actually increase by 6% on the base year (to 1.311 billion tons of CO_2 equivalent), so in order for Japan to fulfill its obligations under the Kyoto Protocol, it became necessary to take additional steps to achieve a 12% reduction in greenhouse gases compared with the base year.

1. The *Kyoto Protocol Target Achievement Plan*[2]

The Kyoto Protocol entered into force in February 2005, and the Japanese government published the ***Kyoto Protocol Target Achievement Plan***, based on the *New Guidelines*, in April of that year. This plan set forth six key pillars representing Japan's basic

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* This chapter was complied by Shoichi Itoh (ERINA) by revising, expanding upon and editing appropriate passages from such official documents as the *Guidelines on the Promotion of Measures to Combat Global Warming*, the *Kyoto Protocol Target Achievement Plan*, and the *Japan Greenhouse Gas Inventory Report*.

perspective concerning measures to counter global warming.

(1) **Striking a balance between the environment and the economy.** Creating a high standard of living for the people, while aiming to build an environmentally friendly economic system, in order to achieve Japan's international commitment to reducing greenhouse gas emissions by 6%. Ways of doing this will include developing and popularizing energy-conserving equipment, improving the efficiency of energy use and increasing environmental awareness.

(2) **Promoting technological innovation.** Aiming to create a world-leading country founded on the principles of environmental protection, by such means as ultimately reducing dependence on fossil fuels and accelerating technological innovation relating to energy conservation and the use of hitherto-untapped energy.

(3) **Encouraging participation and collaboration by all major actors, and ensuring transparency and the sharing of information to this end.** Conducting initiatives aimed at ensuring participation and collaboration on the part of all major actors, i.e. the state, local authorities, businesses and the populace.

(4) **Utilizing a diverse range of policy instruments.** Implementing versatile policy instruments, such as voluntary methods, regulatory methods, economic methods and information-based methods.

(5) **Emphasizing the evaluation and review process.** In order to grasp the effectiveness of this plan, the government will evaluate the progress of measures, with reference to indices for assessing these measures, and enhance measures as required.

(6) **Securing international collaboration in measures to counter global warming.** Striving to cultivate common roots for the participation of all countries, including the US and developing countries. Taking the lead on the global stage through international cooperation that makes use of Japan's superior technological strength and experience in the field of environmental conservation measures.

2. Measures and Policies for Achieving the Targets[3]

The measures and policies in the *Kyoto Protocol Target Achievement Plan* can be broadly divided into three categories: measures and policies relating to the reduction and absorption of greenhouse gas emissions, cross-cutting measures and basic measures.

(1) Measures and policies relating to the reduction and absorption of greenhouse gas emissions

(i) Reducing greenhouse gas emissions

(a) Reducing energy-derived CO_2

Measures involving equipment relating to energy that makes use of the outcomes of technological innovation, and measures implemented by facilities, such as business establishments, or actor groups. Measures that change socioeconomic systems, including the structure of cities and regions, as well as public transport infrastructure, into low-CO_2-emitting systems.

(b) Reducing non-energy-derived CO_2

Expanding the use of mixed cement, etc.

(c) Methane

Reducing the quantity of waste subject to final disposal.

(d) Dinitrogen monoxide

Upgrading combustion in facilities such as sewage sludge incineration facilities.

(e) Three gases, including hydrochlorofluorocarbons

Systematic initiatives by industries and the development of alternative substances, etc.

(ii) Forests as carbon sinks

Developing sound forests and creating forests with the participation of the populace, etc.

(iii) The Kyoto Mechanisms

Promoting projects overseas, such as emission reduction projects.

(2) Cross-cutting measures

(i) Expanding movements that involve the populace

(ii) Initiatives on the part of public institutions

(iii) Calculation, reporting and disclosure systems concerning emission volumes

(iv) Using a mix of policies (an organic combination of voluntary methods, regulatory methods, economic methods and information-based methods)

(3) Basic measures

(i) Developing systems for calculating the volume of CO_2 emitted and the volume absorbed

(ii) Promoting technological development and research

(iii) Ensuring international collaboration and promoting international cooperation

3. A Message to the World From Japan Concerning Measures to Combat Climate Change

In November 2006, Japan declared the following at the ministerial-level talks that took place in Nairobi, Kenya, during the 12th Conference of Parties to the United Nations Framework Convention on Climate Change (COP12) and Second Meeting of the Parties to the Kyoto Protocol (COP/MOP2).[4]

(1) Through the steady implementation of the Kyoto Protocol Target Achievement Plan, which was formulated in 2005, Japan is determined to ensure that it achieves without fail its commitment to reducing greenhouse gases by 6%.

(2) In light of the present situation, in which global warming has become a serious problem, it is important to enable all countries to work on reducing emissions according to their abilities and to promote collaboration with processes concerning climate change outside the framework of Kyoto Protocol negotiations, such as through the G8 dialogue process, from the perspective of effective measures to counter global warming and the necessity of building effective future frameworks that promote efforts by major emitting countries to reduce emissions to the maximum possible extent.

(3) Measures to adapt to climate change, which is a pressing issue in developing countries, particularly Africa and various island states, are necessary; Japan is making a contribution in this field.

4. The Asia-Pacific Partnership

While Japan is strengthening various measures aimed at achieving the numerical targets for reducing greenhouse gas emissions that it is obliged to meet under the Kyoto

Protocol, it is also playing a part as a member of the Asia-Pacific Partnership on Clean Development and Climate (hereafter referred to as the "Asia-Pacific Partnership"). Japan's measures to counter climate change are aimed at ensuring that the Kyoto Protocol and the Asia-Pacific Partnership play mutually complementary and synergistic roles. As well as Japan, the latter includes the ROK, China and India, which have ratified the Kyoto Protocol but are not Annex I countries, so are not bound by the same obligation to reduce greenhouse gases, and the US and Australia, which have not ratified the Protocol.

In January 2006, the first ministerial summit was held in Sydney; the *Partnership Work Plan was* adopted and taskforces were established in eight fields: i) clean use of fossil energy; ii) renewable energy and distributed power supply; iii) power generation and supply; iv) steel; v) aluminum; vi) cement; vii) coal mining; and viii) buildings and electrical equipment.[5] Of these, Japan chairs the taskforces on steel and cement.

These eight fields account for about 60% of energy consumption and carbon dioxide emissions by the Asia-Pacific Partnership member countries, equivalent to about half of the global totals for both of these categories.

B. The Status of Greenhouse Gas Emissions and Absorption in Japan (Fiscal 2004)

Since the latter half of the 1980s, Japan has continuously calculated the quantity of greenhouse gases emitted. Since 1992, with the cooperation of related ministries and agencies, the Ministry of the Environment has calculated the total quantity of greenhouse gases emitted by Japan, and reports these figures to the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat in May each year.

Table 2-2-1 National Total Greenhouse Gas Emissions (unit: million tons of CO_2 equivalent)

	Base Year of Kyoto Protocol	FY2003 (compared to base year)	Changes from FY2003	FY2004 (compared to base year)
Total	1,261	1,358 (+8.2%)	−0.2%	1,355 (+7.4%)
Carbon Dioxide (CO_2)	1,144	1,284 (+12.3%)	+0.1%	1,286 (+12.4%)
Carbon Dioxide from energy use	1,059	1,196 (+13.0%)	0.0%	1,196 (+13.0%)
Carbon Dioxide from other than energy use	85.1	87.9 (+3.3%)	+1.8%	89.4 (+5.2%)
Methane(CH_4)	33.4	24. (−25.9%)	−1.3%	24.4 (−26.8%)
Nitrous Oxide (N_2O)	32.7	25.8 (−21.3%)	+0.2%	25.8 (−21.2%)
F-gas	51.2	23.5 (−54.2%)	−18.4%	19.1 (−62.6%)
Hydrofluorocarbons (HFCs)	20.2	12.5 (−38.1)	−33.3%	8.3 (−58.7%)
Perfluorocarbons (PFCs)	14.0	6.2 (−55.9%)	+2.0%	6.3 (−55.0%)
Sulfur Hexafluoride (SF_6)	16.9	4.7 (−72.0%)	−5.7%	4.5 (−73.6%)

Source: *Japan Greenhouse Gas Inventory Report*
(Edited by the *Greenhouse Gas Inventory* Office / Supervised by the Ministry of the Environment Global Environment Office Global Warming Countermeasures Department, August 2006)

Table 2-2-2 Trends of Greenhouse Gas Emissions

	GWP	Base year of Kyoto Protocol	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
CO_2 Emissions	1	1,144	1,144	1,153	1,161	1,153	1,213	1,226	1,239	1,235	1,199	1,234	1,255	1,239	1,277	1,284	1,286
CH_4	21	33.4	33.4	33.1	32.9	32.6	31.9	31.0	30.2	29.2	28.3	27.7	27.0	26.2	25.2	24.7	24.4
N_2O	310	32.7	32.7	32.3	32.4	32.0	33.2	33.5	34.7	35.3	33.8	27.4	29.9	26.4	26.0	25.8	25.8
HFCs	HFC-134a：1,300 etc.	20.2						20.2	19.8	19.8	19.3	19.8	18.6	15.8	13.1	12.5	8.3
PFCs	PFC-14：6,500 etc.	14.0						14.0	14.5	15.5	12.6	9.7	8.6	7.2	6.5	6.2	6.3
SF_6	23,900	16.9						16.9	17.5	14.8	13.4	9.1	6.8	5.7	5.3	4.7	4.5
Total		1,261	1,210	1,218	1,226	1,218	1,278	1,342	1,356	1,349	1,306	1,327	1,346	1,321	1,353	1,358	1,355

Note: GWP = Global Warming Potential
Source: *Japan Greenhouse Gas Inventory Report*
(Edited by the Greenhouse Gas Inventory Office / Supervised by the Ministry of the Environment Global Environment Office Global Warming Countermeasures Department, August 2006)

1. Situation Concerning Greenhouse Gas Emissions

Emissions of greenhouse gases totaled 1.355 billion tons of CO_2 equivalent, representing an increase of 7.4% on the base year, but a decrease of 0.2% on the previous year. CO_2 is the largest source of greenhouse gas emissions, accounting for about 95% of the total.

2. Volume of Carbon Dioxide (CO_2) Emissions

CO_2 emissions totaled 1.286 billion tons, an increase of 12.4% on the base year and a rise of 0.1% on the previous year. Of the amount of CO_2 emitted, 93% stemmed from energy consumption. Moreover, businesses and the public sector accounted for about 80% of CO_2 emissions, while the household sector, including cars for private use, accounted for about 20%. The per capita volume of emissions was about 10 tons (up 8.8% on the base year and about 0.1% up on the previous year).

3. Situation Concerning CO_2 Emissions From Each Sector

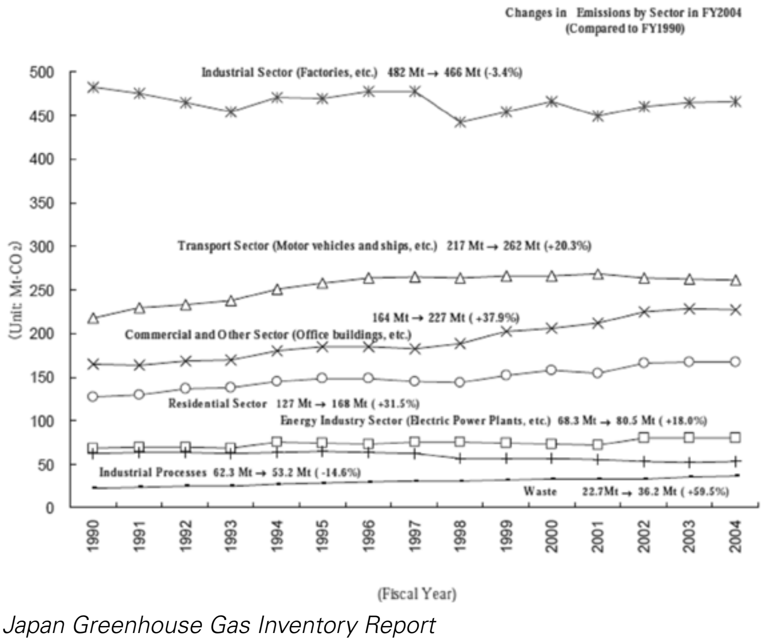
If we look at the quantity of emissions derived from energy by sector, we can see that the industrial sector accounted for the greatest share, totaling 466 million tons, but this represented a decline of 3.4% compared with the base year. Both the transport (262 million tons) and household (168 million tons) sectors were more or less unchanged compared with the previous year, but they had increased by 20.3% and 31.5% on the base year, respectively. The service and other business sector generated 227 million tons (up 37.9% on the base year and down 0.6% on the previous year), while the energy conversion sector generated 850 million tons (up 18.0% on the base year and up 1.2% on the previous year).

Table 2-2-3 Changes in Total Carbon Dioxide Emissions
(unit: million tons of CO_2 equivalent)

		Base Year of Kyoto Protocol	FY2003 (compared to base year)	Changes from FY2003	FY2004 (compared to base year)
Total		1,144	1,284 (+12.3%)	0.1%	1,286 (+12.4%)
Energy use	Sub Total	1,059	1,196 (+13.0%)	−0.0	1,196 (+13.0%)
	Industries (Factories, etc.)	482	465 (−3.5%)	+0.1%	466 (−3.4%)
	Transport (Cars, ships, etc.)	217	262 (+20.4%)	−0.1%	262 (+20.3%)
	Commercial and Other (Commerce, Service, Office, etc.)	164	228 (+38.7%)	−0.6%	227 (+37.9%)
	Residential	127	167 (+31.3%)	+0.1%	168 (+31.5%)
	Energy Industries (Power Plants, etc.)	68.3	79.5 (+16.5%)	+1.2%	80.5 (+18.0%)
Other than energy use	Sub Total	85.1	87.9 (+3.3%)	+1.8%	89.4 (+5.2%)
	Industrial Process	62.3	52.3 (−16.2%)	+1.8%	53.2 (−14.6%)
	Waste (Incineration, etc.)	22.7	35.6 (+56.9%)	+1.7%	36.2 (+59.5%)
	Fugitive Emissions	0.04	0.03 (−5.9%)	+1.6%	0.03 (−4.4%)

Source: *Japan Greenhouse Gas Inventory Report*
(Edited by the Greenhouse Gas Inventory Office / Supervised by the Ministry of the Environment Global Environment Office Global Warming Countermeasures Department, August 2006)

Figure 2-2-1



Source: *Japan Greenhouse Gas Inventory Report*
(Edited by the Greenhouse Gas Inventory Office / Supervised by the Ministry of the Environment Global Environment Office Global Warming Countermeasures Department, August 2006)

4. Situation Concerning Emissions of Greenhouse Gases Other Than CO_2[6]

Methane (CH_4)	24.4 million tons of CO_2 (down 26.8% from the base year and down 1.3% from the previous year)
Dinitrogen monoxide (N_2O)	25.8 million tons of CO_2 (down 21.2% from the base year but up 0.2% on the previous year)
Hydrochlorofluorocarbons (HFCs)	8.3 million tons of CO_2 (down 58.7% from the base year and down 33.3% from the previous year)
Perfluorocarbons (PFCs)	6.3 million tons of CO_2 (down 55.0% from the base year but up 2.0% on the previous year)
Sulfur hexafluoride (SF_6)	4.5 million tons of CO_2 (down 73.6% from the base year and down 5.7% from the previous year)

5. Situation Concerning Emissions and Absorption by Forests, etc.

Total volume of greenhouse gases emitted and absorbed as a result of land use, changes in land use and the forestry sector: approximately 9,490 tons of CO_2 absorbed.

C. Japanese Policies Promoting the Kyoto Mechanisms

1. Japan's Objectives

When the aforementioned Kyoto Protocol Target Achievement Plan was formulated, it was anticipated that even if Japan implemented the maximum possible domestic measures, there would be a shortfall of 1.6%. The current situation is such that, in achieving the obligations imposed by the Kyoto Protocol reliably and cost effectively, Japan must promote and use the Kyoto Mechanisms appropriately, based on the principle that they fulfill a role complementary to domestic measures.

At the same time, Japan believes that, through the promotion of these mechanisms, it can contribute to measures aimed at countering warming on a global scale and assisting the sustainable development of developing countries.

The plan takes heed of the following three points.

(1) If the Kyoto Mechanisms are not used before 2013, when the final determination of the shortfall in the implementation of the Kyoto Protocol will take place, there is a very strong possibility that it will not be possible for Japan to obtain the credits that it requires in order to meet its commitment.

(2) The Green Investment Scheme (GIS), which is a mechanism for the trading of emissions that ties in with CDM/JI and specific environmental measures, will take 3-5 years from planning to implementation and the acquisition of credits.

(3) All of the other countries are also systematically implementing such measures as the selection of good quality projects aimed at securing the requisite number of credits in order to achieve their commitments, in the event that it is anticipated that it will be difficult to fulfill their obligations through domestic measures alone, so this plan is also based on the status of such foreign initiatives.

2. Basic Development Plan for the Operation of the Kyoto Mechanisms

Japan is aiming to facilitate the implementation of CDM and JI with a wide range of regions and countries, and in a variety of business fields. Firstly, in order to acquire the necessary qualifications to make use of the Kyoto Mechanisms from 2008, when the first commitment period begins, a National Registry System and the domestic systems required to calculate the quantity of greenhouse gases emitted and absorbed will be put in place. Secondly, Japan is prepared to make an active contribution to the formulation and operation of international rules relating to CDM and JI, with the aim of ensuring that they are versatile and practical. With the goal of promoting understanding among host countries of the utility of these mechanisms and ensuring that host countries satisfy the requirements for the mechanisms, Japan will provide support in the development of frameworks relating to such aspects as domestic systems.

3. The Support Plan for Identifying and Forming CDM/JI and Other Projects

With the aim of obtaining credits from projects such as CDM and JI, Japan will provide support in such areas as human resource development to ensure that private sector businesses in its own country are able to be designated as independent entities and operational entities for CDM/JI, and will promote the identification of promising energy and environment technology and projects, and the enhancement and implementation of feasibility studies. In doing so, it will conduct negotiations with the governments of host countries and strive to build consensus.

At the same time, with the objective of strengthening relations with host countries and gaining an understanding of priority fields, Japan will conduct intergovernmental consultations and provide support for the development of frameworks in host countries, as well as promoting the conclusion of agreements with the governments of host countries and putting in place the conditions necessary in order to ensure the smooth transfer of credits from host countries to Japan.

4. Japan's Designated National Authority and Designated Operational Entity

Designated National Authority (DNA)

Kyoto Mechanism Utilization Liaison Committee (consisting of department and office heads who are closely involved with CDM/JI projects in the Cabinet Secretariat, Ministry of the Environment, Ministry of Economy, Trade and Industry, Ministry of Foreign Affairs, Ministry of Agriculture, Forestry and Fisheries, and Ministry of Land Infrastructure and Transport)

Designated Operational Entity (DOE)

In Japan, four DOE have been approved by the UN CDM Executive Board.

☆ The Japan Quality Assurance Organization (JQA)
☆ JACO CDM
☆ Tohmatsu Evaluation and Certification Organization Co., Ltd. (TECO)
☆ Japan Consulting Institute (JCI)

5. Initiatives of Individual Ministries Aimed at the Promotion and Use of the Kyoto Mechanisms

(Excerpt from p.52 of the *Kyoto Protocol Target Achievement Plan*)

(Ministry of the Environment)

☆ As a Deputy Director of the Global Warming Prevention Headquarters, the Ministry will implement autonomous initiatives concerning the government's overall efforts to promote and utilize the Kyoto Mechanisms, aimed at the achievement of Japan's commitments under the Kyoto Protocol.

☆ From the perspective of encouraging initiatives by private sector businesses aimed at the formation of projects and contributing to sustainable development in host countries through CDM/JI, the Ministry will independently address the promotion and utilization of the Kyoto Mechanisms.

(Ministry of Economy, Trade and Industry)

☆ As a Deputy Director of the Global Warming Prevention Headquarters, the Ministry will implement autonomous initiatives concerning the government's overall efforts to promote and utilize the Kyoto Mechanisms, aimed at the achievement of Japan's commitments under the Kyoto Protocol.

☆ From the perspective of encouraging initiatives by private sector businesses aimed at the formation of projects, disseminating Japanese energy and environment technology worldwide and easing restrictions on energy use, the Ministry will independently address the promotion and utilization of the Kyoto Mechanisms.

☆ Based on the premise of obtaining the agreement of the country receiving the support, while complying with international rules, the Ministry will independently address the promotion and utilization of the Kyoto Mechanisms using ODA.

(Ministry of Foreign Affairs)

☆ From the perspective of compliance with international treaties, the Ministry will implement autonomous initiatives concerning the government's overall efforts to promote and utilize the Kyoto Mechanisms, aimed at the achievement of Japan's commitments under the Kyoto Protocol.

☆ The Ministry will independently address such matters as the negotiations and consensus building with foreign governments that are necessary in Japan's promotion and utilization of the Kyoto Mechanisms, the construction of cooperative relations with foreign governments concerning the Kyoto Mechanisms, the implementation of the requisite studies and the promotion and utilization of the Kyoto Mechanisms through participation in international organizations.

☆ Based on the premise of obtaining the agreement of the country receiving the support, while complying with international rules, the Ministry will independently address the promotion and utilization of the Kyoto Mechanisms using ODA.

(Ministry of Land, Infrastructure and Transport)

☆ The Ministry will independently address the promotion and utilization of the Kyoto Mechanisms in the fields of transport and social capital development.

(Ministry of Agriculture, Forestry and Fisheries)

☆ The Ministry will autonomously address the promotion and utilization of the Kyoto Mechanisms in the field of forestry.

(Ministry of Finance)

☆ From the perspective of international finance, such as supporting proactive initiatives by international development finance institutions and making use of international cooperation banks, the Ministry will independently address the promotion and utilization of the Kyoto Mechanisms.

☆ Based on the premise of obtaining the agreement of the country receiving the support, while complying with international rules, the Ministry will independently address the promotion and utilization of the Kyoto Mechanisms using ODA.

6. Use of the Kyoto Mechanisms by Private Businesses, etc.

In promoting participation in the Kyoto Mechanisms by private sector businesses, the Japanese government has a policy of promoting human resource development and the provision of information, the development of manuals on the use of the Kyoto Mechanisms, the provision of support for the identification and development of projects, the effective utilization of investment systems with regard to the composition of the carbon fund, measures for facilitating the acquisition of credits and the development of institutional foundations for autonomously liquidating credits.

In March 2005, with the aim of effectively and efficiently promoting the Kyoto Mechanisms in a way that brings together the Japanese government, institutions relating to the Kyoto Mechanisms and private sector businesses, the Japan Kyoto Mechanisms Acceleration Programme was established. The following institutions participate in each stage in the formation of projects through these mechanisms.

(1) Capacity building

(i) Goal: Information dissemination and education

Related institutions: the Global Environment Center Foundation (GEC), the Institute for Global Environmental Strategies (IGES), the Japan Bank for International Cooperation (JBIC), the Japan International Cooperation Agency (JICA), the New Energy and Industrial Technology Development Organization (NEDO), the Overseas Environmental Cooperation Center, Japan (OECC)

(ii) Goal: Formulation of Project Design Documents (PDD)

Dissemination of knowledge concerning such matters as the development of baseline methodologies.

Related institutions: GEC, IGES, JBIC, JICA, NEDO

(iii) Goal: Support for the development of institutions in host countries

Related institutions: IGES, JBIC, JICA, NEDO

(iv) Goal: Capacity building in the financial sector

Related institutions: IGES, JBIC, NEDO, Japan Carbon Finance (JCF)

(v) Goal: Support relating to projects for other private sector businesses

Related institutions: GEC, IGES, JBIC, Japan External Trade Organization (JETRO), NEDO, OECC

(2) Project planning

(i) Goal: Project feasibility studies

Related institutions: GEC, NEDO, JETRO, JBIC, JCF

(ii) Support for business matching

Related institution: JETRO

(3) Project implementation

(i) Goal: Upfront payment

Related institution: JCF

(ii) Goal: Underlying finance

Related institutions: JBIC, Nippon Export and Investment Insurance (NEXI)

(4) The issue of credits

(i) Goal: Credit acquisition

Related institutions: NEDO, JCF

(ii) Goal: Development of national registries

Related institutions: Ministry of Economy, Trade and Industry, Ministry of the Environment

D. Status of Japanese Implementation of CDM/JI in Northeast Asia (as of 25th December 2006)[7]

1. Current Status of Project Formation

Japan is promoting 20 CDM projects with China (of which, five have been approved by the CDM Executive Board), seven CDM projects with the ROK (of which, four have been approved by the CDM Executive Board), two CDM projects with Mongolia and one JI project with Russia. In addition, of the 464 CDM projects that have already been approved by the UN CDM Executive Board, Japan is participating in 32 as a sole partner or joint partner with one or more third-party countries.

(Progress of Projects with China)

Project Title	CDM/JI	Approval Date	Host Countries	Project Proponents	Estimated Reduction (tCO2/e, per year)	Ministry to Support Implementation	Status
Inner Mongolia 49.5MW Find Farm Project	CDM	25 Dec,2006	China	Mitsui & Co., Ltd.	12,700	METI	Under Approval Procedure by Host Country
Coke Dry Quenching (CDQ) Cogeneration Project in Hunan Hualing Liangang	CDM	1 Dec,2006	China	Marubeni Corporation	133,000	METI	Approved by Host Country
7MW TRT Captive Power Project in Hunan Hualing Liangang	CDM	1 Dec,2006	China	Marubeni Corporation	51,000	METI	Approved by Host Country
Gas Turbin Cogeneration Project (CCPP) in Liangang Group	CDM	1 Dec,2006	China	Marubeni Corporation	331,000	METI	Approved by Host Country
Manashi River Hydro Power Generation Project in Xinjiang, China	CDM	28 Nov,2006	China	TEPCO	243,000	METI	Under Approval Procedure by Host Country
Inner Mongolia Hoitenryang 49.5MW Wind Farm Project	CDM	22 Nov,2006	China	Sumitomo Corporation	110,000	METI	Approved by Host Country
Inner Mongolia Chifeng 49.3MW Wind Farm Project	CDM	22 Nov,2006	China	Sumitomo Corporation	126,000	METI	Approved by Host Country
CMM utilization power project	CDM	13 Nov,2006	China	Mitsui & Co., Ltd.	541,000	METI	Under Approval Procedure by Host Country
N2O Reduction Project in China	CDM	2 Nov,2006	China	Mitsubishi Corporation	350,000	METI	Approved by Host Country
Wuxi Taohuashan Landfill Gas Power Plant Project in China	CDM	2 Nov,2006	China	Toyota Tsusho Corporation	75,000	METI	Approved by Host Country
49MW Gansu Datang Yumen Wind Power Project	CDM	31 Oct,2006	China	Chubu Electric Power Co., Inc.	105,000	METI	Under Approval Procedure by Host Country
50.25MW Ningxia Tianjing Wind Power Project	CDM	31 Oct,2006	China	Chubu Electric Power Co., Inc.	70,000	METI	Approved by Host Country
120MW Coal Mine Methane Project at Shanxi Jincheng Sihe	CDM	31 Oct,2006	China	Japan Carbon Finance, Ltd. (JCF)	2,880,000	METI	Under Approval Procedure by Host Country
Waste Heat Recovery Project From a Coke Plant in Qian'an China	CDM	16 Oct,2006	China	Nippon Steel Corporation	210,000	METI	Approved by Host Country
Danpa Hydropower Project	CDM	28 Aug,2006	China	TEPCO	140,000	METI	Approved by Host Country
Fuel Switch Project of Shanxi Luneng Jinbei Aluminium Co., Ltd.	CDM	23 Aug,2006	China	Marubeni Corporation	160,000	METI	Approved by Host Country
Luertai 12.2MW Hydropower Station Project	CDM	10 Jul,2006	China	Kansai Electric Power Co., Inc.	42,000	METI	Registered by CDM-EB
Kanfeng 15MW Hydropower Station Project	CDM	10 Jul,2006	China	Kansai Electric Power Co., Inc.	52,000	METI	Registered by CDM-EB
30MW Tuoli Wind-farm Project in Urumqi, Xinjiang of China	CDM	12 Jun,2006	China	TEPCO	94,000	METI	Registered by CDM-EB
Gansu Dang River Hydropower Project	CDM	12 Jun,2006	China	Japan Carbon Finance, Ltd. (JCF)	162,000	METI	Approved by Host Country
Yantai Coal Boiler Efficiency Improvement Project	CDM	12 Jun,2006	China	Idemitsu Kosan Co., Ltd.	5,600	METI	Approved by Host Country
HFC23 Decomposition Project of Shandong	CDM	14 Dec,2005	China	Mitsubishi Corporation/ Nippon Steel Corporation	10,110,000	METI MOE	Registered by CDM-EB
HFC23 Decomposition Project of Zhejiang Juhua Co., Ltd, P. R. China	CDM	11 Nov,2005	China	JMD GHG Reduction Co., Ltd.	5,800,000	METI MOE	Registered by CDM-EB

(Progress of Projects with theROK)

Project Title	CDM/JI	Approval Date	Host Countries	Project Proponents	Estimated Reduction (tCO2/e, per year)	Ministry to Support Implementation	Status
Hanwha Corporation N2O Abatement Project in the Tail Gas of the Nitric Acid Plant in Ulsan	CDM	25 Dec,2006	Republic of Korea	Mitsubishi Corporation	28,100	METI	Under Approval Procedure by Host Country
Fuel Switch Project of Jeollanam-do, Republic of Korea	CDM	16 Oct,2006	Republic of Korea	Mitsubishi UFJ Securities Co., Ltd.	9,000	METI	Under Approval Procedure by Host Country
746kW Biomass Power Project in Chungcheongbuk-do, Republic of Korea	CDM	11 Aug,2006	Republic of Korea	Mitsubishi UFJ Securities Co., Ltd.	4,800	METI MOE	Under Approval Procedure by Host Country
Youngduk Wind Power Project	CDM	27 Dec,2005	Republic of Korea	Marubeni Corporation	60,000	METI	Registered by CDM-EB
Gangwon Wind Power Project	CDM	5 Oct,2005	Republic of Korea	Marubeni Corporation	150,000	METI	Registered by CDM-EB
Lhodia Japan N2O Project	CDM	26 Jul,2005	Republic of Korea	Lhodia Japan Ltd.	9,150,000	METI	Registered by CDM-EB
HFC Decomposition Project in Ulsan	CDM	15 Jul,2003	Republic of Korea	INEOS Fluor Japan Limited	1,400,000	METI MOE	Registered by CDM-EB

(Progress of Projects with Mongolia)

Project Title	CDM/JI	Approval Date	Host Countries	Project Proponents	Estimated Reduction (tCO2/e, per year)	Ministry to Support Implementation	Status
Hydro Power Project in Taishir, Mongolia	CDM	9 Nov,2006	Mongolia	Mitsubishi UFJ Securities Co., Ltd.	30,000	METI	Under Approval Procedure by Host Country
Hydro Power Project in Durgun, Mongolia	CDM	9 Nov,2006	Mongolia	Mitsubishi UFJ Securities Co., Ltd.	30,000	METI	Under Approval Procedure by Host Country

(Progress of Projects with Russia)

Project Title	CDM/JI	Approval Date	Host Countries	Project Proponents	Estimated Reduction (tCO2/e, per year)	Ministry to Support Implementation	Status
Project for GHG Emission Reduction by Thermal Destruction of HFC23	JI	13 Mar,2006	Russia	Sumitomo Cooperation	390,000	METI MOE	Under Approval Procedure by Host Country

2. Future Prospects for Regional Cooperation

Firstly, Japan currently faces an issue of great urgency, in that it will be difficult for the country to achieve its obligations under the Kyoto Protocol, with regard to numerical targets for the reduction of greenhouse gases, without the use of the Kyoto Mechanisms.

Secondly, the Japanese government believes that the dissemination of Japanese energy-conserving technology is the motive force behind energy and environmental cooperation in Asia, and this is also stipulated *in the New National Energy Strategy*, which was published in May 2006.

Hitherto, due to the difficulty of calculating additionality and other problems, it was difficult to undertake energy conservation projects as CDM projects, but one of the outcomes of COP12 (COP/MOP2), which took place in November 2006, was that the scope of small-scale CDM activities in the energy conservation field expanded considerably, in the way in which Japan had consistently asserted was necessary up to that point.

In the future, it is hoped that the utilization of the Kyoto Mechanisms by Japan will evolve, so that the resolution of these two issues has a multiplier effect.

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[1] <http://www.env.go.jp/earth/ondanka/taiko/all.pdf>

[2] <http://www.env.go.jp/houdou/gazou/5937/6699/2278.pdf>

[3] <http://www.env.go.jp/houdou/gazou/5937/6699/2285.pdf>

[4] <http://www.mofa.go.jp/mofaj/gaiko/kankyo/kiko/cop12_2_gh.html >

[5] <http://www.meti.go.jp/press/20060112003/app-set.pdf>

[6] The base year for the three gases, including hydrochlorofluorocarbons (HFCs, PFCs and SF6) is 1995.

[7] Kyoto Mechanism Information Platform homepage <http://www.kyomecha.org/about.html#projectlist>

2.2.2 RUSSIA*

A. National Responses to Climate Change

In general, activities related to the implementation of the UNFCCC in the Russian Federation are regulated by the Federal Target Program on the "Prevention of Dangerous Climate Changes and Their Negative Consequences", called the Federal Climate Program for short, which was adopted by the Russian government on October 19, 1996. Roshydromet supervises this program on behalf of the state, with various ministries and state agencies participating in its implementation process. The implementation period of this program was 1997-2001. Furthermore, a Federal Target Program on the "Prevention of Dangerous Climate Changes and Their Negative Consequences in the Period 2002-2006" has been formulated.

This program outlined measures to be implemented in 6 subprograms, including:

i. The creation and provision of information systems concerning climate change and the influence of anthropogenic factors on these changes.

ii. The creation and provision of information and analytical systems concerning the collection and statistical accounting of data regarding sources and the removal of greenhouse gases, emissions and sinks, and their impact on global warming;

iii. The creation and provision of observation systems concerning greenhouse gases and aerosol in the atmosphere;

iv. A system of preventive measures for adapting the Russian economy to climate change;

v. A system of mitigation measures to limit anthropogenic emissions and enhance sinks;

vi. The development of a strategy and measures for the period to 2020 to prevent dangerous climate changes and their consequences.

The most climate-dependent sectors of the Russian economy include agriculture, forestry and the use of water resources. Some regions could potentially be affected by rises in the sea level. Permafrost currently covers 67% of the total area of Russia. The melting of permafrost due to global warming may cause serious negative consequences for urban settlements and other managed territories. Accordingly, wide-ranging research into the Earth's climatic system is being carried out within the framework of various national and international research and observation programs.

The Interagency Commission of the Russian Federation on Climate Change Problems (ICCCP) is an official body responsible for climate change issues. It was established in 1994 under Russian Federation Government Decree No. 34 of January 22, 1994. Its structure, functions and the members were set forth under Russian Federation Government Decree No. 346 of April 19, 1994. A new list of the members of the Commission was agreed and adopted in 1997 and a partial change of its members was made under Russian Federation Government Decree No. 1187 of October 25, 1999. Furthermore, a new structure for the ICCCP was established under Russian Federation Government Decree No. 863-r of June 27, 2003. The Commission considers all issues and problems related to the following:

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* Compiled by Dr. Enkhbayar Shagdar, Associate Senior Researcher, ERINA.

- Russian Federal Target Program "Prevention of Dangerous Climate Changes and Their Negative Consequences";
- Problems concerning the fulfillment of Russian obligations under the UNFCCC, aspects of national strategy, etc.;
- Joint Implementation projects; and
- Any other problems concerning domestic activity relevant to climate change.

In this context, the Commission plays a central coordinating role in Russia's institutional system concerning the regulation of climate change related issues. Any proposals and schemes relating to activity development, which take into account the Kyoto Protocol, include the Commission as a top control body and recognize its role as a moderator in achieving consensus among ministries and agencies.

B. GHG Emissions in Russia

Due in part to the industrial recession during the 1990s, Russia does not anticipate trouble in meeting its obligations under the Kyoto Protocol during the first commitment period of 2008-2012. Data on GHG emissions in Russia indicate that total national GHG emissions decreased by 36% and CO_2 emissions by 38% during the period 1990-1998 (Table 2.2.2.1).

The decline in industrial production is undoubtedly one of the main reasons for this reduction in greenhouse gas emissions in Russia. According to available estimates, this has led to a 60-70% reduction in total emissions. However, there are other reasons for the reduction in greenhouse gas emissions in Russia. They include the national energy conservation policies being pursued in the country, such as the federal energy conservation program, the federal energy conservation law, the price and institutional policy, and a great number of laws adopted at the regional level. These efforts reduced greenhouse gas emissions by 8-12%. The growth of natural gas in the national fuel balance (more than a 10% increase since 1990) is also one of the reasons. The restructuring of the country's economy is another important factor in the mitigation of greenhouse gas emissions. This made it possible to achieve a 12-16% reduction of their emissions into the atmosphere (Figure 2.2.2.1).

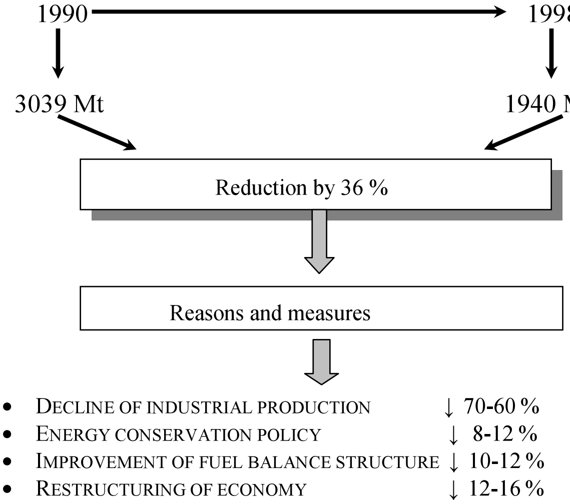
Table 2.2.2.1 GHG Emissions in Russia, million tons (Mt)/year

Indices	Years		
	1990	1998	2000
1. Russia [1], total, including:	3039	1940	2128
- CO_2	2372	1475	1653
- CH_4, Mt CO_2 equiv.	557	390	400
- Others, Mt CO_2 equiv.	110	75	75
2. World [2], total	21832	22600	23647
3. Share of Russia in total world emissions, %	13.9	6.0-8.0	8.0-9.0

Sources: 1. State Committee of the Russian Federation on Environmental Protection, 2000;
2. International Energy Outlook, 2000.

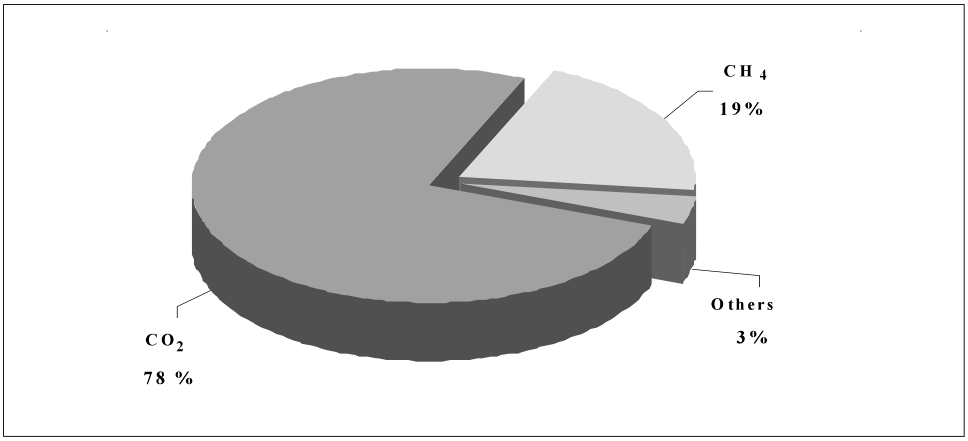
[1] See, for example, A.Mastepanov, O.Pluzhnikov. The Energy Strategy of Russian Federation after Kyoto (Ministry of Energy of RF), 2000. - 12 p. (in Russian).

Figure 2.2.2.1 Greenhouse Gas Emission Reductions in Russia



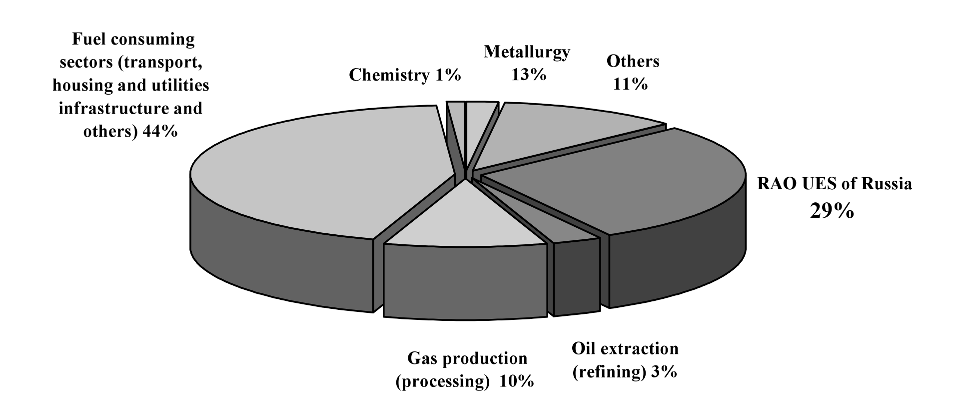
The main greenhouse gas in Russia is CO_2, which accounts for 78% of total emissions, while emissions of methane (CH4) account for 19% and the remaining gases for 3% (Figure 2.2.2.2).

Figure 2.2.2.2 Structure of GHG Emissions in Russia (2000)



The structure of GHG emissions in Russia by industrial sector is shown in Figure 2.2.2.3. The most polluting industries are the fuel-consuming industries (transport and housing and utility infrastructure) and the United Energy System (RAO UES) of Russia. They account for 44% and 29% of total GHG emissions in Russia. RAO UES accounts for approximately 2% of total global CO_2 emissions, which is greater than the emissions of most European countries.

Figure 2.2.2.3 Structure of GHG Emissions by Industrial Sectors in Russia



The energy sector has consistently played an important role in the country's economy. During the years of economic reform in Russia, its role has further increased due to the sharp decrease in production in other sectors. The energy sector of Russia produces 30% of the country's industrial output, providing 54% of tax revenues to the federal budget and accounting for 46% of foreign currency earnings from the export of energy resources. It causes 40% of human-induced emergencies and 47% of gross emissions of harmful substances into the atmosphere. At the same time, the energy sector generates 75% of all GHG emissions in Russia and fuel combustion accounts for 98% of emissions of the main greenhouse gas: CO_2.

The contributions of individual industries within the energy sector to atmospheric pollution are shown in Figure 2.2.2.4. The electric power industry makes the greatest contribution to air pollution, with its share accounting for almost 48% of all gross emissions of pollutants.

Forecasts of GHG emissions and energy consumption in Russia based on the assumption of 4-5% annual growth in GDP show an increasing national trend towards anthropogenic GHG emissions. The primary factor behind such increases is increasing energy consumption and its production processes. A substantial amount of energy generation is still based on the combustion of fossil fuels, as was the case throughout the last few centuries, and scientists forecast that this situation will continue for several decades more (Tables 2.2.2.2 and 2.2.2.3).

Figure 2.2.2.4 Contribution of Energy Industries to Air Pollution
(percentage of total)

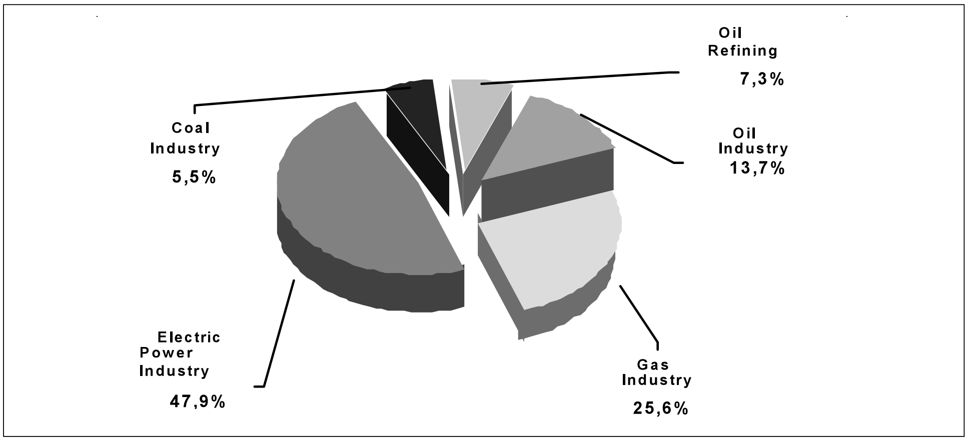


Table 2.2.2.2 Forecast GHG Emissions and Energy Consumption in Russia, 2008-2012 (assuming a 4-5% GDP growth rate per year)

	First commitment period under the Kyoto Protocol				
	2008	2009	2010	2011	2012
GDP, billion dollars	945	982.7	1,022	1,063	1,105
Real emissions, million tons CO_2	2,702	2,810	2,922	3,038	3,160
Cumulative reduction effect, million tons CO_2	-328	-548	-656	-648	-518
Cumulative energy saving effect for 20 %	-868	-1430	-2014	-2621	-3253
Population, millions			145		
Per capita emissions, tons CO_2 per annum			20.1		
Consumption of fuel and energy resources, tons of oil equivalent (toe)			1,010		
Energy consumption per capita			7.0		

Table 2.2.2.3 Forecast GHG Emissions and Energy Consumption in Russia, 2013- 2017 (assuming a 4-5% GDP growth rate per year)

	Second commitment period under the Kyoto Protocol				
	2013	2014	2015	2016	2017
GDP, billion dollars	1,149	1,195	1,243	1,293	1,344
Real emission, million ton CO_2	3,286	3,418	3,545	3,697	3,845
Cumulative reduction effect, million ton CO_2	256	644	1,159	1,826	2,641
Cumulative energy saving effect for 20 %	-401	-697	-891	-963	-917
Population, millions			145		
Per capita emission, ton CO_2 per annum			24.4		
Consumption of fuel and energy resources, toe			1,086		
Energy consumption per capita			7.5		

Russia's Energy and GHG Emission Reduction Strategy

As was mentioned earlier, the electric power industry makes the greatest contribution to GHG emissions in Russia. Evidently, in the foreseeable future its development will determine to a large extent Russia's fulfillment of its commitments to reduce GHG emissions. The necessity of creating the conditions for meeting Russia's commitments under the Kyoto Protocol became the most important reason for elaborating the energy strategy that was approved by the Russian government in August 2003.

The energy strategy of Russia aims mainly to determine the direction of the development of the national energy sector and to create the conditions for the country's socioeconomic progress by enhancing the efficiency of energy production and consumption. Improving energy efficiency should make a major contribution to reducing the environmental impact of energy industries. In elaborating the energy strategy, several scenarios for the socioeconomic development of Russia to 2020 were considered.

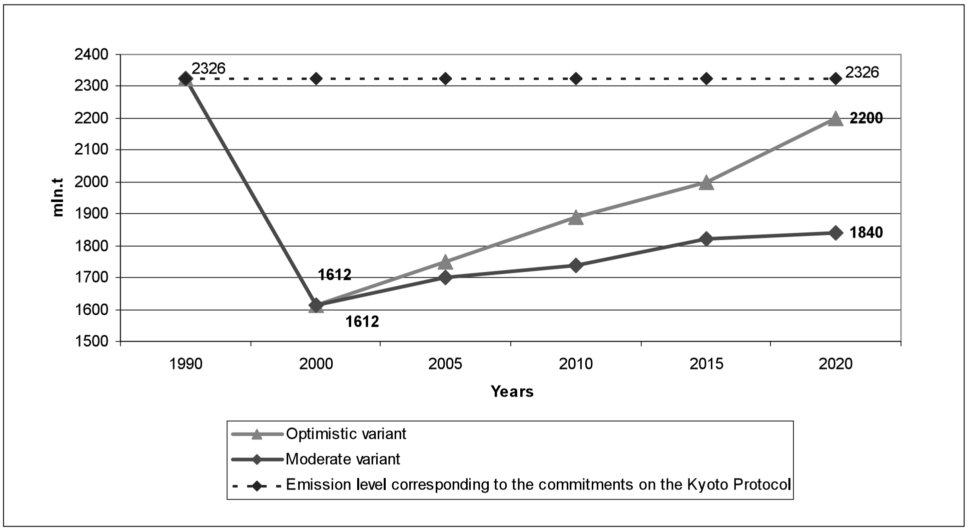
The optimistic scenario supposes that by 2020, the Russian economy will approach the current average level of European countries in terms of per capita GDP. This target can be achieved at an average annual GDP growth rate of not less than 6% over the period to 2020. Thereafter, GDP growth will apparently slow down, but the level will remain higher than the forecasts for developed European countries.

The optimistic variant assumes the maximum use of the existing domestic potential for energy conservation. According to this, CO_2 emissions can be reduced by 500 million tons per annum during the period 2008-2012 (relative to the emission level corresponding to Russia's commitments under the Kyoto Protocol), through the restructuring of the economy, and the implementation of organizational and technological measures relating to energy conservation.

The moderate variant supposes an annual decrease in the GDP energy intensity level of

2.5-3.5%, which will guarantee the safe operation of the energy sector and the country's economy, while completely meeting Russia's commitments under the Kyoto Protocol. Both variants assume the application of various patterns and mechanisms for attracting investment to energy efficiency improvement projects (Figure 2.2.2.5).

Figure 2.2.2.5 Dynamics of GHG Emissions in Russia



Source: Energy of Russia, 2003.

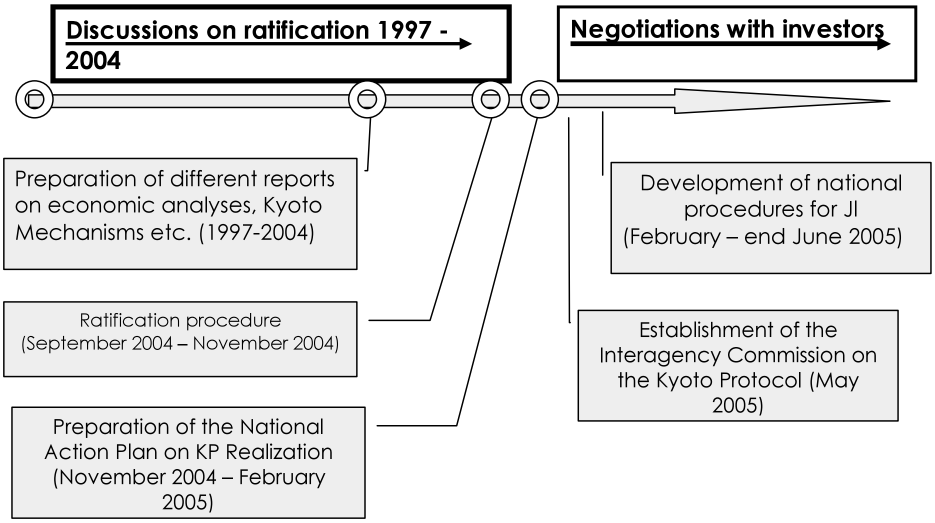
Along with the main industrial and technological processes in the various branches of the fuel and energy complex, considerable volumes of emissions result from such specific conditions as the aging of machinery and equipment and the failure to introduce highly efficient, environment-oriented methods and equipment into the major production processes. The Energy Strategy of Russia to 2020 states that ecological safety is one of the strategic goals of the long-term energy policy, which is to a great extent predetermined by energy consumption efficiency.

The basic level of the allowable volume of GHG emissions established by the Kyoto Protocol is the level of 1990, when the volume of emissions in Russia was 2,326 million tons. The volume of GHG emissions in 2004 was 1,705 million tons, which was a 1% increase on the 2003 level. The volume of GHG emissions could reach 1,900 million tons (81.7% of the base level) in 2010 and 2,030 million tons (87.3% of the base level) in 2015. At the same time, the commitments of Russia under the Kyoto Protocol do not limit the country's economic growth; moreover, there is great potential that could be used in part for selling emissions quotas on a commercial basis under the JI scheme.

C. Russia's Policy and Measures on JI

Russia's ratification process was crucial in the entry into force of the Kyoto Protocol. The history of Russia's breakthrough in the ratification process is illustrated in Figure 2.2.2.6.

Figure 2.2.2.6 History of Russia's Breakthrough Regarding Kyoto Protocol Ratification



The preparation phase has lasted for seven years (1997-2004) and Russia ratified the Kyoto Protocol in November 2004, while the National Action Plan (NAP) was approved in February 2005. The NAP set forth policies and measures as follows:

i. Share of renewable energy sources in the total volume of primary energy supply to be increased by 2.2 - 3 times by 2008;
ii. Reduction of fuel consumption at the power stations of RAO UES of Russia;
iii. Reduction of airborne emissions associated with petroleum gas;
iv. Increase in the share of replaceable old networks in municipal heat supply systems; Elimination of market distortion and increase of the investment attractiveness of the municipal sector;
vi. Implementation of reforms to reduce GHG emissions in the transport sector; Implementation of measures on introducing competition in the electricity and gas industries;
vii. Measures to contribute to the natural renovation of forests.

In addition, the Russian government set up several tasks and timelines for meeting the eligibility criteria as below:

☆ Preparation of an annual report to the government on the implementation of the Kyoto Protocol;
☆ Governmental decree on the national system - end of June 2005;
☆ Annual corrections of federal programs;
☆ Calculation of the Assigned Amounts (AA) - 3rd quarter of 2006
☆ The authorities and responsibilities of the federal ministries on the realization of the Kyoto Protocol to be clarified by the end of June 2005;
☆ Elaboration of domestic procedures for the implementation of the Kyoto Mechanisms - by the end of June 2005;
☆ Elaboration of a national registry - 3rd quarter of 2005.

In accordance with the rules set up by the UNFCCC, a party to the convention has to have in place a national system for estimating and counting its emissions. Accordingly, GHG inventories in seven Russian regions and the GHG inventory of RAO UES of Russia have been prepared according to the UNFCCC guidelines. In addition, a methodology for the regional GHG inventories was prepared. A methodology for estimating methane emissions in the gas sector is under development.

Necessary elements of national GHG emission regulation systems

1. Necessary elements according to the UNFCCC:

   1.1 Annual inventory of emission sources and absorbers with estimates of emission and absorption levels arranged by the intergovernmental experts' group on climate change methodology (national cadastre).

   1.2 Annual inventory of the results of projects aimed at the reduction of GHG emissions, including international joint implementation projects (national list of results).

   1.3 System for controlling the authenticity of companies' reports on emission levels and responsibility for violations.

2. Necessary elements of national policies and measures regarding the stabilization and reduction of GHG emissions:

   2.1 National taxation system concerning GHG emissions.

   2.2 System of providing funds for stimulating national reductions and an emission estimating system through emission taxation.

   2.3 A system of awarding bonuses to companies for reducing GHG emissions.

In the process of implementing national policies aimed at stabilizing and reducing GHG emissions, each country needs to formulate its own national system for regulating GHG emissions. Upon creating such a system, it is desirable to substantially utilize all possible premium systems to encourage the reduction of GHG emissions aimed at stimulating the reduction of energy consumption and the production of more energy-efficient consumer goods. Therefore, in order to enhance competition, it is desirable to put into practice market mechanisms that will stimulate the reduction of GHG emissions; one such mechanism would be the creation of a national market for emission reductions. The market for reductions in emissions of destructive gases that has been functioning in the US since 1992 is an example of such a market.

Moreover, imposing taxes on GHG emissions in excess of the norms is a necessary tool for regulating GHG emissions, allowing the evaluation of the economic effectiveness of the GHG emission reduction result (ERR) of completed, ongoing and developing projects and technologies in the industry, energy, forestry and agriculture sectors. This means that the tax imposed will be a tool for evaluating the economic efficiency of natural resources that are circulating in the economy. Such measures permit the following:

- The counting of potential cost-effectiveness over the previously fixed amount of actual emissions as an enterprise asset in the ERR;
- The formation of national sources of financing for the introduction of energy-saving and energy-efficient technologies in all fields of economic activity on the basis of saved fuel and energy resources;
- The creation of a domestic market for ERR to facilitate the implementation of the market mechanisms and instruments that will stimulate the introduction of energy-

saving and energy-efficient technologies in all fields of economic activity;
- The attraction of domestic and international financial sources for the financing of projects with ERR, therefore enabling financing for the applied sciences to be obtained.

A similar approach can be applied and implemented in the international market formed to stimulate emission reduction mechanisms. Within this scheme, each country could have its own policies and measures while complying with a fixed set of principles for its national system, which is obligatory for participants in an international market. The procedures for verifying and evaluating the project results by means of GHG emission reductions, including joint implementation projects, have been formulated in the Kyoto Protocol negotiation process and contain several sets of regulations to be followed.

In the process of establishing a national system for regulating GHG emission reductions, it is desirable to formulate a set of legislative rules and regulations, as described below, taking into account the economic and social specifics of a country. Examples of these include:

- "Decree on the National System of Estimating and Conducting Inventories of Anthropogenic Emissions by Sources and Removals by Sinks"
- "Decree on the National Plan on Regulating Current and Future Levels of GHG Emissions";
- "Decree on Controlling GHG Emission Levels in Enterprises and Establishments Located Within the Country";
- "Decree on Procedures for Transferring Project Results that Reduce Anthropogenic Emissions and Increase GHG Sinks Located Within the Country";
- "Decree on the Promotion of Projects that Reduce Anthropogenic Emissions and Increase GHG Sinks Located Within the Country".

Realization of the Kyoto mechanisms

The Ministry of Natural Recourses has prepared and presented to the Russian government a draft regulation entitled "About the Passage of a Law Concerning the Register of Assigned Amount Units (AAUs) and Their Transfer to Other Countries/Parties of the Kyoto Protocol, Along with Emission Reduction Units (ERUs) and Certified Emission Reductions (CER)". Together with specialists from other ministries, the Ministry of Economic Development and Trade has formulated a draft law concerning the development and approval of and control over the realization of investment projects aimed at GHG reduction, which are implemented within the framework of the Article 6 of the Kyoto Protocol and the UNFCCC. Meetings of the Interdepartmental Commission and of the Russian government concerning the Kyoto Protocol were deferred to the latter half of February 2006. In addition, a draft federal law regulating activities aimed at preventing climate change was being considered and was scheduled to be read by the State Duma during the spring session of 2006.

The principal approaches of Russia to the Kyoto Protocol investment mechanisms were as follows:

1. *JI second track.* Advantage: projects can be started right now and the early start would be appreciated. Disadvantage: risks relating to approval by the Supervisory (JI) Committee and relatively high transaction costs (Probable start - August-September

2005);

2. *JI first track* - "in general", projects can be started right now. Countries have to agree on a bilateral basis, but there is the outstanding question of how to manage the risk that Russia entails in order to meet the eligibility criteria (Probable start - 2006);
3. *Green Investment Scheme (GIS)* - the same problems as for 2. Transaction costs for 2 and 3 can be lower than in case 1 (Probable start - 2006);
4. *ET scheme.* Voluntary agreements vs. mandatory obligations. The question is how to provide compatibility with existing ET schemes (Probable start - after 2008).

Also, it was desirable to:

Avoid:

- Individualization of decision making and subjective decisions
- Excessive bureaucratization in the process of decision making
- Transfer of AA or ERU without real reductions in emissions
- In the near future: strict regulation of emissions from Russian utilities

Promote:

- Development and approval of transparent quantitative criteria for decision making
- Greatest possible use of existing competence of federal authorities
- Translation of state obligations to business
- 100% fulfillment of Kyoto Protocol provisions
- Minimization of transaction costs.

Moreover, the realization of the Kyoto Protocol as part of the country's ecological strategy is based on the GIS, which considers:

- The increase in energy efficiency through additional investment
- The improvement of the economic situation
- The improvement of the environment
- The improvement of energy security supply and safety
- The strengthening of international links and cooperation.

However, there could be some problems, such as the development of a general approach and harmonization with existing Russian legislation.

The main risks associated with the realization of JI projects are considered to be as follows:

1. Typical project risks and risks associated with the host country (reliability of the project participants and project scheme, currency fluctuations, overestimation of project results, sustainability of the tax regime, transfer of ERUs guaranteed by the host country, etc.)
2. International and Kyoto Protocol risks (risk of non-eligibility, risk that the methodology or the project will not be approved by the Supervisory Committee, etc.)

The domestic procedures will depend on the scheme for risk distribution: (i) 1st scenario, in which all or almost all the risks are covered by the investors or project participants with the possible participation of a 3rd party, and with minimal risks being covered by the host state; (ii) 2nd scenario, in which the host state covers a significant part of the risks.

The priority directions of international energy cooperation within the framework of the Kyoto Protocol are believed to be:

- The auditing of energy and industrial enterprises and inventories of greenhouse gas emissions;

- The reconstruction of existing power and boiler plants and the construction of new ones to increase the efficiency of electric power industry operation and reduce greenhouse gas emissions in the long run;
- The gasification of industrial centers, especially in Eastern Siberia and the Far Eastern region;
- The utilization of nontraditional renewable energy sources.

Some clarifications concerning the latter three proposals are provided below.

(1) The reconstruction of existing power plants and the construction of new ones

At present, the production potential of the Russian power industry is based on more than 700 power plants with a total capacity of 215 million kW. The installed capacity of thermal power plants is equal to about 69% of all power plants in Russia and they produce about 66% of its electricity and more than 30% of its heat. Thermal power plants consume about 31% of all fuel used in the country annually. It should be underlined that in some districts of Russia in Eastern Siberia and the Far Eastern region, the share of coal in the fuel balance of power and boiler plants reaches 75-80%, which has an adverse impact on the environment.

In order to achieve further development in the majority of industrial centers in the Asian regions of Russia, the environmental situation should be radically improved. This can be achieved through the installation of environmentally sound facilities at existing and new power and boiler plants. The use of the environmentally sound energy facilities of foreign firms at Russian thermal power plants could be an important component in international energy cooperation.

The market for energy facilities in Russia is very large. The aging process of the fixed assets of power plants in Russia is intensifying. Currently, more than 20% of generating capacity has become worn out. By 2010 this will rise to more than 50% of the generating capacity, increasing further to 90% by 2020. The replacement of retired capacity requires the annual commissioning of 5-6 million kW rather than 1.2 million kW commissioned on average during recent years. The policy of the accelerated construction of new power plants is clearly shown in the "Energy Strategy of Russia to 2020" and is a prerequisite for national energy security. The Energy Strategy of Russia envisages constructing 177 million kW of new capacity during the period 2003-2020 and as a result the installed capacity of power plants will increase from 215 million kW now to 280 million kW by 2020.

(2) The gasification of industrial centers in Eastern Siberia and the Far Eastern region

A large fuel and energy base for the country has been created in Eastern Siberia and the Far Eastern region. Though these regions possess unique reserves of hydrocarbon fuels, there is currently no large-scale production of natural gas. Annual natural gas production is only 7-8 billion cubic meters (Bcm). However, the availability of explored large-scale natural gas fields in Eastern Siberia and the Far Eastern region gives grounds to address the possibility of creating a large-scale gas industry with an annual production of 70-80 Bcm of natural gas. This amount will be sufficient to meet regional natural gas demand and to export it to Japan, China, the ROK and the other countries of Northeast Asia.

The annual demand of these regions for natural gas is estimated at 20-25 Bcm, and 60-70% of this demand relates to thermal power and boiler plants. The conversion of power and boiler plants in large industrial centers, such as Krasnoyarsk and Irkutsk (Eastern Siberia), and Khabarovsk and Vladivostok (Far Eastern region), to natural gas will result in the reduction of CO_2 emissions in these areas by 30-40%. According to official data, 67,000 communal boiler plants are currently in operation in Russia. The majority of them (particularly in Eastern Siberia and the Far Eastern region) use coal, diesel fuel and heavy oil. The conversion of such boiler plants to natural gas is convenient in terms of the economic conditions and achieving a sizable decrease in CO_2 emissions (Figure 2.2.2.7). The estimated cost of reducing CO_2 emissions by converting boiler plants from coal to natural gas are demonstrated in Table 2.2.2.4.

Figure 2.2.2.7 The Reduction of CO_2 Emissions Through the Gasification of Energy Enterprises in the Main Industrial Centers of Eastern Siberia and the Far Eastern Region (Million tons per annum)

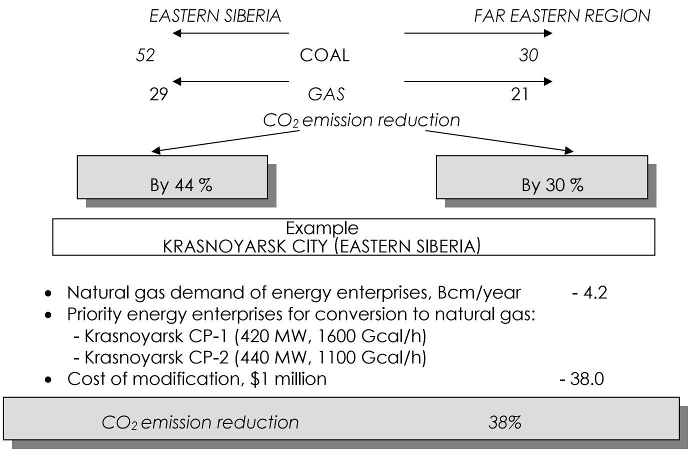


Table 2.2.2.4 Estimated Cost of Reducing CO_2 Emissions by Converting Boiler Plants from Coal to Natural Gas*

Indicators	Small boiler plants (5 Gcal/hour)	Medium-sized boiler plants (5-20 Gcal/hour)	Large boiler plants (20 Gcal/hour)
Volume of reduced CO_2 emissions, thousand t/year	2.6	9.6	17.2
Cost of reducing emissions, $1,000			
European part	120	338	539
Siberia	125	355	569
Far East	141	414	675
Cost of reduced emissions, US$/t$CO_2$			
European Russia	46	35	31
Siberia	48	37	33
Far Eastern region	54	43	39

*The estimates are based on the costs of creating gas distribution networks.

(3) The utilization of nontraditional renewable energy sources

In Eastern Siberia and the Far Eastern region, a great number of small consumers are supplied with electricity not from the centralized electricity grid, but from small diesel-powered plants. The annual delivery of diesel fuel for such consumers amounts to more than 2 million tons. The utilization of nontraditional renewable energy sources, such as small and mini hydroelectric, wind and geothermal power plants is very attractive for energy supply to these consumers.

The installed capacity of such energy sources in the Far Eastern region is currently about 60 MW. The rational scales of using wind, small hydropower plants and non-traditional renewable energy for energy supply to consumers in the northern areas of Eastern Siberia and the Far Eastern region are demonstrated in Tables 2.2.2.5 and 2.2.2.6.

Figure 2.2.2.5 Rational Scales of Using Wind Power Plants and Small Hydropower Plants for Energy Supply to Small Consumers of the Northern Regions of Eastern Siberia and the Far Eastern Region, (as of 2020)

Indices	Values
Total commissioned capacity, MW, total	65
Of which•Wind power plants	30
•Small hydropower plants	35
Required capital investment, $1 million	140-180
Fuel saving, thousand tons/year	35-50
Electricity production, million kWh/year	100-150
CO_2 emission reduction, thousand tons/year	35-50

Table 2.2.2.6 Potential Installation of Nontraditional Renewable Energy Sources in the Northern Regions of Far Eastern Russia*, MW

Non-traditional renewable energy sources	Installed capacity	Capacity to be commissioned			
	2002	2003-2005	2006-2010	2011-2020	Total for 2002-2020
	Magadan oblast				
Wind power plants		10	40	50	50
	Chukotka autonomous okrug				
Wind power plants		2.5		2.5	2.5
	Kamchatka oblast				
Wind power plants	0.5	5	6	11	11.5
Small hydropower plants	22.1	35	27.5	62.5	84.6
Geothermal power plants	48	43	100	143	176
	Sakhalin oblast				
Wind power plants		3.6			3.6
Small hydropower plants	0.6	0.4		0.4	1.0
Geothermal power plants	3.4	5.2	12	17.2	0.6
TOTAL	59.6	104.7	185.5	290.2	349.8

* *Recommendations of project institutes*

D. Perspectives on JI Projects in Far Eastern Russia

In 2001, RAO "UES of Russia" set up an open joint stock company called "Far Eastern Energy Managing Company" (JSC "FEEMC") to act as an antirecession managing company and to exercise the functions of an executive body for its Far Eastern companies. At present, the company incorporates JSC "Dalenergo", CJSC Luchegorsky Fuel and Energy Complex"(Lutek), JSC "Kamchatskenergo", JSC "Sakhalinenergo" and JCS "Geotherm". JSC "FEEMC" has been working on improving the attractiveness of all five companies and making arrangements for reforming the entire energy system of the Far Eastern region; this is scheduled to be completed by January 1, 2007. RAO "UES of Russia" has also established the "Energy Carbon Fund" for the utilization of the Kyoto Mechanisms in February 2001.

JSC "FEEMC" has developed an action program to attract investment to JI projects using the Kyoto Mechanisms. The proposed projects listed in the program have substantial potential with regard to the reduction of CO_2 emissions. Specific project documents have already been prepared for the projects and efforts to find potential investors within the framework of JI projects are already underway. Lists of the projects and their GHG reduction potential are provided in Tables 2.2.2.6 and 2.2.2.7.

Table 2.2.2.6 Realization of the Economic Mechanisms of the Kyoto Protocol Concerning the Attraction of Investment in the Far Eastern Companies Managed by FEEMC

Project name	Project realization period	Project cost ($1 million/ € 1million)	Potential for reducing GHGs, thousand tons	Investment in JI, € 1 million
JSC "Dalenergo" Reconstruction of the Vladivostok heating network	2008-2012	59.5/50.4	471.6	4.716
JSC "Sakhalinenergo" Switch to natural gas flaring at Sakhalinskaya TPP	2008-2009	13.3/11.3	1,770	17.7
JSC "Sakhalinenergo" Switch to natural gas flaring at Yuzhno-Sakhalinskaya TPP-1	2008-2009	20.5/17.4	2,600	26.0
JSC "Kamchatskenergo" Technical re-equipment of Kamchatsky TPP-1 and TPP-2, with the shift of the boilers to natural gas	2007-2009	11.4/ 9.7	775	7.75
JSC "Kamchatskenergo" Construction of Tolmachevskaya TPP-2	2007	23/ 19.5	346	3.46
JSC "Geotherm" Construction of 6.5 MW Binary Cycle Geothermal Unit at Verkne-Mutnovskaya Geothermal Power Plant	2009	10.3/ 8.7	175	1.75

Note: The cost of 1 ton of GHG emissions is approximately equal to € 10.

Table 2.2.2.7 Annual Volumes of Hazardous Emissions at Major Energy Producing Entities in Far Eastern Russia

Name	Amount of hazardous emissions per annum, tons of CO_2	Potential annual reductions, tons of CO_2	Reduction measures
Kamchatskaya TPP1 and TPP2	1,050,101 (incl. N_2O-1,829t; CH_4-619t)	199,628	Shift from oil to gas
Total in Kamchatka oblast	*1,050,101*	*199,628*	
Uzhino-Sakhalinskaya TPP1	3,450	689,500	Allocating a share of the gas from the Sakhalin II project, along with reconstruction focused on a shift to gas
Sakhalinskaya TPP	1,253,385	518,750	
Novikovskaya DPS	3,450	3,450	Construction of a 35kV high-voltage power transmission line in Ozersky-Novikovo. Estimated cost of construction is 45.0 million rubles.
Total in Sakhalin oblast	*1,260,285*		*1,211,700*
Primorskaya TPP	5,763,843 (incl. N_2O-77.6t CH_4-58,413	32,014	Introduction of full-scale automatic process control in unit no.9
Partizanskaya TPP	511,075	160,633	Improvement of housing and utilities infrastructure
Artemovskaya TPP	2,097,781	273,156	Improvement of housing and utilities infrastructure
Vladivostokskaya TPP-2	2,909,938	95,776	Current repairs and maintenance
Heat supply network entities in Vladivostok	363,625	104,000	Reconstruction of the heating network
Total in Primorsky krai	*11,646,262*	*665,579*	

ANNEX I

Chronology of Meetings

No	Date	Place	Title	Note
1	February 2nd, 2004	Marine Hall, Toki Messe International Convention Center, Niigata, Japan	Meeting of Environment Experts	Held as a part of the 2004 Northeast Asia Economic Conference/ Northeast Asia Economic Forum
2	June 5-6th, 2005	Hotel Nikko Niigata, Japan	The Northeast Asia Environment Network/ 1st Meeting of Organizing Committee Environment Subcommittee	Held as a part of 2005 Northeast Asia Economic Conference in Niigata
3	January 17th, 2006	Harbin International Convention Center, Harbin, Heilongjiang Province, China	Organizing Committee Environment Subcommittee Meeting/ Network of Environment Experts of Northeast Asia (NEENEA)	Held concurrently with the Northeast Asia Economic Conference Organizing Committee Meeting

ANNEX II

List of Participants

No	Country	Name	Position	Organization
1	China	ZHOU Dadi*	Director-General	Energy Research Institute, National Development and Reform Commission (NDRC) www.eri.org.cn
		ZHENG Shuang	Associate Professor	
		CUI Cheng	Deputy Director, Center for Energy, Environment and Climate Change	
2	Japan	KIMURA Kotaro	Executive Director	Global Industrial and Social Progress Research Institute (GISPRI) www.gispri.or.jp
		SAKAMOTO Toshiyuki	Director, Global Environmental Affairs Office	Ministry of Economy, Trade and Industry (METI) www.meti.go.jp
		YAMAGATA Hiroshi	Director for Environmental Affairs, Minister's Secretariat	
		UETA Kazuhiro	Professor of Environmental Economics and Public Finance	Graduate School of Economics, Kyoto University www.econ.kyoto-u.ac.jp
		TANAKA Hiromu	President	Japan Carbon Finance, Ltd (JCF) www.jcarbon.co.jp
		OTOTAKE Bunji	Executive Director, Business Department	
		JUNG Tae Yong	Climate Policy Project Leader	Institute for Global Climate Environmental Strategies (IGES) www.iges.or.jp
		KUDO Hiroyuki	Group Manager, Environment and Energy Efficiency Group	The Institute of Energy Economics (IEE), Japan http://eneken.ieej.or.jp
		HIGASHI Nobuyuki	Chief Representative for Energy Resources (Paris)	Japan Bank for International Cooperation (JBIC) www.jbic.go.jp
		MASUDA Masato	President	M4U Limited Advisory Service on CDM & Environmental Financing
		SUZUKI Mitsutoshi	Senior Consultant, Consulting Department	Toyo Engineering Corporation (TEC) www.toyo-eng.co.jp

3.	Mongolia	BADARCH Dorjsuren	Director-General, Industrial Policy and Coordination Department	Ministry of Industry and Trade of Mongolia www.mit.pmis.gov.mn
		DORJPUREV Jargal	Chief, Renewable Energy Division	Ministry of Fuel and Energy of Mongolia www.mfe.energy.mn
		DAGVADORJ Damdin	Director, International Cooperation Division	National Agency for Meteorology, Hydrology and Environment Monitoring of Mongolia http://env.env.pmis.gov.mn/Namhem
		ADYASUREN Tsohio*	President and Professor, Scientific secretary & Academician of Mongolian National Science Academy	Environmental Education and Research Institute ECO ASIA www.moneco.org
4	ROK	OH Dae-Gyun	General Manager, Center for Climate Change Mitigation Projects	Korea Energy Management Corporation (KEMCO) www.kemco.or.kr
		HA Gyung-Ae	Project Coordinator, Center for Climate Change Mitigation Projects	
		HAN Seung-Ho	Project Coordinater,GHG Auditor, Center for Climate Change Mitigation Projects	
5	Russia	MAKSIMOV Vladimir	Adviser, Division of Economics of Environment Protection	Ministry of Economic Development and Trade of Russian Federation www.economy.gov.ru
		POTAPOV Victor*	Former Chairman of the Board, Climate Project Centre of Joint Implementation	Roshydromet www.meteorf.ru
		SANEEV Boris*	Deputy Director of the Institute, Professor	Energy Systems Institute of the Siberian Branch of the Russian Academy of Science, Irkutsk www.sei.irk.ru
		MINAKOV Viktor	Director-General	JSC "Vostokenergo" www.vostok.interrao.ru
		GLINCHIKOVA Tatiana	General Manager, Department of External Economic Relations	JSC, Far Eastern Energy Managing Company "FEEMC" www.dveuk.ru

Note: *submitted report, but did not attend.

ANNEX III

Chairman's Summary

A meeting of the Northeast Asia Environment Experts' Network (NEAEEN) was held at Harbin International Convention Center on 17 January 2006 in accordance with the agreement reached among the participants in the Environment Experts' Meeting at the 2005 Northeast Asia Economic Conference in Niigata on 5-6 June 2005.

As a result of the NEAEEN meeting, the participants agreed on the following points:

1. This experts' network is to be called the "Northeast Asian Environment Experts' Network" (ENEXNET).

2. It was proposed that ERINA consider functioning as the secretariat of the Northeast Asian Environment Experts' Network and organizing its regular meeting as part of the new Northeast Asia International Conference (title to be decided).

3. The ENEXNET acknowledges that the promotion of the Kyoto Mechanisms is one of the most promising ways to develop subregional bilateral as well as multilateral cooperation in Northeast Asia in the fields of energy conservation, energy efficiency and environmental protection.

4. Each participant will strive to encourage his / her institution to work on the building of public-private partnerships for the promotion of the Kyoto Mechanisms at both the domestic and international levels, in order to increase the level of the dialogue from the conceptual to the practical stage, identifying new business opportunities.

5. The secretariat of the ENEXNET (hereafter referred to as "the secretariat") will be prepared to consider signing bilateral memoranda with each participant's institute, with a view to facilitating communication and logistics for future events.

6. The participants expressed a common interest in launching an English-language homepage for the ENEXNET, for the purpose of disseminating information about its activities, the latest developments regarding Kyoto Mechanism projects in Northeast Asia, and other related matters. The secretariat will strive to achieve the realization of this proposal as soon as possible, in cooperation with all the members of the Northeast Asian Environment Experts' Network.

7. The participants expressed a common interest in bringing together information about the ENEXNET activities and the promotion of the Kyoto Mechanisms in the context of Northeast Asia through a homepage and regular publications.

17 January 2006, Harbin, Heilongjiang Province, PRC.
Northeast Asian Economic Conference Subcommittee Meeting / Environment Experts' Network
Chairman, Kazuhiro Ueta
Dr. Kazuhiro UETA, Kyoto University, Japan