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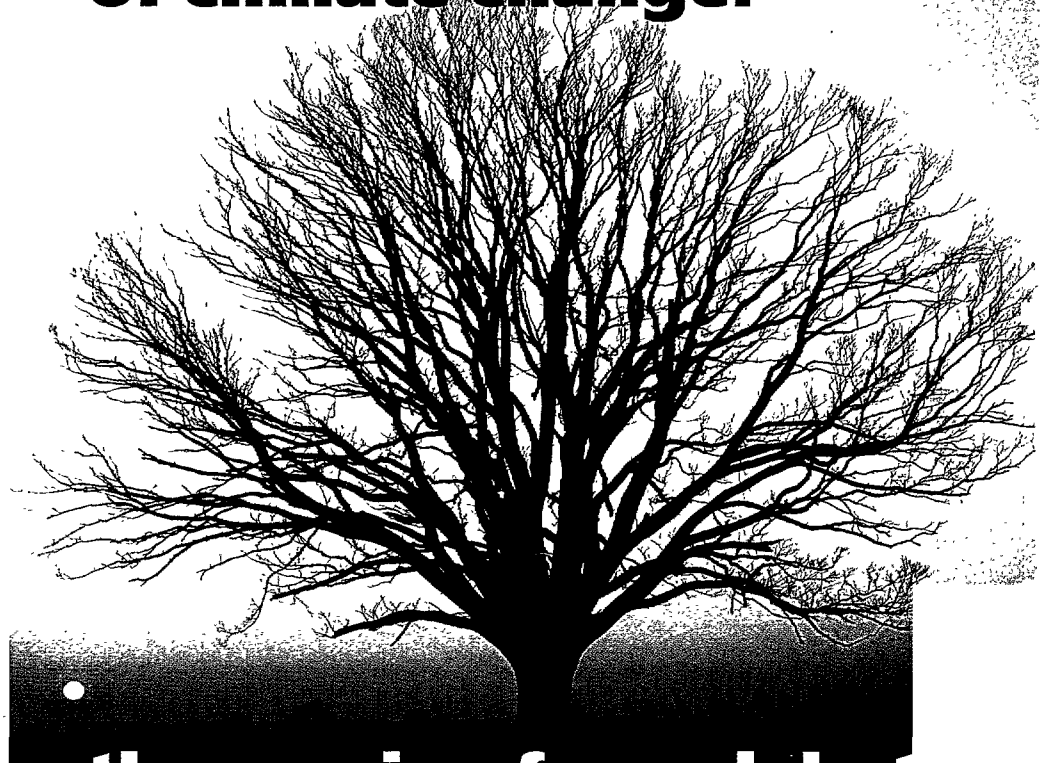

the moving from debate to practical steps

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US Agency for International Development
Environmental Policies and Institutions for Central Asia

PREVENTION OF CLIMATE CHANGE: THE MOVING FROM DEBATE TO PRACTICAL STEPS

WITHIN THE FRAMEWORK OF "THE PREVENTION OF CLIMATE CHANGE AND RESCUE OF HUMANKIND" PROJECT

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PREFACE

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GREENHOUSE EFFECT

"The biosphere will inevitably turn into noosphere, i.e. into the sphere where the human intellect will play a dominating role in the development of the man-nature system."

Law of Noosphere by V.I. Vernadsky

Insight into greenhouse gases and greenhouse effect

For milleniums one natural human desire was to change the environment. At present we all of a sudden find ourselves on the verge of huge climate change resulting from human activities. Unfortunately these climate changes are unplanned and often uncontrolled and can entail catastrophic effects.

Climate on the Earth is determined by intricate interactions between the atmosphere, world oceans, ice caps, animals, vegetation and sedimentary rocks. When speaking of "a climate system" scientists mean all natural factors which form the climate in interaction. This system includes at least four main components: atmosphere, hydrosphere, lithosphere and biosphere. When a climatic system is in equilibrium – as it had been before the technological revolution - the solar radiation absorbed is balanced by the surface radiation of the Earth and atmosphere. The anthropogenic factors that produce an accumulation of solar energy impact the thermal balance, changing the climate. The factors which actively influence the solar energy balance include technological gases called greenhouse gases.

Greenhouse gases create a screen in the atmosphere that retains the infrared radiation resulting in the heating of the Earth is surface and lower layers of the atmosphere. Traces of these gases were present in the atmosphere almost through the whole history of the Earth. The most significant natural greenhouse gas is water vapor. The next in this row of greenhouse gases – carbon dioxide (CO_2) – has either natural or anthropogenic origin. Through the entire history of the Earth it entered the atmosphere from volcanic activities, and its balance was kept on by the biota due to natural circulation. Without CO_2 the temperature of the Earth surface would have been by around 33 °C lower than at present creating extremely unfavorable living conditions for animals and vegetation.

Scholars know how the chemical composition of the atmosphere has been changing during the last 160 thousand years. These data were obtained from the analysis of air bubbles in the ice cores pulled from a depth of 2 km at the "Vostok" station in Antarctica and in Greenland. The data indicate that in warm periods concentrations of CO_2 and CH_4 were some 1.5 times higher than in cold drift periods. These findings support the assumption expressed in 1861 by John Tyndall that the history of Earth's climate changes can be explained by changes in the atmospheric concentrations of carbon dioxide.

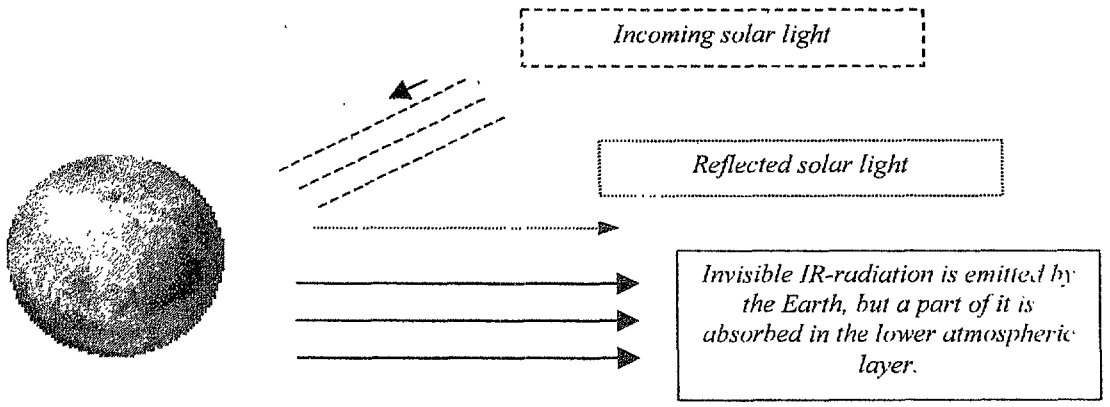


Figure 1. Greenhouse effect mechanism. *[Source: United Kingdom Environmental Protection Department, "Global Climate Change", May 1990.] Solar radiation reaches the Earth and a portion of it is reflected. The greater part sinks through the atmosphere and heats the Earth surface. The Earth emits invisible infrared (IR) radiation resulting in the Earth's cooling. However a portion of this IR-radiation is absorbed by greenhouse gases in the atmosphere, and the heat is held in this way.*

Carbon dioxide increases in the atmosphere not only in this natural way, but also due to human activities, mainly from combustion of fossil fuels and forest destruction. Therefore it is necessary to differentiate between the natural greenhouse effect and anthropogenic. enhanced greenhouse effect (or global warming).

The natural greenhouse effect keeps the thermal balance of Earth's atmosphere favorable for animals and vegetation. The biota is also a natural temperature regulator because it can emit or absorb CO_2 due to a complex feedback mechanism formed and "adjusted" over millions of years. The anthropogenic greenhouse effect, on the contrary, disturbs the established thermal balance in the atmosphere-hydrosphere-lithosphere system and therefore can produce a catastrophic rise in the temperature of the Earth.

The anthropogenic greenhouse effect is caused by increases in the atmospheric carbon dioxide[1]. This will entail climate warming and hence increased melting of glaciers and rise in sea levels as well as drastic weather changes throughout the world.

[1] Chloroflourocarbons, methane, nitrous oxide (see section "Sources of greenhouse gases")

Greenhouse effect. A car or a greenhouse are heated under the sun, because light energy sinking inside through the glass is absorbed and converted into the thermal energy that cannot pass through the glass (Fig. 2). When the heat is trapped in this way, temperature rises. The Earth's atmosphere is heated likewise: light goes through the atmosphere while greenhouse gases, that act as "a blanket" holding heat, absorb infrared radiation. For instance, the temperature and climate we are used to are ensured by carbon dioxide concentration in the atmosphere at the level of 0.03 %. By raising this concentration, we increase the tendency for climate warming. Thus, the higher the greenhouse gas concentration, the stronger the greenhouse effect.

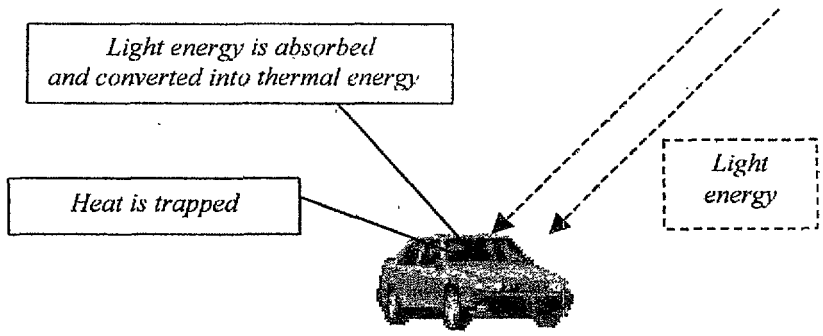


Fig. 2. Greenhouse effect.

Greenhouse gases make up around 0.1 % of the atmosphere, which is mainly comprised of nitrogen – 78 % and oxygen – 21 %. The main greenhouse gases enhancing anthropogenic changes in the atmosphere are carbon dioxide (CO_2) methane (CH_4), nitrous oxide (N_2O) and chlorofluorocarbons (CFCs)

Forests on the Earth occupying around 28 % of the land and the world's oceans occupying 70 % of the total surface of the Earth can influence the global carbon cycle,[2] the level of atmospheric CO_2 and the climate. While growing, forests absorb carbon dioxide from the atmosphere and accumulate it in phytomass and forest humus. According to assessments of the World Wildlife Fund, forests account for 80 % of carbon contained in vegetation and 40 percent of the total soil carbon. Scientists estimated that every year 1.6±1.0 billion tons of carbon are emitted into the atmosphere due to destruction of forests and land use change.

Carbon dioxide concentration in the world's oceans is several times higher in the deep than at the surface. This is because the level of inorganic carbon dissolved in water in the form of bicarbonate ions in equilibrium with CO_2 is almost two orders more than in the atmosphere. If life in the ocean ceases, concentration of inorganic carbon in the depth and at the surface will become equal, leading to manifold increase in the atmospheric CO_2

[2] Supplement 10: Biogeochemical cycle

concentration. Therefore, the ocean biota regulates atmospheric CO_2 concentration and through this maintains the surface temperature within the limits optimal to the life. A number of climatologists suggest that the world's oceans have a great potential to absorb CO_2, and when water temperature rises, the capability of the ocean to absorb carbon increases. Thus, we can infer that the world ocean will probably play a stabilizing role in the carbon dioxide balance in global warming.

Table 1. Possible climate changes due to doubling of atmospheric CO_2[3]
(source: US National Academy of Sciences)

Item Nos	*Climate change*	*Probability*	*Cause and effect*
1	Significant stratospheric cooling	Already happened	Decrease in ozone concentration in the upper stratosphere will produce decreased absorption of solar ultraviolet radiation and hence less heating of it. Increase in the concentration of the stratospheric carbon dioxide and other radioactive trace gases will entail increase in the stratospheric heat emission. Combination of decreased speed of heating and increased speed of cooling will produce a considerable decrease in the temperature of the upper stratosphere.
2.	Global average warming of the surface	Highly probable	Long-term mean global warming of the surface within 1.5 to 4.5 °C is anticipated upon doubling CO2 content (or equivalent amount of other greenhouse gases). The most questionable is, to what extent global warming is connected with the increase in the speed of greenhouse gases intake into the atmosphere and to what extent with natural change of slowly responding components of the climate system, i.e. world ocean and inland ice.
3.	Global increase in average precipitation	Highly probable	Increased heating of the surface will produce increased evaporation and global precipitation. Despite this fact, in certain areas a decrease in the rain level can be anticipated.
4.	Decrease in the sea ice area	Highly probable	As the climate becomes warmer, the decrease in the sea ice surface can be anticipated.
5.	Warming of polar winters	Highly probable	As the boundaries of sea glaciers shift to the poles, the models predict drastic increase in the area of surface warming in polar regions. A big share of open water and thinner sea ice would probably produce warming of the polar zone of the lower troposphere, by a factor of at least 3.
6.	Summer drying up (warming) of continents	Probable in distant future	A number of researchers anticipated an appreciable long-term decrease in soil moisture content in summer periods in inland areas of middle latitudes. This drying up results mainly from earlier ending of snow melting and rain periods and spring-summer drying out of soil. Of course, this modeling of long-term equilibrium conditions cannot be a reliable reference-point in explaining the trend of changes in the atmosphere composition and climate in advance for several decades.
7.	High-latitude increase in	Probable	As the climate becomes warmer, the increased penetration of heat and humid air to the poles would

[3] Doubling of atmospheric CO_2 is expected in 2030-2050.

	precipitation		increase the annual average precipitation at high latitudes.
8.	Rise in the mean level of oceans	Probable	The rise in the average level of oceans is anticipated from the heat spread in seawater under warmer climate conditions in future. Less definite is the contribution of inland ice melting to this process.

Some scientists believe that the global climate warming can have positive effects. For instance, agricultural crops and livestock yield can increase. That means the local climate change. However, despite these assumptions, it is as yet unknown how microorganisms will behave that can impact the quality of water, soils and air. We all are witnesses of hurricane winds, dust storms, and soil salinization and flooding even in quite safe areas.

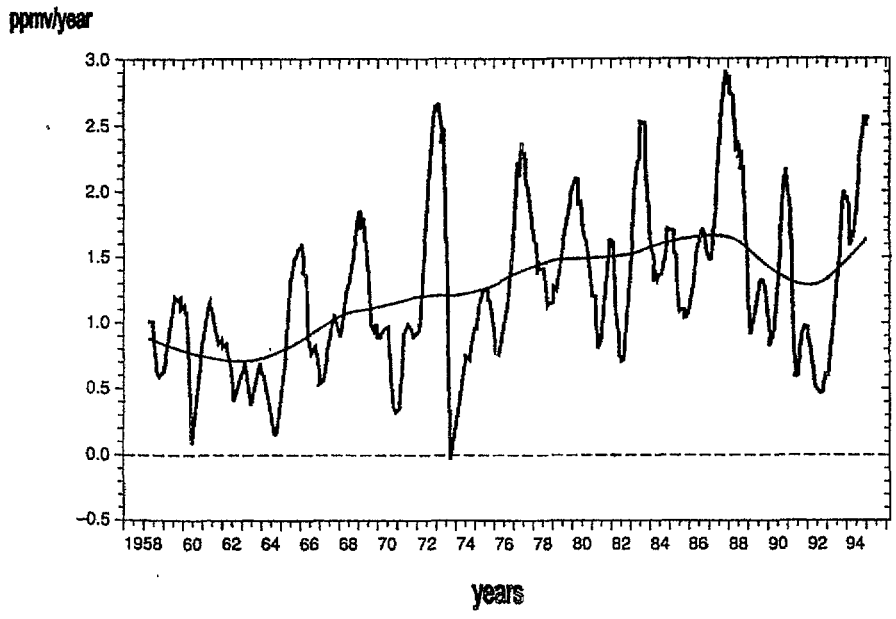


Fig. 3 Rise of atmospheric CO_2 concentration according to the data of Mauna Loa station, Hawaii [Source: *C.D. Keeling and T.P. Worf, Scripps Institute of Oceanography, and P. Tans, NOAA CMDL]*

Sources of greenhouse gases

In the biosphere the concentration of carbon dioxide was maintained at one and same level due to the natural circulation of carbon. At present this balance is being disturbed by people due to fossil fuel combustion and forests destruction.

The initial cause of the heat-trapping gases accumulation is industry and transport utilizing fossil fuel as a source of energy. Combustion of every pound of fuel (coal, oil products and natural gas) produces about three pounds, or 2 m^2, of carbon dioxide.

THE BIG THREE: COAL, NATURAL GAS AND OIL [Source: Curtis Moore // "Energy Production: New Epoch"]	
COAL	Of the three major fossil fuels, coal is used most extensively. According to the ratio of its consumption and extraction, coal reserves will be sufficient for 390 years. Above 60 percent of world coal reserves are attributed to developing countries, 50 % of these – to China alone. Of industrially developed countries the richest deposits of coal are available in the former Soviet Union countries and the United States of America – 13 % and 12 %, respectively. In spite of growing anxiety about global climate warming, acid rains and other negative ecological factors, coal as before remains the cheapest and most widely used fossil fuel. Coal is the main source of energy in Poland and former Czechoslovakia and Bulgaria. Most families in these East European countries use coal to heat their houses: the residential sector accounts for 47 percent of total coal consumed in Poland, and 75 % in Hungary. In the East, in China, 73 % of the energy demand for the national economy are met by coal, and a quarter of the total coal consumed is used to heat residential houses raising the level of urban pollution. In developing countries 92 percent of the total coal mining is attributed to China, India, South Africa and the Democratic People's Republic of Korea.
NATURAL GAS	Of all fossil fuels, natural gas is the cleanest environmentally. Natural gas is suitable for implementing a whole array of technologies, being more cost-effective and environmentally friendly than the processes based on combustion of coal and oil. Developing and developed countries share equally the world reserves of natural gas. According to the ratio of production and consumption of natural gas, its reserves will be sufficient for 155 years in developing countries, and for 39 years – in developed countries. The richest fields of natural gas are available in the former Soviet Union, which has 38 % of the total reserves. Natural gas is the most important source of energy in developed countries that are not members of Organization for Economic Cooperation and Development (OECD), surprassing oil in 1983 and coal – in 1987.
OIL	Despite the fact that oil reserves remain considerable, they are still less than reserves of coal or natural gas. As estimated, world oil reserves account for 124 billion metric tones, and taking as the baseline the production level of 1989, they will be sufficient for 40 years. The share of developing countries account for above 86 % of the world oil reserves. Many developed countries keep in memory the oil crises of the seventies giving rise to continuous attempts to find alternatives to oil. As a result, since 1973 in most developed countries oil consumption for electricity production, heating and use of energy for industrial purposes has been declining as a rule. In many countries the use of this fuel for transport purposes has also reduced. However, e.g. in the USA oil usage in this application has risen and as a result the country today is more dependent on

	oil import than 20 years ago. Despite the decline, oil as before remains the major source of energy in the world. In 1989 its share was about 39 % of the total energy produced in the world, followed by coal (28 %), natural gas (21 %), hydropower (7 %) and nuclear energy (6 %). Taking into consideration mass multimillion dollar investments in oil pipelines, storage tanks, engines and other applications of oil, it hardly to be losing its predominating positions.

Every year the amount of fossil fuel combustion is about 2 billion tons. This means that the atmospheric uptake of carbon dioxide is almost 5.5 billion tons. Almost 1.7 billion tons of this gas is emitted due to the destruction and burning-out of tropical forests and the oxidation of soil organic matter (humus).

This problem is much aggravated by other gases emitted into the atmosphere from human activities, in particular methane, chlorofluorocarbons (CFCs) and nitrous oxides, all of which absorb infrared radiation more than carbon dioxide. Therefore, though the level of these gases in the air is much lower, they affect the temperature regime of the planet almost to the same degree as carbon dioxide.

For example, rice fields produce about 110 million tons of methane annually, accounting for 20 % of the total amount of anthropogenic emissions of this gas. The ability of methane to induce global warming for the period of 20 years is 24 times stronger than that of carbon dioxide. This means that 1 kg of methane for this period will exceed 24 times the effect of global warming compared to 1 kg of carbon dioxide. Because methane production from rice fields depends considerably on temperature and soil moisture content (increase in these parameters will rise emission of CH_4), it should be admitted that the problem is not so simple. This conclusion is strongly supported by differences in the data obtained from rice fields throughout the world. However D.A. Lashof ["The dynamic greenhouse: feedback processes that may influence future concentrations of atmospheric trace gases and climate change", Climate Change (1989), vol. 14, pp 213-42] who conducted his own assessment basing on the available data, stresses that methane production from rice fields will increase by more than 30 million tons annually.

Table 2

Widespread greenhouse gases and major anthropogenic sources of these

GAS	MAJOR SOURCES
Carbon dioxide (CO_2)	1. Energy production: - combustion of coal, oil, gas and other fuels
	2. Industry: - production of cement and other processes
	3. Transport: - fossil fuel combustion
	4. Deforestation and land use change
Chlorofluorocarbons (freons) and related gases	1. Various industrial applications: - Aerosols - Cooling agents - foam solvents

Methane (CH_4)	1. Energy production: - coal mining and oil production - gas leakage in gas production and application
	2. Industry: - production waste
	3. Agriculture: - Livestock breeding - rice fields - biomass combustion (humus degradation, peat combustion)
Nitrous oxide (N_2O)	1. Energy production: - combustion of coal, oil and gas
	2. Agriculture: - Fertilizer applications - Biomass combustion (humus degradation, peat combustion)
	3. Deforestation and land use change

Temperature dynamics

Scientists share the opinion that the direct effect of increases in greenhouse gas concentrations will be global warming. If the present tendency persists, then by the years 2030-2050 the atmosphere will contain so much greenhouse gas that will have a thermal absorption capacity twice higher than the carbon dioxide available in the atmosphere in the middle of the last century.

Table 3. Concentration of greenhouse gases in the pre-industrial period and in 1990
[source: IPCC (Intergovernmental Panel on Climate Change)]

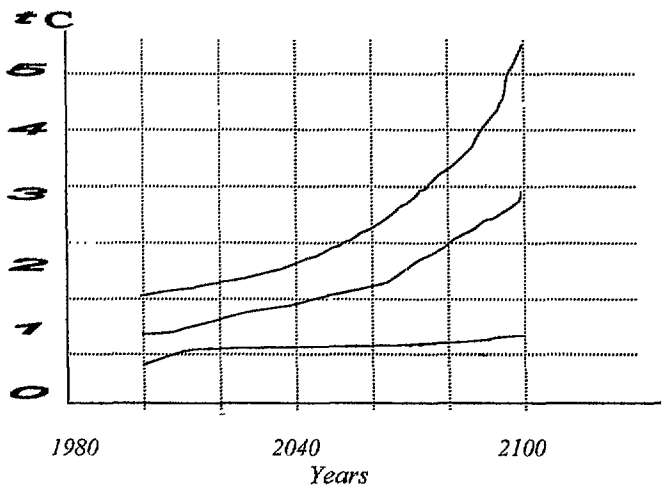
Greenhouse gases	***Pre-industrial period (1750-1800)***	***1990***
Carbon dioxide (CO_2) *(ppmv)**	280	353
Methane (CH_4) *(ppmv)**	0.8	1.72
CFCs-11 *(pptv)**	0	280
CFCs-12 *(pptv)**	0	484
N_2O *(ppbv)**	288	310

* *ppmv = parts per million volume*
ppbv = parts per billion volume
pptv = parts per trillion volume

Modeling of climatic processes shows that this concentration of greenhouse gases will entail an average warming of the Earth's surface by 1.5-4.5 °C. Warming will probably be stronger in polar areas (up to 10 °C) and less – near the equator (1-2 °C). Significant differences arise relating to how this warming will influence cloudiness and how it will affect the distribution of solar radiation. However no one repudiates the probability of warming.

At first sight warming seems moderate. However, air temperature increases by 4.5-5.5 °C above the peaks of 38 °C can be catastrophic. Moreover such warming will entail melting of mountain glaciers and polar ices sufficient to raise the world ocean level by 1.5 m. This will cause flooding and more exposure of vast littoral areas to storms, i.e. it will force people to leave settled coastal areas and migrate deep inland. In this connection many countries of the world face a number of vital questions. To what extent are we ready to rearrange and re-equip all seaports with regard to rising sea levels? Are the inland cities and towns ready to receive millions of resettled people? These and other acute questions require answers.

Figure 4. Three possible scenarios of global temperature change by the year 2100.
[source: J. Jaeger, Developing Policies for Responding to Climate Change: s summary of the discussions and recommendations for the workshop held in Villach. 28 September to 2 October 1987. Stephen Schneider. Science of climate modeling and discussion of prospects of global warming. 1993]



This Figure presents the trend of global warming in the 21st century according to the data obtained by an international group of scientists. It shows warming from a very moderate temperature increase of 0.5 °C to a catastrophic warming of 5 °C and more, as early as before the end of the next century. The latter can definitely be called catastrophic because it corresponds in magnitude to the warming that took place between 5 and 15 thousand years ago, and that marked the transition from the last drift period to the present-day inter-glacial epoch. The full transition of the warming epoch took 5-10 thousand years and was accompanied by a sea level rise of 100 m, migration of various kinds of vegetation of thousands of kilometers, radical changes in the living environment of animals and plants, extinction of some living organisms and evolution of others, as well as by other significant changes in the environment.

The effect of global warming on precipitation and agriculture seems to be even stronger. Different temperature at the poles and equator is the main driving force of atmospheric circulation. Stronger warming at the poles will weaken the circulation. This will change the picture of atmospheric circulation and therefore – the precipitation distribution.

For North Africa, as it is currently a desert, increase in precipitation will probably have a positive effect. However the USA and Canada will lose under these conditions. The central part of North America is one of the most important agricultural regions in the world, producing huge amounts of maize and wheat. Precipitation in the region, already a minimum for its current crops, is expected to reduce significantly. Irrigation will hardly remedy the situation because the level of ground water is already going down in most of this territory because of agricultural consumption. Agriculture will probably manage to adapt to another climate, e.g. by shifting areas under crops to the north. However the main difficulty is in the lack of knowledge – what to expect. Farmers now lose on average every fifth yield because

of unfavorable weather. In climate shifts the weather inconstancy will be even more tangible and crop losses may increase catastrophically.

Climatologists and biologists are able to assess the effects of Earth's temperature changes of 1-2 °C. However more significant temperature fluctuations can entail such climate changes that are beyond scientific experiment and anticipation. No one can surely predict what changes will take place in ocean currents, or how climate will change in that or another place of the Earth with the disappearance of Arctic ices. Likewise we cannot forecast how it will affect the fauna of ocean and inland, fisheries, the redistribution of plowing lands in the continents, the forests and the health of people. To predict possible consequences is more difficult if the changes occur permanently and with acceleration rather than being suspended by human interference. Thus, if anthropogenic emissions of greenhouse gases are not controlled strictly, there will be no "winners" under global warming as has been recently suggested by some scientists and politicians.

"... The speed of changes in the carbon dioxide concentration observed in the atmosphere within the last century is absolutely unprecedented, nothing similar has been on the Earth over the last 200 million years. The causes of these changes are the anthropogenic emissions of carbon dioxide and at the same time of other gases including greenhouse gases, technological products of civilization and human activities...

Rather simple calculations already presented in a number of scientific publications can show that during the last century radical deviation from the balance of equilibrium has occurred in the atmosphere and climate system of the Earth. If earlier carbon dioxide uptake was performed by the biota of both ocean and inland, now, according to recent data, this function is being fulfilled only by ocean. Inland ecosystems emit more CO_2 than they absorb. Moreover, the ecosystems disturbed by a man finally emit CO_2 instead of absorbing it.

This change in the equilibrium regime is an extremely formidable factor. And irrespective of possible scenarios according to which further events will develop, the mankind will face catastrophic consequences if it doesn't stop the process of the climate system's deviation from equilibrium..."[4]

[4] V.I. Danilov-Danilian. "From Kyoto to Buenos Aires: Key steps to the development of greenhouse gases trading, and problems that require immediate solving." Proceedings of the Russian-American Seminar for Emissions Quotas Trading.

Present state and history of the problem

As early as in the 19th century scientists discovered that carbon dioxide retains the heat from the sun in the atmosphere, affecting the Earth's surface temperature. With the beginning of the industrial revolution and scientific and technological progress the world consumption of various fuels grew, raising respectively the atmospheric carbon dioxide level.

Nevertheless for many years scientists didn't take this problem into consideration because it was common knowledge that excessive atmospheric CO_2 sinks into the world's oceans. In 1957-1958, during the International Geophysical Year, scientists decided to check that assumption through a number of investigations on the peak of the Hawaii volcano Mauna Loa. The data from Mauna Loa show that the concentration of carbon dioxide rises evenly. [Source: Matthew Paterson, Global Warming and Global Politics, London and New York, 1996.]

In connection with the political instability in the world during the Cold War, up to the middle of the eighties, international cooperation in the reduction of greenhouse gas emissions was unfeasible. Measures for nature protection policy of most countries did not extend beyond the frameworks of the national level. However attitudes of states started changing due to huge efforts of scientists from many countries with regard to the ozone crisis when in 1987 in Montreal a Protocol on Restrictions was signed and finally follows with a ban on emissions from CFC production. The success of the Montreal Protocol has contributed to the prospects for international cooperation relating to other problems of global nature protection.

When one of outstanding climatologists of the United State James Hansen from NASA declared to the Congress in 1988 that with a high degree of reliability warming (increase in the mean global temperature by around 0.5 °C in this century) can be connected with the anthropogenic greenhouse effect, he stirred up a storm of critics. "It is time to stop waffling so much and say the evidence is pretty strong that the greenhouse effect is here." – he said in his interview to a journalist from New York Times. Thus, the statement of Hansen had an unusual political effect and drew many scientists and politicians of the world to this problem.

At that time many climatologists did not agree with Hansen and considered that recent hot years were normal deviation from mean temperatures. However data confirming the opinion of Hansen are being accumulated. And in 1989 A. Strong from the National Oceanic and Atmospheric Administration reported that the measurements of the ocean surface temperatures conducted from a satellite during 1982-1988... showed that the world's oceans gradually but noticeably grew warmer by about 0.1 °C a year. Later on, some scientists agreed with Hansen that physical manifestations of the anthropogenic greenhouse effect are already definite. Richard Houghton and George Woodwell stated that the heat and drought that affected North America and other regions of the Earth in recent years concurred with the predictions of possible global warming. There were also other signs of increasing warming. These included information on decreasing size of the area of permafrost in Alaska and Canadian Arctic, on rising mean temperatures in Canadian lakes, on decreased maximum yearly extension of ice cover in Antarctica and Arctic, as well as on the diminishing number of icebergs in Europe and other regions. Unusual climatic phenomena in recent years - the Hugo Hurricane, floods in Africa and South-Eastern Asia, storms in Europe, - have given rise to the warming that it is "a

signal" of the growing greenhouse effect. According to ex-director of the US National Center of Atmospheric Research Dr. Walter Roberts [Source: Robert, Walter Orr, "It is Time to Prepare for Global Climate Changes". Conservation Foundation Letter, April 1983.],"the dust bowl in the USA in the middle of 1930s was the greatest climate disaster in the history of our country... However it could seem a childish game in comparison with the dust bowl of the 2040s. As a result of warming... natural precipitation can decrease by 40 %, summers will get hotter, evaporation from the earth's surface will increase, soils will dry out, and winds will raise soils to the sky..."

In December 1988, having revised the strategy for the policy of climate change, the UN General Assembly approved the establishment of the Intergovernmental Panel on Climate Change. And in 1989 at an annual meeting the heads of seven large democratic states recognized the necessity of adopting a world convention on global climate change aimed at mitigation of anthropogenic greenhouse gas emissions.

UN Framework Convention on Climate Change

In 1992 in Rio-de-Janeiro at the Conference on the Environment and Development the UN Framework Convention on Climate Change (UNFCCC) was signed. The Convention was a result of the acknowledgement that climate problems do exist and have to be tackled. The Convention became effective on 21 March 1994 and has been ratified in more than 150 countries of the world.

According to Article 2, the final target of the UNFCCC is to ensure stabilization of anthropogenic GHG emissions at a level which will slow impact on the climate system to a rate that is sufficiently slow for ecosystems to adapt naturally to climate change. This would eliminate the threat of food supply, shortages and ensure sustained economic development in the future.

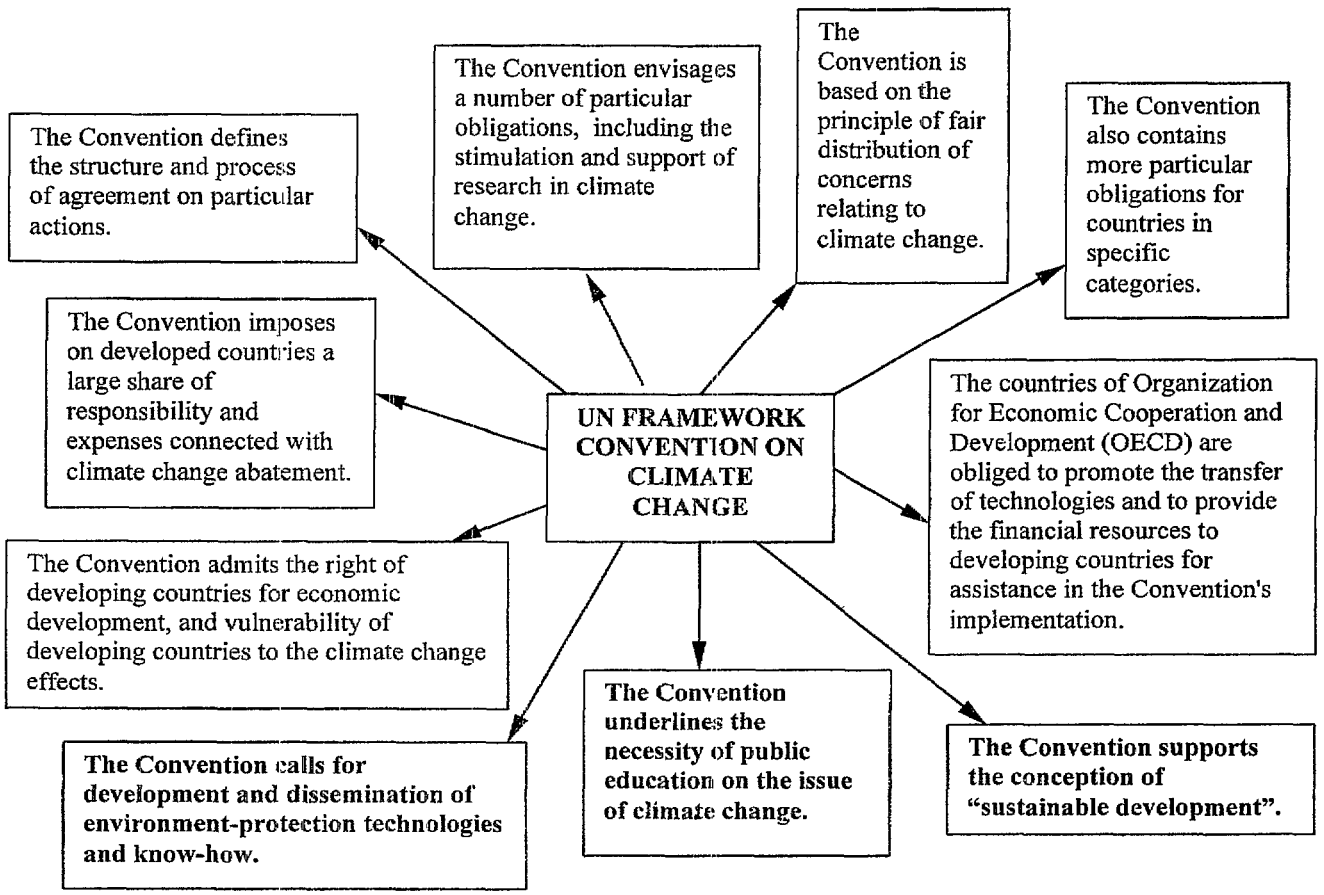
Restoring the balance in the atmosphere which has been disturbed is the ultimate target of the Convention. It is evident that climate changes is a problem, global in all respects.

First, the anthropogenic disturbance of the climate system is global, and its effects will have an impact on every country and every person.

Second, every country and every individual person is involved in this process. This means that both the causes and the effects involove everyone.

Finally, the problem has to be solved by the whole world. It will require global efforts and global coordination.

Figure 5. Basic provisions of the Framework Convention on Climate Change



So, The UN Framework Convention on Climate Change has provided a general outline of the existing problem. However the conditions necessary for implementation of the FCCC decisions were defined five years later, at the Conference in Kyoto.

The Republic of Kazakhstan signed the UN Framework Convention on Climate Change. The Convention was ratified on 15 May 1995 by the President of the Republic of Kazakhstan, N.A. Nazarbaev. The document on ratification was handed over to the chief depositary – the UN General Secretary.

THE KYOTO PROTOCOL

As early as the 1960s textbooks on economics presented air and water as the prototypes of "free commodities" and "public goods". The availability of this wealth was considered unlimited. But later on mankind was forced to change opinion and understand that all natural resources were exhaustible. For instance, atmospheric emissions of one or two industrial enterprises have a slight effect on the people's health, flora and fauna, and climate change. However the growth of such enterprises entails inevitably the general degradation of natural resources and environment throughout the world. Adequate measures are required to regulate the access to these resources in order to prevent their ultimate degradation. As mankind developed, the rules concerning the usage of most natural resources were adjusted. However atmospheric air remained one of a few unsolved issues, and the access to this resource was free.

In December 1997 in Kyoto (Japan) the countries of the world community elaborated an epoch-making agreement on the control of atmospheric emissions of greenhouse gases which cause global warming. The basis of this agreement was a voluntary and legally non-binding statement of the most powerful industrially developed countries of their intention to reduce by the year 2000 the amount of greenhouse gases emitted into the atmosphere to the levels of 1990 emissions. To provide a strong ecological and economic basis for this agreement, three main goals were formulated (see Fig. 6).

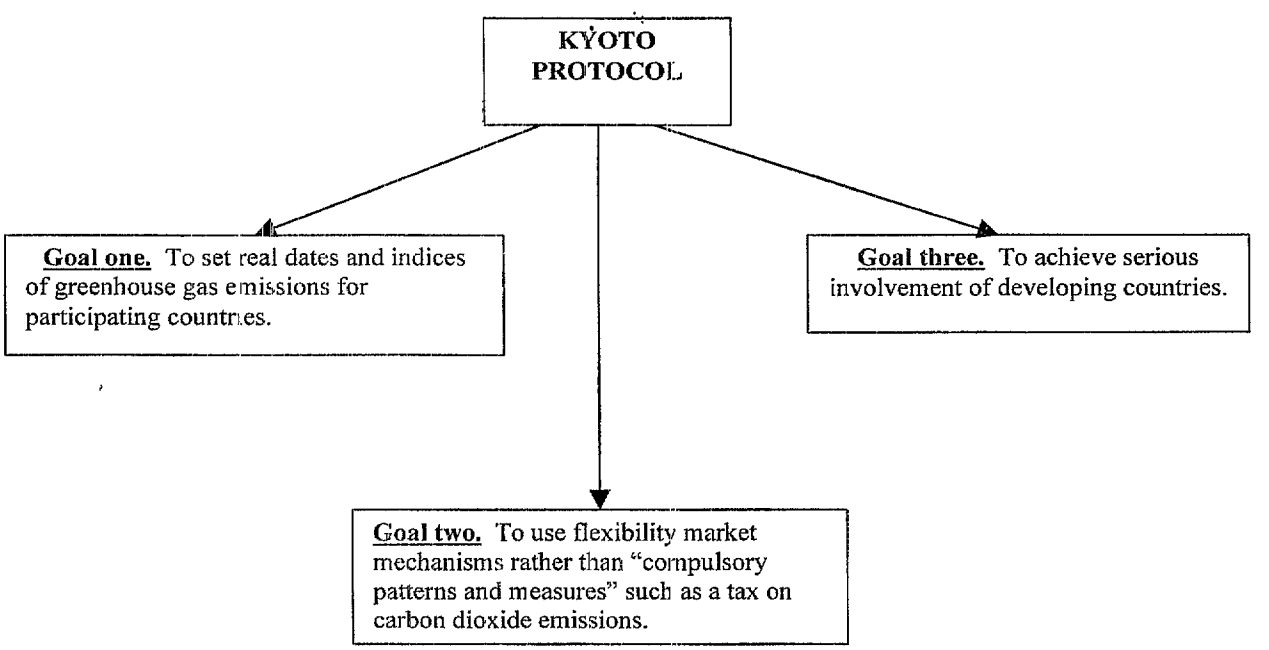


Figure 6. Main goals of the Kyoto Protocol

The diagram in Fig. 7 shows an example of implementation of the first goal of the Kyoto Protocol. It uses the data on anticipated emissions of greenhouse gases for the USA.

[Source: Reistein R.A. 1997. The Road to Kyoto. Reinstein and Associates International. Washington, USA]

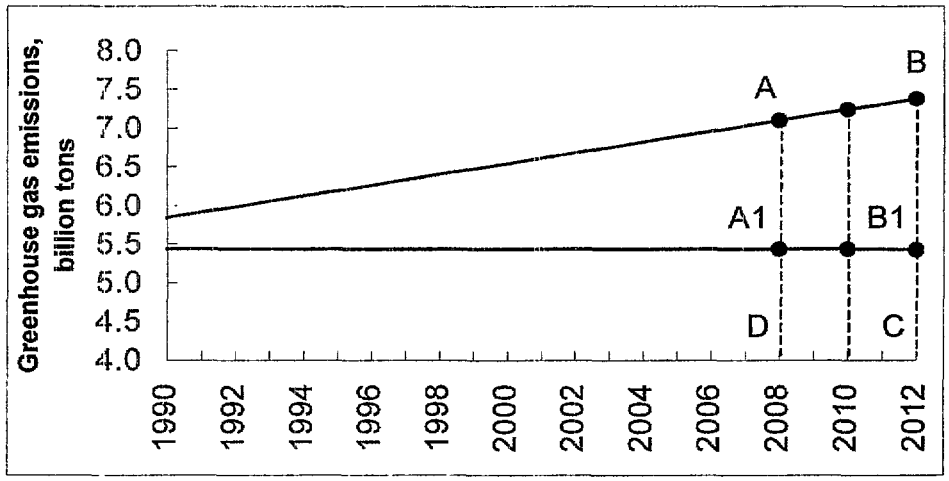


Figure 7. Diagram showing implementation of the first goal of the Kyoto Protocol

Thus, greenhouse gas emissions in the baseline year (1990) in the USA totaled 5,842 billion tons. The emissions prediction of a "business as usual" scenarios for 2010 is 7,241 billion tons. In the diagram the ABCD area shows the amount of greenhouse gas emissions till the year 2012 without any limitations. According to the obligations assumed in Kyoto, the USA will reduce the amount of greenhouse gas emissions to 93 % of the reference year for the period from 2008 to 2012. This means that annual amount of emissions will be 5,433 billion tons (5,842 billion tons X 0.93). In such a way, the A_1B_1CD area shows the amount of emissions after the USA undertakes obligations on the limitation. From this calculation, the possible amount of greenhouse gas emissions in the USA is 27 billion tons (5,433 billion tons X 5 years) instead of the anticipated 36 billion tons. Such a situation arises due to the use of flexibility mechanisms of trading elaborated at the meeting in Kyoto.

The results of implementation of the first goal are as follows:

- Instead of a fixed year of atmospheric emissions reductions, the concept of a long-term period was adopted as suggested by the USA. A long-term schedule provides the countries with more flexible opportunities in achieving the set indices. Setting the mean indices for a five-year period rather than for every year will enable emitters to cut costs, particularly by taking into consideration the uncertainty of the prospects for economic development. Averaging of the indices can smooth down the effect of short-term factors, such as fluctuations of the business cycle and of demand for energy carriers, or unusually cold winters and hot summers during which energy consumption rises and the amount of atmospheric emissions increases correspondingly.

- Participating countries have to achieve the set indices in the period from 2008 to 2012. This gives them great opportunities for gradual implementation of new technologies with

optimal costs and also for mitigation of effects of this implementation on a company and its employees.

- Differentiated indices for key developed countries are set within the range of 6 to 8 percent below the baseline levels (1990 and 1995) of greenhouse gas emissions.

- It was proposed that certain kinds of activities as an off-set of emissions should be taken into account to encourage development of "natural absorbers", e.g. planting of trees that absorb CO_2. Through promotion of the implementation of this type of cost-effective method of solving the climate change problem, the useful practice of forests planting can be encouraged.

Implementation of the second goal consists of the following:

The Kyoto Protocol outlines the main element of this commercial approach – from now on companies and countries have an opportunity to sell and purchase greenhouse gas emissions quotas. Therefore, the quotas are also a commodity having a price. The accounting mechanism of the sale and purchase of quotas is similar to the mechanism of money accounting in a banking system. If bank has excess money, it offers the money to other banks at a higher interest rate than the bank paid when purchasing this money. The earnings from the sale are used by the bank for its own interests. The bank willing to purchase additional money, e.g. in order to settle with creditors, finds its own resources through attracting resources from other banking facilities. In the end, the total balance of the resources does not change despite transactions inside the bank.

Below is an example of purchase and sale of greenhouse gas emissions quotas. Three countries are presented: A, B and C. The emissions limit set by the Protocol for every country is 150, 100 and 200 million tons per year, respectively (see Table 5).

Table 4. Example of implementation of the second goal of the Kyoto Protocol

	Emissions limit (million tons)	*Sale of quotas (million tons)*	*Purchase of quotas (million tons)*	*Permissible emissions (million tons)*
Country A	150	20	10	140
Country B	100	-	30	130
Country C	200	20	-	180
TOTAL	450	40	40	450

Assume that country A made the decision to sell 20 million tons of greenhouse gases from its total allowed limit, and later on, for some reason, decided to purchase 10 million tons. In the end the amount of permissible emissions for country A will be 140 million tons a year (150 – 20 + 10). A similar calculation is done with regard for permissible emissions for countries B and C. So, the initial total amount of emissions limits for the three countries accounting for 450 million tones did not change. However, the emissions of each of the countries differs from the initial distribution. Motivation for these changes is an economic benefit obtained by every party involved in the quotas trading. The above example answers the question: will these emissions have an adverse effect on the climate? A negative answer is rather obvious because the quotas trading does not increase the amount of the emissions, but only re-distributes these emissions. Without disturbing the fundamental basis of the

emissions limits set earlier, the community gets an opportunity to find the best way to meet these restrictions.

The third goal is connected with involvement of developing countries:

Global warming is a global problem that requires global solution. The search of such a solution requires involvement of not only developed countries, but also of the key transition and developing countries. In developing countries the level of atmospheric emissions of greenhouse gases is lower, and within the first period of the treaty no particular changes are anticipated there, because at present above 70 % of the greenhouse gases in the atmosphere result from the activities of industrially developed countries.

At the same time it is necessary to take into consideration that by around the year 2015 China will become the biggest emitter of greenhouse gases, and by 2025 developing countries will emit more greenhouse gases into the atmosphere than the developed world. So, from the viewpoint of ecological prospects this problem cannot be solved until developing countries contribute their efforts to the worldwide work in this field. Certain developing countries erroneously conclude that developed countries aim at restricting their opportunities for industrial development, control of poverty and raising the population living standard.

The concept of joint implementation (developed and developing countries) is set forth in the Convention on Climate Change. It enables two countries with different expenditures for emissions reduction to fulfill jointly their obligations to reduce greenhouse gases. Within the framework of joint implementation the government or enterprise of a donor-country invests in individual projects of carbon dioxide emissions mitigation or sinks in a recipient country. This pattern suggests low-cost activities for carbon dioxide emissions reduction or sinks. A credit (or compensation) of emissions is set up, meaning the controlled reduction of emissions achieved through a particular project can be subsequently used by the donor to cover its own emissions. The recipient, in its turn, receives transfer of advanced technologies and financial sustainability for the project covered by the joint implementation.

Table 5. Example of implementation of the third goal of the Kyoto Protocol

	Developed country A	***Developing country B***
Obligations on reduction of GHG emissions (million tons)	10	10
Cost of 1 ton emissions (dollars)	40	10
TOTAL COST	400	100

As an example, developed country A has to reduce annual emissions of carbon dioxide by 10 million tons (see Table 5). Country A has already spent considerable amounts of money for energy saving, and therefore new investments do not ensure considerable ecological effect, and in this country the reduction of annual emissions of carbon dioxide costs 40 dollars of investments per 1 ton. Country B has just begun serious investments in energy saving, and expenditures in this country are only 10 dollars per one ton of emissions reduction. It is clear that if the countries fulfill their obligations independently, they will spend 400 and 100 million dollars, respectively. However country A, instead of spending 400

million dollars at home, can spend 100 million dollars ($10 X 10 million tones) in country B with the same ecological effect. Due to this, country B will receive 100 million dollars of investments, and country A will save 300 million dollars (10 million tons X (40 – 10) from fulfilling its obligations. Investments relating to the obligations of country A can be successfully compensated with the arrangements done by country B to fulfill its own obligations on emissions reductions by 10 million tons requiring 100 million dollars of investments (10 million tons X 10 dollars). Therefore, this cooperation will give this country not only investments but other benefits as well. These benefits will be reduction of other harmful emissions because of implementing treatment facilities and new advanced technologies from the purchasing country.

The discussions prior to the Kyoto Conference were not very successful, and the most difficult matters were solved only in the last days and even hours of the Conference. The disagreements among the participants related mainly to the following three issues:

(1) Definition of the amounts of compulsory reductions of greenhouse gases and identification of the gases which are subjects of compulsory reduction.

(2) Definition of the need to apply the requirement of atmospheric emissions limitation to developing countries.

(3) Definition of the necessity of introducing a system of trading of emissions permits which may include joint projects with the off-set of the quotas that would allow the country contributing to emissions reduction in other countries to gain off-sets for these activities instead of making more expensive reduction of emissions within its own territory.

In this manner, the decisions of the Kyoto Protocol have supported the approach ofenabling developing countries to continue economic development, but this development has to be on an ecologically grounded and economically sustainable basis due to the use of the advantages of technologies not available in developed countries in the early period of their industrial development.

Participating countries agreed that at the present stage of discussions they would set limitations only for industrially developed countries. In the end of the discussions they established a list of "Annex 1 countries" which agreed to undertake legally binding limitations on atmospheric emissions of greenhouse gases. Developing countries were referred to "the countries not belonging to Annex 1". Eventually the decisions of the Protocol indicate that the Annex 1 countries must – on an individual or collective basis – provide conditions when the amount of greenhouse gases emitted by these countries does not exceed the amounts set for every country in Annex B. It seeks to provide conditions under which total amount of greenhouse gases emitted by Annex 1 members would achieve a level at least 59% lower than 1990 levels during the 2008 - 2012 time period. Annex A includes six main greenhouse gases covered by the agreement.

Even without serious involvement of developing countries, costs can be cut considerably due to trading of atmospheric emissions quotas in these countries. An example of opportunities to raise energy effectiveness can be Russia and Ukraine, which consume six times more energy per one dollar of produced commodity than the United States. Such a big gap in the indices of energy resource utilization in different countries provides grounds to

consider that if these countries use technologies existing in the USA, they will achieve significant reduction in the atmospheric emissions.

The Kyoto Protocol is an epoch-making event, but it is only the first step in long process.

Flexibility mechanisms of trading

The costs of atmospheric emissions mitigation can be cut considerably due to the use of flexibility mechanisms – "flexmex" – including:

1. Emissions trading.
2. Clean development mechanism.
3. Joint implementation.
4. Bubble.

Table 6. Flexibility mechanisms of trading

1. Emissions Trading	To fulfill obligations within the frameworks of the present Agreement, Article 6 of the Kyoto Protocol permits (upon observing certain conditions) trade of emissions permits. The Article stipulates that any country from Annex 1 "can transfer to another country or to purchase from another country accountable quotas of atmospheric emissions mitigation achieved as a result of implementation of projects of either reduction of anthropogenic emissions, or intensification of measures to enhance greenhouse gas sinks. Emissions trading provides for a number of extremely important positive effects influencing both the general prospects of the ultimate success of the Protocol, and interests of every participating party. Emissions trading enables the countries to cut their expenditures individually, so thus providing for the reduction of general costs. At the same time emissions trading can provide countries with an opportunity to start cooperation, and this in its turn can entail the inflow of profits and technologies into the countries that need such a support most of all.
2. Clean Development Mechanism	This mechanism is aimed at setting up a bridge (through economic incentives) between developed and developing countries. This mechanism will enable the companies from developed countries to invest in projects in developing countries. An example can be investments in construction of high-technology, environmentally safe power stations beneficial for both parties. Companies from developed countries will get the offsets of emissions reduction while spending less money than they would have to in their own countries. Developing countries will share these offsets with them and at the same time receive technologies providing for economic growth without environmental damages. Clean Development Mechanism has a great potential, though developing countries will have to make additional efforts in order to become valuable participants of the global climate warming control. And an important consideration is that these countries differ significantly in their economic circumstances. Some of them currently suffer from extreme poverty; the amount of greenhouse gases emitted by these countries into the atmosphere is negligible and most probably will remain the same in the near future. But in the developing world there are also sufficiently prosperous countries with low atmospheric emissions. There are countries which, although poor from the viewpoint of income per capita, are emitting into the atmosphere amounts of greenhouse gases that are comparable or even exceed the amounts of the most developed countries. Certain developing countries are already at the same emissions levels as developed countries. Indices of emissions reductions achieved through this mechanism can, starting with 2000, be accounted as offsets of the indices stipulated as early as at the

	first stage of the agreement implementation (2008-2012). This means that private companies in the developing world will gain benefits if they start their efforts as soon as possible. Within the framework of the Clean Development Mechanism developed countries will be able to use certified reductions of emissions obtained due to implementation of projects in developing countries as a contribution to the achievement of the set indices of atmospheric emissions of greenhouse gases. Companies will get an opportunity for more cost-effective emissions mitigation than in their own countries while developing countries will be able to acquire technologies that would give them an opportunity to achieve sustained economic growth at a high rate. The Clean Development Mechanism can also provide for developing countries a possibility to forward projects on their own in cases when they do not have a particular partner from developed countries to implement these projects. Under the Clean Development Mechanism, companies choose to, can invest in projects or purchase quotas for the account of emissions reductions. Apart from this, the parties will provide for such conditions when a small portion of investments will be used to render assistance to most vulnerable countries, e.g. island states, in their adaptation to climate change effects.
3. Joint Implementation	Countries that have accepted limits on atmospheric emissions of harmful substances can get an offset in favor of their emissions budgets by implementation of emissions reduction projects in other developed countries. The private sector can also be involved in these projects. Joint Implementation allows the countries to fulfill jointly their obligations on the reduction of greenhouse gas emissions. This enables a donor to raise its emissions quota due to investments in an emission reduction project in a recipient country. A Joint Implementation project is a particular voluntary agreement of a donor-investor and a recipient . The donor invests money in a project stipulating additional reduction of greenhouse emissions or increase in carbon absorption. Subsequently this additional reduction increases the quota of donor's emissions. Involvement in Joint Implementation enables countries with high costs of reduction of greenhouse gas emissions to fulfill their obligations with lower costs. A special stage in the Joint Implementation is the "Activities Implemented Jointly" phase. These projects can be considered an experimental phase of Joint Implementation when actual granting of credits is not permitted. The aim is to gain experience in elaboration of initial positions (relative to the emissions amount from a particular project without any measures of emissions reduction). Another purpose is to assess additional emission reduction units (ERU) or certified reduction of emissions under the Clean Development Mechanism relative to initial positions. When crediting is permitted, Joint Implementation will provide incentives for foreign donors to finance projects in recipient countries in exchange for greenhouse gas credits.
4. Bubble	European Community (EC) supported the "dome-type" or cumulative approach for the EC members. This approach is most suitable for neighboring countries with approximately similar conditions of political and economic development. For example, Spain can increase greenhouse gas emissions at the expense of reducing emissions in Germany. Theoretically this mechanism is attractive because of limited requirements unlike previous approaches. However in practice this can raise various discrepancies in its implementation. At present there is an official distribution of quotas in the European Community. But this solution is more political than economic.

Though the Kyoto agreement was unable to reverse the process of greenhouse gas accumulation in the atmosphere, it slowed down its growth. Of no less importance is the fact that this agreement lays a strong basis for attracting market mechanisms of the whole world to the reduction of greenhouse gas emissions.

The Umbrella Group

In December 1997 at the Kyoto Conference the USA delegation suggested to arrange a so called "Umbrella Group" that could enable the United States and some other countries to carry out international trading of emissions quotas with the states from Annex 1 of the UN Framework Convention on Climate Change. The most interest in this proposal was displayed by such countries as the Russian Federation, Australia, Canada and New Zealand.

The Kyoto Conference stressed that it would be possible to cut the costs of fulfillment of emission reduction commitments if an understanding was reached regarding international trade in emissions permits. The advantage of this proposal is also the fact that the composition of the group engaged in trade can change if other countries display an interest in joining the system of international trading within the framework of the Umbrella Group.

At present the Umbrella Group includes the countries as shown in Fig. 8 below:

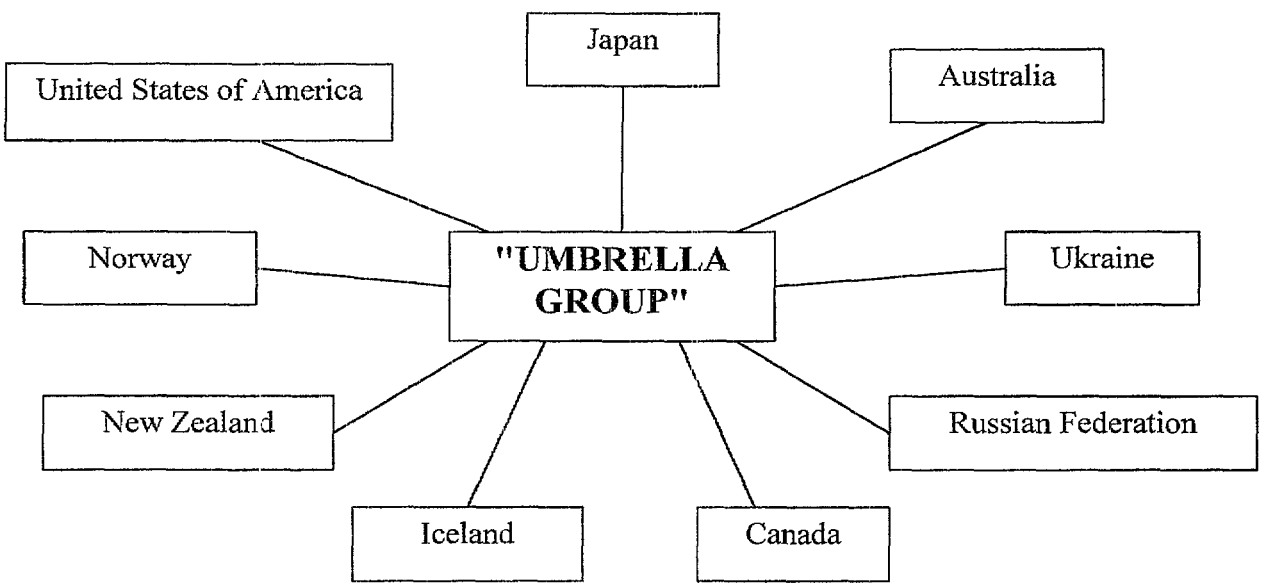


Figure 8. Umbrella Group

So, the Umbrella Group is a prototype of a system of internationally tradable emissions and is based on the economic interest of the participating countries.

POLITICAL AND ECONOMIC PREREQUISITES FOR MITIGATION OF GREENHOUSE GAS EMISSIONS IN THE REPUBLIC OF KAZAKHSTAN

Geographically the Republic of Kazakhstan borders upon the Siberian taiga and Central Asian deserts, the Caspian Sea - a giant closed water reservoir, and the Tien Shan mountains. The climate is continental. Average January air temperature varies from –18 °C in the north to –3 ° in the south, and in July – from 19 °C to 30 °C. Kazakhstan has the ninth largest landmass of any country in the world, 2,724.9 thousand square kilometers. In 1999 the population of Kazakhstan was 14.9 million.

Kazakhstan is richly endowed with natural resources and an important exporter of oil. Recoverable oil reserves are estimated at 12 billion barrels. Industry is dominated by mining and processing activities. Livestock (mainly sheep-breeding) is the most important agricultural activity. The most important agricultural crop is wheat. Kazakhstan has close economic links with the FSU republics, especially Russia, as well as with China and a number of East European countries.

Kazakhstan has huge energy resources. In the total energy resources balance hard coals and, to a lesser degree, brown coals prevail. In 1990 the share of coals was 49.3 %. The share of oil, gas and nuclear fuel was 21.6 %, 5.2 % and 23.4 %, respectively. The share of renewable energy resources was about 0.5 %. [Source: Initial National Communication of the Republic of Kazakhstan, 1998]

The major problem connected with climate change is emission of atmospheric pollutants. The most harmful in the republic are lead-and-zinc production near Ust-Kamenogorsk, lead-and-phosphate production in Shymkent, the phosphorous industry in Taraz and chrome activities in Aktobe. In addition, the East-Kazakhstan, Karagandy and Pavlodar regions are most polluted because of high concentration of industrial enterprises in these territories.

Other most adverse sources of atmospheric pollution are oil-processing companies: JSC "Mangistaumunaigas", JV "Kazakturkmunai LTD" and others. Development of old and new sources of raw materials contributed much to the region's atmospheric pollution with hydrogen sulfide and mercaptan, with their level in oil production areas exceeding maximum permissible emissions (MPE) ten times. The environment is being polluted with combustion products from natural gas burnt at flares of oil-production enterprises. Huge amounts of greenhouse gases, sulfur oxides and nitrogen are emitted into the atmosphere, and increased heat is formed around oilfields. Motor transport is also a significant contribution to the pollution of the urban atmosphere.

Moreover, Kazakhstan is the largest emitter of greenhouse gases in Central Asia (Table 7).

Table 7. CO_2 emissions throughout Central Asia, 1995 (metric tons)

Country	*Total emissions*	*Population (million)*	*Emissions per capita*
Kazakhstan	**221.5**	**16.11**	**13.3**
Kyrgyzstan	5.5	4.52	1.2
Tajikistan	3.7	5.84	0.6
Turkmenistan	28.3	4.51	6.3
Uzbekistan	98.9	22.79	4.3

[Source: World Resources 1998-1999]

The basins of the Irtish, Ili and Syrdariya rivers remain environmentally troublesome. The major pollutants are mercury, copper, zinc, cadmium, lead and arsenic that get into the rivers with the wastewater of metallurgical processes. In addition, major water reservoirs of Kazakhstan – the Aral Sea and the Caspian Sea – were also affected by human activities. Thus, starting with 1960 water inflow into the Aral Sea reduced appreciably. Intensive water usage for irrigation of cotton and rice fields entailed the decrease in the run-off of the Syrdariya and Amudariya rivers by over 90 %. The sea area reduced considerably exposing 3.3 million hectares of the sea floor. The sea lost more than 50 % of its volume. Every day 200 tons of salt and sand are scattered by wind to a distance of up to 300 km. This creates desertification, soil salinization, extinction of flora and fauna, and a rise in the incidence of diseases. In the Caspian basin due to the rise of the Caspian Sea level vast coastal areas are flooded including oil and gas producing sites. This does not only produce material damages but also creates oil pollution in the sea. [Source: Information Bulletin of the National Ecological Center of the Republic of Kazakhstan, November 1998]

The world position of Kazakhstan relating to emissions of greenhouse gases also reflects poor environmental standards (Table 8).

Table 8. Worldwide CO_2 emissions, 1995

Country	*Total emissions (million tons)*	*Emissions per capita (tons)*	*Emissions to GDP ratio (kg/US$)*	*Obligations*
Kazakhstan	**221.5**	**13.3**	**3.38**	**?**
Austria	59.3	7.4	0.41	-8 %
Germany	835.1	10.2	0.63	-8 %
Russia	1,818.0	12.2	2.14	0 %
Ukraine	438.2	8.5	2.45	0 %
Australia	289.8	16.2	0.88	+8%
USA	5,468.5	20.5	0.85	-7 %

[Source: World Resources 1998-1999]

At present the Republic of Kazakhstan is experiencing difficulties in its development. The total nominal GDP in 1998 was 1,747.7 billion tenge or 97.5 % of the 1997 level. The GDP structure is declining - the share of commodity production decreased gradually to 34.8%

compared to 38.3 % in 1997. The share of industry was 22 % compared to 23.1 %, and that of agriculture – 8.4 % compared to 11 %. At the same time the share of services increased from 56.5 % to 60.2 % and the share of net taxes remained at the level of 5 %.[5]

This structure is close to the GDP structures of many developed countries. It could be construed as a success of governmental economic policy if it hadn't been achieved at the expense of persistent decline of production in the tangible sectors of the economy, especially in industry and agriculture.

Because of the economic decline the demand for energy in Kazakhstan has decreased drastically. In 1997 electricity consumption fell by more than 45 % compared to 1990, and in 1998 the decrease was 5.7 % more. According to the "Energy Sector Development Strategy until 2030" project, the level of electricity demand of 1990 can be reached by 2010 under the "maximum" energy demand scenario and by about 2025 under "the minimum" scenario. It would be possible to meet the increasing electricity demand by restoration of the energy production up to the previous level on the existing power plants, as well as by installation of new turbines on a number of power stations and increase in energy production by renewable energy resources. The main way to implement the targets and priorities of the Energy Strategy is through development of a power engineering market regulated by the government.

Since 1994 the Laboratory of Climate Change Research under KazNIIMOSK has carried out research in the assessment and prediction of greenhouse gas emissions in Kazakhstan. The results of the researches are:

- Compilation of the National Inventory of emissions and sinks of greenhouse gases for 1990 in accord with the adopted methodology elaborated by the IPCC.

- Calculation of predictions of greenhouse gas emissions up to 2020 for a baseline scenario and under the scenarios regarding measures of greenhouse gas emissions mitigation in the energy production sector.

The National Inventory presents the data on emissions of three direct greenhouse gases: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O); and three indirect greenhouse gases: carbon monoxide (CO), nitrogen oxides (NO_x) and non-methane volatile organic compounds (NMVOC). According to the results of the refined Inventory, the net emission of all greenhouse gases in Kazakhstan (taking into consideration the uptake) amounted to about 266 million tons of CO_2-equivalent in 1990, and in 1994 – about 213 million tons of CO_2-equivalent. In other words total greenhouse gas emissions in Kazakhstan for that period reduced by over 20 % compared to the baseline level. In 1990 greenhouse gas emissions in Kazakhstan exceeded 15 tons per capita, CO_2 accounting for 13 tons. [Source: Initial National Communication, 1998]

[5] Report by K. B. Berentayev, page 3.

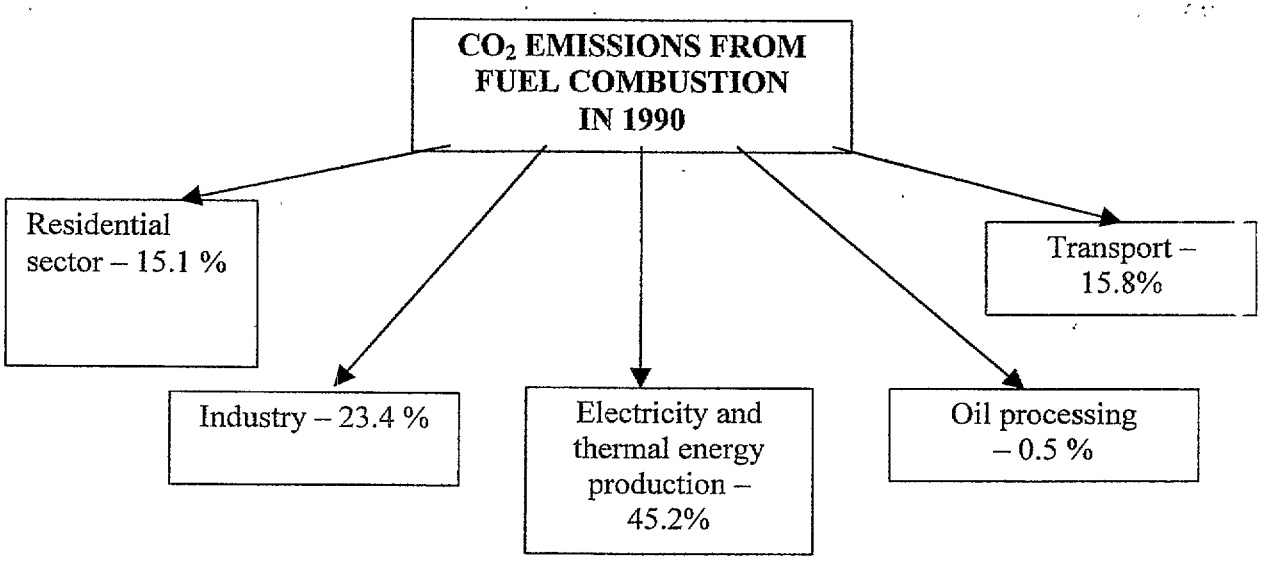


Figure 9. *[Source: Initial National Communication of the Republic of Kazakhstan, 1998]*

Fuel combustion in Kazakhstan produced carbon dioxide emissions totaling 226 million tons and 178 million tons in 1990 and 1994, respectively. Energy production is the main source of CO_2 emissions accounting for almost fifty percent of total emissions from fossil fuel combustion, and in absolute terms amounted to 93 million tons in 1990 and 74 million tons in 1994.

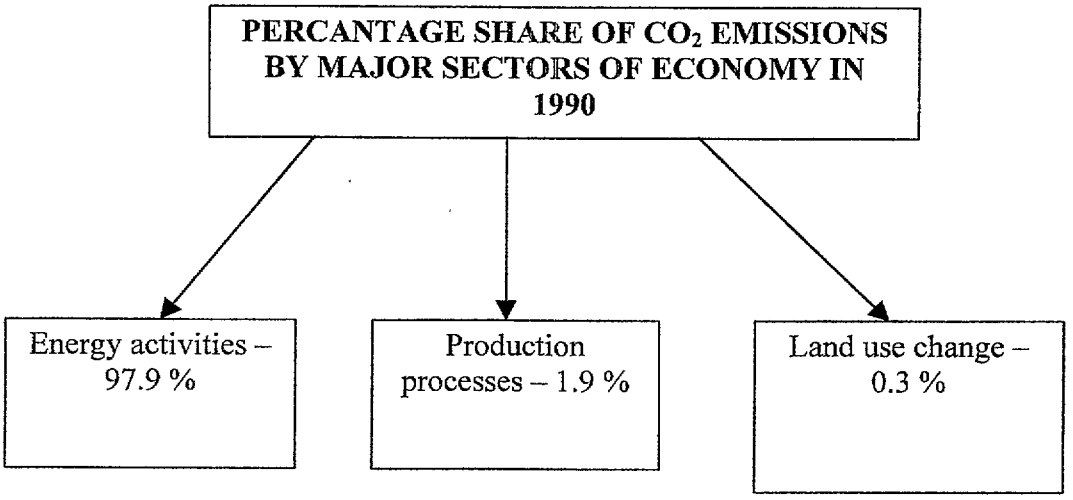


Figure 10. *[Source: Initial National Communication of RK, 1998]*

As Figure suggests, main efforts aimed at GHG emissions mitigation in Kazakhstan will be focused on emissions reduction in the energy production sector.

According to preliminary assessments of CO_2 emissions in 1996-1998 are 40-45 % of the 1990 level. Predictions of CO_2 emissions indicate that emissions will achieve the level of

1990 by around 2011 and will exceed this level by 37 % in 2020. Predictions will be adjusted as macroeconomic scenarios are refined.

In Kazakhstan, as in any developing and transition country, the programs on GHG emissions mitigation and adaptation to climate change have to be integrated with other national and sectoral plans and programs of economic development and environment protection.

Measures for rehabilitation and modernization of thermal power plants have the greatest GHG emissions reduction potential followed by development of wind and hydro energy and use of associated gas. Solar energy production also has some GHG emissions reduction potential. Implementation of these measures would result in reduction of coal and oil utilization as well as reduction of electricity import.

Rehabilitation and modernization of thermal power plants and establishment of small hydroelectric plants appear to be the most cost-effective and feasible measures. Implementation of the first program would allow the reduction of annual CO_2 emissions by 1.6 million tons (20 % of the baseline level) by the year 2005 and by around 2.3 million tons (1.6 %) by 2020. Cumulative CO_2 emissions reduction for the entire period would amount to 40 million tons. To implement the whole program of improving the efficiency of fuel utilization at the thermal power plants, presented in the strategy for the energy sector development, would require 400 million USD by the year 2005 and 1 billion USD by 2020. Increasing energy efficiency at thermal power plants along with energy saving and improvement of the heat supply system was included as the main priority for medium and short-term measures in the electricity generation sector. The first step in the implementation of this program was the project "Capacity Building to Reduce Key Barriers to Energy Efficiency in Heat and Hot Water Supply in Kazakhstan", with the support of United Nations Development Program of the Global Ecological Fund (UNDP/GEF).

The energy sector development strategy up to the year 2030 outlines river basins and regions most promising for construction of small hydroelectric plants. At present it is feasible to construct about 23 small and middle-sized hydroelectric plants with 600 MW cumulative capacity. With the implementation of this measure, the GHG emissions annual reduction potential is estimated at 0.2 and 3.7 million tons by the years 2000 and 2020, respectively. Small hydroelectric plants are the only option that could result in reducing electricity prices and saving financial resources. The funds required to install all the small hydroelectric plants projected by the energy sector development strategy will amount to around 17 million USD by the year 2005 and 578 million USD in 2020.

Kazakhstan possesses significant potential for wind energy development. According to completed research, nine regions were identified in Kazakhstan as most suitable for development of wind energy – these are the regions characterized by wind speeds exceeding 8 m/s.

Developing wind energy is one of the best-supported and sustainable options for the long-term program of energy sector development in Kazakhstan. Its development, though, requires strong governmental support. According to the energy sector development strategy, it requires construction of big wind power plants with total capacity of 520 MW. Total investment required is about 500 million USD. It is anticipated that the scale effect will reduce the cost of this energy, and in the future move it closer to costs of the traditional

sources. At present the amount of associated gas burnt at flares at oil extraction is estimated at approximately 740 million m^3. The annual CO_2 emissions reduction potential of associated gas utilization is about 2.7 million tons.

Development of solar energy at the initial stage may annually reduce the amount of GHG emissions by 0.9 % from the baseline scenario. Installation of solar plants is feasible in remote regions where consumers do not need much heat and electricity.

In *the non-energy sector*, increasing CO_2 sinks by expanding forest area and converting relatively unproductive arable land into grasslands and rangelands are the most promising measures. Measures like increasing the livestock productivity and optimization of the livestock population, biogas utilization, and optimization of areas covered with rice would provide for the reductions of up to 20 % of methane emissions from agriculture.

An important feature of the energy sector in Kazakhstan is the predominance of coal coal predominance in the fuel balance. Utilization of coal bed methane is another promising measure for CH_4 emissions reduction in the non-energy sector. At present coal bed methane is not utilized, and its atmospheric emissions account for almost 50 % of total methane emissions in Kazakhstan.

In conformity with the international obligations under the UNFCCC, the Republic of Kazakhstan as a country not included into either of the Convention Annexes has to elaborate and present to the Conference of the Parties the National Inventory of greenhouse gas emissions, the general description of the measures taken by the state to achieve the objectives of the Convention, and any other useful information.

In August 1998 the government of Kazakhstan made a decision to sign the Kyoto Protocol. Therefore certain activities will be aimed at fulfilling the conditions of the Protocol. One of the conditions is voluntary adoption of the greenhouse gas emissions budget. The budget can increase reflecting the necessity of the economic development of the country.

Noted economists Daniel Dudek and Alexander Golub[6] mention in their research that "the Clean Development Mechanism enables Kazakhstan to sell much less amounts than when trading the emission permits". Revenue ratio (not profits) in permits trading will 3.3 times exceed the earnings from implementation of the Clean Development Mechanism.

So, in order to make the measures of reduction of greenhouse gas emissions in Kazakhstan economically expedient and cost-effective rather than occasional and non-coordinated, a strategy has to be developed based on the interaction and cooperation of ministries, sectors and concerned organizations. This work requires certain arrangements in the Republic of Kazakhstan.

[6] "The Kyoto Protocol and its effects for transition countries not included in Annex B", Almaty 1998

Top-priority measures in greenhouse gas emissions mitigation

[Source: National Ecological Center for Sustained Development of the Republic of Kazakhstan]

- **Electricity and thermal energy production sector:**
  - To implement an energy-saving policy
  - To include renewable sources of energy into the energy balance
  - To increase the natural gas share in the energy balance

- **Industry:**
  - To implement restructuring
  - To increase energy efficiency
  - To implement energy-saving technologies

- **Coal mining:**
  - To utilize methane

- **Agriculture:**
  - To increase livestock productivity and to optimize livestock population
  - To optimize land use
  - To develop ecological farming

- **Forestry:**
  - To increase the area covered by forests

In fulfilling the above arrangements the interests of the Republic of Kazakhstan will be observed.

Table 9. Interests of the Republic of Kazakhstan in implementation of the measures aimed at GHG mitigation

Social	*Economic*	*Political*	*Ecological*
1. Public health. 2. Increased trust of the population in governmental decisions. 3. Advancement of scientific and technological progress.	1. Attraction of investments to solve environmental and social-and-economic problems. 2. Attraction of clean technologies and improvement of product quality. 3. Increase in production of	1. Recognition of Kazakhstan as a civilized state which recognizes the importance of global climate change control. 2. Establishment of friendly relations with developed and developing countries and international	1. Conservation and rational use of nature's potential. 2. Improvement of the environment quality. 3. Implementation of self-control mechanism of industrial enterprises. 4. Providing of accurate

	energy carriers with simultaneous reduction in utilization of natural raw materials. 4. Assistance in establishing the exchange of trading CO_2 emissions quotas and attraction of extra financial resources to the economy of the country.	organizations. 3. Establishment of interactions at regional and intrarepublican levels. 4. Maintenance of long-term peace-keeping policy	information on actual emissions of greenhouse gases.

Despite the difficulties in the social and economic situation in Kazakhstan, much attention is paid to the problem of climate change. Signing and ratification of the UN Framework Convention, signing of the Kyoto Protocol, declaration of the will to join Annex 1 of the Convention and Annex C of the Kyoto Protocol are manifestations of the readiness of Kazakhstan to fulfill the obligations under the Convention.

Implementation of this policy complies with the objectives and goals of the National Ecological Strategy and Long-term Development Strategy of the Republic of Kazakhstan. The remaining task is to integrate efforts at reducing GHG emissions into all sectors of the economy.

SUPPLEMENT 1

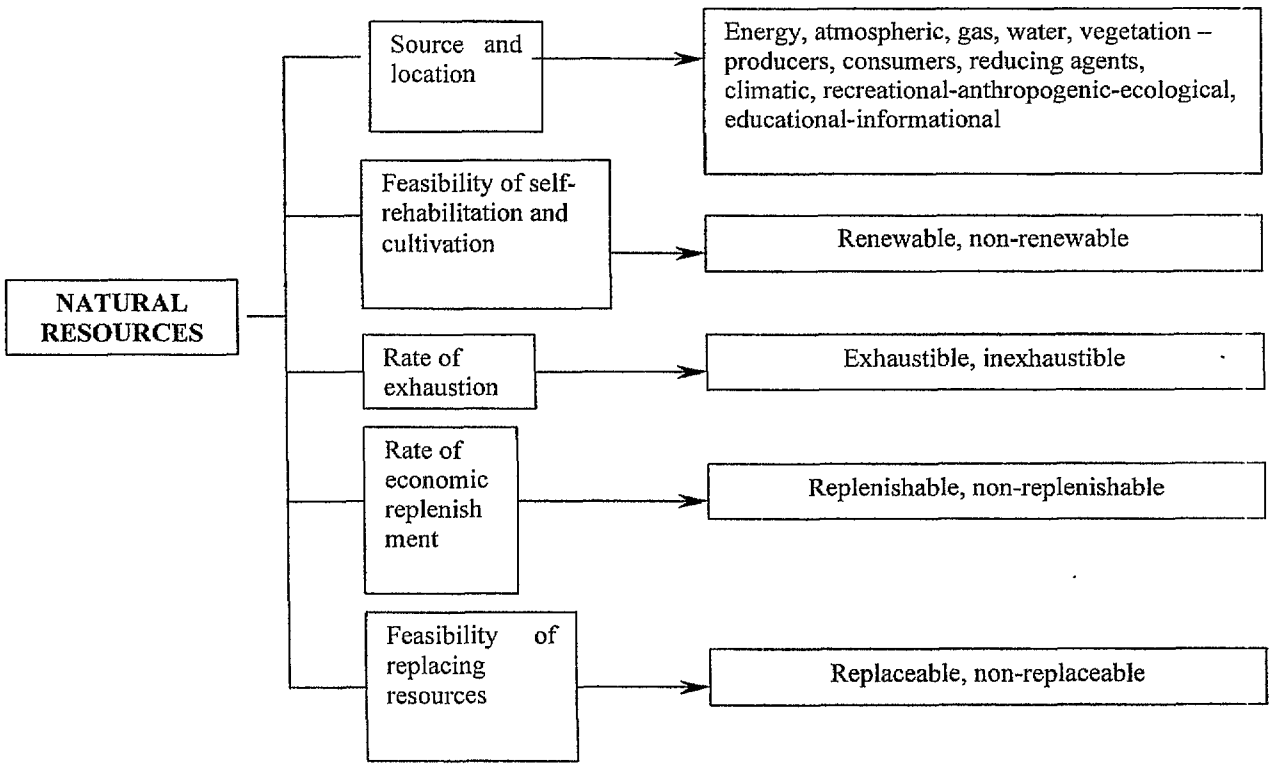
ECONOMIC ASPECTS OF NATURAL RESOURCES UTILIZATION

All natural wealth as well as ecological services should be considered limited resources. Under-estimation of these resources, either intentional or by an oversight, is a primary factor in degradation of natural resources and environment throughout the world.

For the time being people cannot live without changing the environment. Therefore people in their activities should continuously assess the scale and expediency of changes they perform, as they strive to achieve improvements in their cultural, scientific, technological and demographic potential and every-day living.

The problem of the environment pollution cannot be eliminated fully. Rather the task is to take into account the ecological impact of human activity. People bear the cost of negative environmental impacts. If a driver has to wash his car every morning to remove dust accumulated in the night because of emissions from a neighboring industrial plant, his time and effort is the cost imposed on him by the plant. So, in order to evaluate comprehensively the expenses connected with environmental impact, these expenses have to be included in the plant expenditures.

Natural resources can be classified by the attributes as follows:



Elements of nature have to be evaluated using different approaches. For the atmosphere, water and land a necessary requirement is conservation (and in a number of

regions – obligatory improvement) of their optimal characteristics; flora and fauna require maintaining of conditions for self-reproduction. Underground resources cannot renew under the existing rates of extraction and utilization. Therefore, the present generation consumes exhaustible resources and by this decreases the opportunity of their consumption by the next generation.

Deposits of crude oil, gas, nickel, iron and other minerals are examples of exhaustible resources. This means that available reserves of such resources do not remain unchanged for decades or centuries. High prices of resources often raise the value of reserves and convert mountain rocks into ore, and insignificant sedimentation basins – into commercially attractive deposits, and oil companies can spend billions of dollars to develop these deposits. But resources extracted from the developed deposits of zinc or depleted. oilfields cannot be renewed by the nature in the next millenium (if at all).

For most countries concentration of capital is a slow and often painful process necessitating asceticism in domestic consumption, or considerable inflows of financial resources, or both at the same time. Many countries have been lucky with geological anomalies that resulted in huge resources of natural capital in the form of deposits of non-renewable resources. These countries have discovered sufficient reserves of natural capital within their borders enabling them to decrease the usually labor-intensive and slow moving processes of capital accumulation.

All countries with substantial availability of mineral resources have experience of decades of extraction of non-renewable natural resources in the form of immense reserves of physical and human capital. In 1973-1982, the period of relatively high prices of oil, several oil-producing countries not belonging to big oil-exporting countries of the Near East, have managed to turn flourishing export of resources into a temporary high increase in earnings. Examples of such countries are Ecuador, Indonesia and Malaysia where the annual rise of the actual GDP was 6 %. At the same time the rise of actual GDP in developing oil-importing countries decreased drastically in the period of relaxation of the world oil market from 1982 to 1987. [Source: Institute of World Resources, "World Resources 1900-1991", New-York: Oxford University Press, 1990]

Exhaustible resources require utilization providing for long-term net profits to the community. At times this rule means that resources should remain undeveloped because they are more valuable for the community in their initial condition. For instance, a coal deposit is discovered underground in the business part of a big industrial center. However the costs of its extraction are much higher than the cost of rehabilitation or moving to another place of the residential district and, respectively, the obtained profit from the coal sale is not sufficiently high.

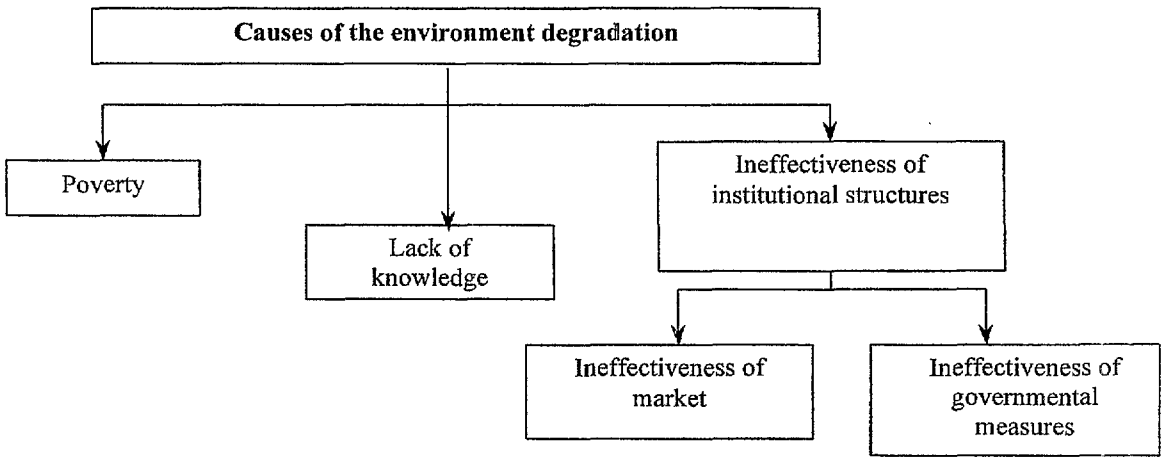
So, every country has to consider the potential of converting some part of the natural resources base into other forms of capital aimed at the long-term support or increase in inflow of earnings to the country.

Moreover, these problems are urgent at present in the populated localities throughout the world, and especially in urban and industrial areas. How to determine the top-priority problems? What should be the guideline to make decisions on the choice of amount of forces required to solve a particular ecological problem? What criteria should be used in decision-making? Should the resources be invested in the measures aimed at mitigation of problems

threatening the health of people of the present generation, or must the resources be concentrated at mitigating risks for future generations? Is it possible to ignore the effect of job loss for thousand of workers of a polluting industry on their health and living conditions if these enterprises are closed? Will it be right if in making decisions on closing enterprises polluting water with industrial wastes, a decision is made more to the benefit of sustaining the living conditions of fishermen, than of the living conditions of the workers at wood-processing factories? Should any efforts be made to prevent already known cases of mercury methyl remaining in bays for a century? These and other forms of screening ecological problems according to their priority cover the most significant economic and ecological issues, as well as the issues of fair distribution of public goods.

Economic conceptions can be useful in improving the base for such a choice. Economic and ecological means can jointly assist in seeking answers to the above and similar questions.

Causes of environmental degradation can be grouped into three major categories. In doing so it should be considered that numerous ecological problems arise from two or three interrelated causes.



Poverty is definitely the most important cause. The Republic of Kazakhstan is unfortunately a country with certain negative effects of poverty. The data of the National Statistical Agency of the Republic of Kazakhstan on the ecological situation in 1997 in the Pavlodar region indicate that the quality of water delivered to the population from water supply systems did not meet the GOST requirements in 2.1 % of cases. Discrepancy of water quality supplied through water pipelines did not exceed 3 % for bacterial indices (meeting the permissible level). But chemical characteristics (color and turbidity) of the water did not meet the republican standard in 10 % of samples. The situation with the quality of water supplied to the rural localities of the region is still worse.

From 1975 to 1993 the Pavlodar chemical plant produced caustic soda and chlorine with the use of mercury. As a result of imperfect technologies and equipment over 900 tons of mercury have accumulated beneath one workshop. In 1998 the management of the chemical plant JSC "Khimprom" made a decision to start demercurization on their own in the hope of the government assistance. However they received only 35 million tenge instead of 246 million tenge required. Contractors refused to work without payment. The mercury

rising to the surface became dangerous when summer came. The vapors are being carried away by wind across great distances. Extreme protection measures require 213 million tenge. The city's budget lacks money, and the mayor has declared an emergency situation. As a result the contractors have to work day and night irrespective of the money available. The plant's experts and management have suggested two options to solve the problem. First – to cover all mercury on the surface with a soil layer 10 cm thick. This will ensure decrease in the maximum permissible concentration from 250 to 3. But in this case the plant will receive an additional 1,400 m^3 of contaminated soil that subsequently has to be buried. The second option is to cover the floor with flexible PVC sheets. But this method is too expensive for the available budget. [Source: Panorama, 9 April 1999, No. 14]

The Pavlodar region is located in the north-east of the republic. Its area is 124.8 thousand km^2 and population – 873.9 thousand as of 1 January 1998. Population density is 7 people per 1 km^2. In the region there is the Irtish River (about 500 km within the borders of the region) and the Irtish-Karaganda canal (458 km long).

The Pavlodar region plays an important role in the raw materials complex of the Republic of Kazakhstan – it possesses 35 % of the republic's coal reserves (the deposits of Ekibastuz and Maikube basins), 9.4 % of gold of the Maikain group (Alpys, Tortkuduk and other ones), 37 % of copper and 2.3 % of molybdenum (the Boschekul deposit), and 30.8 % of limestone (the Keregetas deposit) etc.

Lack of knowledge results from appreciable ignorance regarding to human impact on the environment. This happens because information about the economic and ecological impact of natural resource utilization is rather incomplete and has significant short comings. Thus, industry in the Karagandy region were long developed with no regard for the environment resulting in the poor air quality in the region. Atmospheric emissions of pollutants from stationary sources amount to about 1 million tons or one third of all emissions in the republic. The maximum permissible concentrations of dust, phenols, carbon dioxide, nitrogen oxides and ammonia are exceeded regularly.

A specific problem connected with air pollution is atmospheric emission of gaseous methane fromthe coal beds of the Karagandy basin, amounting to one trillion cubic meters, though coal is a valuable environmentally clean fuel. Recently a team of scientists have developed a project for the region aimed at reducing the atmospheric emissions of greenhouse gases by decreasing the output of coal and roasted limestone and by replacing these materials with production waste – coal sludge concentrates and calcium-bearing steel-making slams.[7]

However, this project requires large financial investments which are problematic given the present state of the Kazakhstani economy.

The Karagandy region is a major industrial center of Kazakhstan. The region is located in the center of the republic, and its area is 428.0 thousand square kilometers. As of 1 January 1998, the population was 1.5 million. The average

[7] Project "Reduction of atmospheric emissions of greenhouse gases (CO_2 and CH_4) due to utilization of production waste from JSC Ispat-Karmet", "Improvement/// of urban air /// basins"

population density is 3.7 people per 1 km^2.

The region is richly endowed with minerals and raw materials resources. There are large deposits of coal, copper, lead, manganese, iron, molybdenum, tungsten, as well as ore occurrences of arsenic, cobalt, nickel and other ores. There are also large resources of non-ore raw materials, building stones, cement raw materials, clay, sand etc.

Ineffectiveness of institutional structures is the third major factor influencing the general degradation of the environment. Economists consider institutional structures by two basic approaches. First, institutional structures can behave according to the game rules that can govern the decision-making process of individual entities such as producers and consumers. Second, institutional structures can also be organizations, in particular governmental organizations or departments influencing the functioning of the economy. Institutional structures influence individual or social choice through formation of incentives, accessibility of information and resources and *setting of basic regulations for social operations.* These structures include systems of vesting property rights, systems of contracting and market development including markets of capital, commodities and labor, i.e. all being the intermediaries in the interaction of supply and demand. They also include such state economic organizations as governmental departments, state-owned companies and banks. In some cases, when analyzing the causes of environmental problems, it becomes obvious that these problems arise directly from ineffectiveness of such institutional structures.

In the Soviet Union the government set almost zero prices on water used for cotton irrigation from the Syrdariya and Amudariya rivers falling into the Aral Sea. Because of this the water was used wastefully for irrigation and the Aral Sea, although once larger than West Virginia, decreased by almost 40 % from 1951 to 1989. Direct economic damages from incredible losses of the sea's biological productivity included the vanishing of fisheries with 60,000 jobs and cotton field pollution with salt scattered by storms. Environmental effects included strong dust storms arising from overdried land and sharp fluctuation of temperatures and humidity throughout the vast territory adjacent to the sea. In future the sea could be dried into a saline lake. It is sad to admit that none of ten projects discussed in publications of western and soviet scientists devoted to the Aral Sea Basin conservation mentioned the role of setting increased prices of irrigation water in water conservation. Therefore the sea has been treated as an *accessible resources* or *common property* with free access for everyone. This institutional measure creates a phenomenon known as *"tragedy of the commons"* present in the degradation of almost any public property including atmosphere and oceans. The fact that everyone is the owner of the property means that nobody is in charge of it and therefore the motivation for conservation and improvement of public property is absent or very weak.

Market imperfections is the most studied form of the ineffectiveness of institutional structures resulting in degradation of the environment. Markets of nature conservation services – clean air and water, soil conservancy, and climate protection – do not exist, or are underdeveloped, or work poorly. Open access, non-guaranteed or non-assigned rights of natural resources can contribute to the environment degradation. But market imperfections also include monopoly and oligopoly power, externalities and public goods

Economists and ecologists recommend three urgently needed changes in policies and programs influencing natural resources and environment as follows:

(1) To pay more attention to the role of prices in resource conservation

(2) To implement a system of ecological resource accounting within the framework of the national revenue accounting

(3) To use properly discounted rates in projects relating to infrastructure which has an impact on the environment.

Proper usé of prices aimed at environmental conservation often require a new method of taxing - either through raising the price of the resource extraction, or through raising the prices for consumers of goods and to incorporate th externalities of production and consumption. Taxes on the operations adversely affecting the environment can promote changes in industrial processes, methods of resources extraction and consumer behavior more aware of its consequences. Economic progress has to be coordinated with environmental protection arrangements. This coordination, in its turn, when companies and private households make decisions, requires the integration (internalization) of consideration for the issues of resources effectiveness and environmental protection. When an investor chooses a technology, the prices of the equipment must reflect external costs of damage to the environment connected with the production; when a consumer buys gasoline, he must pay for nature conservation expenditures relating to atmospheric emissions of combustion products.

The national accounting system used in any country usually does not consider or misinterprets the role of natural resources in further development of the economy, and this always influences the development of ecological policy in future. The following example illustrates this statement. In measuring income levels and formulating economic policy, economists and policy-makers proceed from the main sums of cumulative incomes published in the national revenue accounts compiled in conformity with the National Account System. In the National Account System particular attention is paid to the level of Gross Domestic Product (GDP), which is above all a measure of market activities that does not consider the devaluation of production capital. Apart from this, the structure of the National Account System does not recognize natural resources as economic assets and does not consider utilization of the nature capital. Because of this, nature conservation services provided by these assets are not evaluated while extra costs the society has to pay when losing these services are evaluated. As a result, the symmetry of measurement is disrupted and the measure of the value of natural resources formed. This asymmetry contributes to implementation of abnormal and non-profitable practices.

On the other hand, according to the National Account System, the country can exhaust all its forest resources or silt its rivers and bays. But unmeasured national revenue will not be cut as soon as these resources are depleted. And a country annually using its assets in the form of natural resources through mining, extraction and logging, can have high levels of the national domestic product growth during long periods, even absent any new investments in sustaining the reserves of these natural assets. According to most national revenue accounts systems, the economy will remain healthy when resources are utilized gradually. And even in some countries paying sufficient attention to the calculation of the net domestic product there is a discrepancy between utilization of production and nature capital, the of which can either decrease or increase the natural revenue.

So, proper utilization of natural resources and environment are issues which demand an economic approach to resolve. Forceful economic arguments can be forwarded in favor of drastic reduction of wasteful utilization of natural resources and degradation of the environment. Because the governmental policy of each country bears direct or indirect responsibility for a considerable share of environmental degradation, this policy has to be reformed immediately. Economic arguments are important to support biological and ethnic arguments.

SUPPLEMENT 2

UN FRAMEWORK CONVENTION ON CLIMATE CHANGE

Full Text of the Convention

UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

The Parties to this Convention,

Acknowledging that change in the Earth's climate and its adverse effects are a common concern of humankind,

Concerned that human activities have been substantially increasing the atmospheric concentrations of greenhouse gases, that these increases enhance the natural greenhouse effect, and that this will result on average in an additional warming of the Earth's surface and atmosphere and may adversely affect natural ecosystems and humankind,

Noting that the largest share of historical and current global emissions of greenhouse gases has originated in developed countries, that per capita emissions in developing countries are still relatively low and that the share of global emissions originating in developing countries will grow to meet their social and development needs,

Aware of the role and importance in terrestrial and marine ecosystems of sinks and reservoirs of greenhouse gases,

Noting that there are many uncertainties in predictions of climate change, particularly with regard to the timing, magnitude and regional patterns thereof,

Acknowledging that the global nature of climate change calls for the widest possible cooperation by all countries and their participation in an effective and appropriate international response, in accordance with their common but differentiated responsibilities and respective capabilities and their social and economic conditions,

Recalling the pertinent provisions of the Declaration of the United Nations Conference on the Human Environment, adopted at Stockholm on 16 June 1972,

Recalling also that States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction,

Reaffirming the principle of sovereignty of States in international

cooperation to address climate change,

Recognizing that States should enact effective environmental legislation, that environmental standards, management objectives and priorities should reflect the environmental and developmental context to which they apply, and that standards applied by some countries may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries,

Recalling the provisions of General Assembly resolution 44/228 of 22 December 1989 on the United Nations Conference on Environment and Development, and resolutions 43/53 of 6 December 1988, 44/207 of 22 December 1989, 45/212 of 21 December 1990 and 46/169 of 19 December 1991 on protection of global climate for present and future generations of mankind,

Recalling also the provisions of General Assembly resolution 44/206 of 22 December 1989 on the possible adverse effects of sea-level rise on islands and coastal areas, particularly low-lying coastal areas and the pertinent provisions of General Assembly resolution 44/172 of 19 December 1989 on the implementation of the Plan of Action to Combat Desertification,

Recalling further the Vienna Convention for the Protection of the Ozone Layer, 1985, and the Montreal Protocol on Substances that Deplete the Ozone Layer, 1987, as adjusted and amended on 29 June 1990,

Noting the Ministerial Declaration of the Second World Climate Conference adopted on 7 November 1990,

Conscious of the valuable analytical work being conducted by many States on climate change and of the important contributions of the World Meteorological Organization, the United Nations Environment Programme and other organs, organizations and bodies of the United Nations system, as well as other international and intergovernmental bodies, to the exchange of results of scientific research and the coordination of research,

Recognizing that steps required to understand and address climate change will be environmentally, socially and economically most effective if they are based on relevant scientific, technical and economic considerations and continually re-evaluated in the light of new findings in these areas,

Recognizing that various actions to address climate change can be justified economically in their own right and can also help in solving other environmental problems,

Recognizing also the need for developed countries to take immediate action in a flexible manner on the basis of clear priorities, as a first step towards comprehensive response strategies at the global, national and, where agreed, regional levels that take into account all greenhouse gases, with due consideration of their relative contributions to the enhancement of the greenhouse effect,

Recognizing further that low-lying and other small island countries,

countries with low-lying coastal, arid and semi-arid areas or areas liable to floods, drought and desertification, and developing countries with fragile mountainous ecosystems are particularly vulnerable to the adverse effects of climate change,

Recognizing the special difficulties of those countries, especially developing countries, whose economies are particularly dependent on fossil fuel production, use and exportation, as a consequence of action taken on limiting greenhouse gas emissions,

Affirming that responses to climate change should be coordinated with social and economic development in an integrated manner with a view to avoiding adverse impacts on the latter, taking into full account the legitimate priority needs of developing countries for the achievement of sustained economic growth and the eradication of poverty,

Recognizing that all countries, especially developing countries, need access to resources required to achieve sustainable social and economic development and that, in order for developing countries to progress towards that goal, their energy consumption will need to grow taking into account the possibilities for achieving greater energy efficiency and for controlling greenhouse gas emissions in general, including through the application of new technologies on terms which make such an application economically and socially beneficial,

Determined to protect the climate system for present and future generations,

Have agreed as follows:

ARTICLE 1
DEFINITIONS*

For the purposes of this Convention:

1...."Adverse effects of climate change" means changes in the physical environment or biota resulting from climate change which have significant deleterious effects on the composition, resilience or productivity of natural and managed ecosystems or on the operation of socio-economic systems or on human health and welfare.

2...."Climate change" means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

3...."Climate system" means the totality of the atmosphere, hydrosphere, biosphere and geosphere and their interactions.

4...."Emissions" means the release of greenhouse gases and/or their

precursors into the atmosphere over a specified area and period of time.

5...."Greenhouse gases" means those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation.

6...."Regional economic integration organization" means an organization constituted by sovereign States of a given region which has competence in respect of matters governed by this Convention or its protocols and has been duly authorized, in accordance with its internal procedures, to sign, ratify, accept, approve or accede to the instruments concerned.

7...."Reservoir" means a component or components of the climate system where a greenhouse gas or a precursor of a greenhouse gas is stored.

8...."Sink" means any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere.

9...."Source" means any process or activity which releases a greenhouse gas, an aerosol or a precursor of a greenhouse gas into the atmosphere.

* Titles of articles are included solely to assist the reader.

ARTICLE 2
OBJECTIVE

The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

ARTICLE 3
PRINCIPLES

In their actions to achieve the objective of the Convention and to implement its provisions, the Parties shall be guided, INTER ALIA, by the following:

1....The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Accordingly, the developed country Parties should

take the lead in combating climate change and the adverse effects thereof.

2....The specific needs and special circumstances of developing country Parties, especially those that are particularly vulnerable to the adverse effects of climate change, and of those Parties, especially developing country Parties, that would have to bear a disproportionate or abnormal burden under the Convention, should be given full consideration.

3....The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures, taking into account that policies and measures to deal with climate change should be cost-effective so as to ensure global benefits at the lowest possible cost. To achieve this, such policies and measures should take into account different socio-economic contexts, be comprehensive, cover all relevant sources, sinks and reservoirs of greenhouse gases and adaptation, and comprise all economic sectors. Efforts to address climate change may be carried out cooperatively by interested Parties.

4....The Parties have a right to, and should, promote sustainable development. Policies and measures to protect the climate system against human-induced change should be appropriate for the specific conditions of each Party and should be integrated with national development programmes, taking into account that economic development is essential for adopting measures to address climate change.

5....The Parties should cooperate to promote a supportive and open international economic system that would lead to sustainable economic growth and development in all Parties, particularly developing country Parties, thus enabling them better to address the problems of climate change. Measures taken to combat climate change, including unilateral ones, should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade.

ARTICLE 4
COMMITMENTS

1....All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, shall:

(a)....Develop, periodically update, publish and make available to the Conference of the Parties, in accordance with Article 12, national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, using comparable methodologies to be agreed upon by the Conference of the Parties;

(b)....Formulate, implement, publish and regularly update national and, where

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appropriate, regional programmes containing measures to mitigate climate change by addressing anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, and measures to facilitate adequate adaptation to climate change;

(c)....Promote and cooperate in the development, application and diffusion, including transfer, of technologies, practices and processes that control, reduce or prevent anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol in all relevant sectors, including the energy, transport, industry, agriculture, forestry and waste management sectors;

(d)....Promote sustainable management, and promote and cooperate in the conservation and enhancement, as appropriate, of sinks and reservoirs of all greenhouse gases not controlled by the Montreal Protocol, including biomass, forests and oceans as well as other terrestrial, coastal and marine ecosystems;

(e)....Cooperate in preparing for adaptation to the impacts of climate change; develop and elaborate appropriate and integrated plans for coastal zone management, water resources and agriculture, and for the protection and rehabilitation of areas, particularly in Africa, affected by drought and desertification, as well as floods;

(f)....Take climate change considerations into account, to the extent feasible, in their relevant social, economic and environmental policies and actions, and employ appropriate methods, for example impact assessments, formulated and determined nationally, with a view to minimizing adverse effects on the economy, on public health and on the quality of the environment, of projects or measures undertaken by them to mitigate or adapt to climate change;

(g)....Promote and cooperate in scientific, technological, technical, socio-economic and other research, systematic observation and development of data archives related to the climate system and intended to further the understanding and to reduce or eliminate the remaining uncertainties regarding the causes, effects, magnitude and timing of climate change and the economic and social consequences of various response strategies;

(h)....Promote and cooperate in the full, open and prompt exchange of relevant scientific, technological, technical, socio-economic and legal information related to the climate system and climate change, and to the economic and social consequences of various response strategies;

(i)....Promote and cooperate in education, training and public awareness related to climate change and encourage the widest participation in this process, including that of non- governmental organizations; and

(j)....Communicate to the Conference of the Parties information related to implementation, in accordance with Article 12.

2....The developed country Parties and other Parties included in Annex I commit themselves specifically as provided for in the following:

(a)....Each of these Parties shall adopt nationall policies and take

corresponding measures on the mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases and protecting and enhancing its greenhouse gas sinks and reservoirs. These policies and measures will demonstrate that developed countries are taking the lead in modifying longer-term trends in anthropogenic emissions consistent with the objective of the Convention, recognizing that the return by the end of the present decade to earlier levels of anthropogenic emissions of carbon dioxide and other greenhouse gases not controlled by the Montreal Protocol would contribute to such modification, and taking into account the differences in these Parties' starting points and approaches, economic structures and resource bases, the need to maintain strong and sustainable economic growth, available technologies and other individual circumstances, as well as the need for equitable and appropriate contributions by each of these Parties to the global effort regarding that objective. These Parties may implement such policies and measures jointly with other Parties and may assist other Parties in contributing to the achievement of the objective of the Convention and, in particular, that of this subparagraph;

(b)....In order to promote progress to this end, each of these Parties shall communicate, within six months of the entry into force of the Convention for it and periodically thereafter, and in accordance with Article 12, detailed information on its policies and measures referred to in subparagraph (a) above, as well as on its resulting projected anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol for the period referred to in subparagraph (a), with the aim of returning individually or jointly to their 1990 levels these anthropogenic emissions of carbon dioxide and other greenhouse gases not controlled by the Montreal Protocol. This information will be reviewed by the Conference of the Parties, at its first session and periodically thereafter, in accordance with Article 7;

(c)....Calculations of emissions by sources and removals by sinks of greenhouse gases for the purposes of subparagraph (b) above should take into account the best available scientific knowledge, including of the effective capacity of sinks and the respective contributions of such gases to climate change. The Conference of the Parties shall consider and agree on methodologies for these calculations at its first session and review them regularly thereafter;

(d)....The Conference of the Parties shall, at its first session, review the adequacy of subparagraphs (a) and (b) above. Such review shall be carried out in the light of the best available scientific information and assessment on climate change and its impacts, as well as relevant technical, social and economic information. Based on this review, the Conference of the Parties shall take appropriate action, which may include the adoption of amendments to the commitments in subparagraphs (a) and (b) above. The Conference of the Parties, at its first session, shall also take decisions regarding criteria for joint implementation as indicated in subparagraph (a) above. A second review of subparagraphs (a) and (b) shall take place not later than 31 December 1998, and thereafter at regular intervals determined by the Conference of the Parties, until the objective of the Convention is met;

(e)....Each of these Parties shall :

i)....Coordinate as appropriate with other such Parties, relevant economic and administrative instruments developed to achieve the objective of the Convention; and

(ii)....Identify and periodically review its own policies and practices which encourage activities that lead to greater levels of anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol than would otherwise occur;

(f)....The Conference of the Parties shall review, not later than 31 December 1998, available information with a view to taking decisions regarding such amendments to the lists in Annexes I and II as may be appropriate, with the approval of the Party concerned;

(g)....Any Party not included in Annex I may, in its instrument of ratification, acceptance, approval or accession, or at any time thereafter, notify the Depositary that it intends to be bound by subparagraphs (a) and (b) above. The Depositary shall inform the other signatories and Parties of any such notification.

3....The developed country Parties and other developed Parties included in Annex II shall provide new and additional financial resources to meet the agreed full costs incurred by developing country Parties in complying with their obligations under Article 12, paragraph 1. They shall also provide such financial resources, including for the transfer of technology, needed by the developing country Parties to meet the agreed full incremental costs of implementing measures that are covered by paragraph 1 of this Article and that are agreed between a developing country Party and the international entity or entities referred to in Article 11, in accordance with that Article. The implementation of these commitments shall take into account the need for adequacy and predictability in the flow of funds and the importance of appropriate burden sharing among the developed country Parties.

4....The developed country Parties and other developed Parties included in Annex II shall also assist the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects.

5....The developed country Parties and other developed Parties included in Annex II shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention. In this process, the developed country Parties shall support the development and enhancement of endogenous capacities and technologies of developing country Parties. Other Parties and organizations in a position to do so may also assist in facilitating the transfer of such technologies.

6....In the implementation of their commitments under paragraph 2 above, a certain degree of flexibility shall be allowed by the Conference of the Parties to the Parties included in Annex I undergoing the process of transition to a market economy, in order to enhance the ability of these Parties to address

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climate change, including with regard to the historical level of anthropogenic emissions of greenhouse gases not controlled by the Montreal Protocol chosen as a reference.

7....The extent to which developing country Parties will effectively implement their commitments under the Convention will depend on the effective implementation by developed country Parties of their commitments under the Convention related to financial resources and transfer of technology and will take fully into account that economic and social development and poverty eradication are the first and overriding priorities of the developing country Parties.

8....In the implementation of the commitments in this Article, the Parties shall give full consideration to what actions are necessary under the Convention, including actions related to funding, insurance and the transfer of technology, to meet the specific needs and concerns of developing country Parties arising from the adverse effects of climate change and/or the impact of the implementation of response measures, especially on:

(a)....Small island countries;

(b)....Countries with low-lying coastal areas;

(c)....Countries with arid and semi-arid areas, forested areas and areas liable to forest decay;

(d)....Countries with areas prone to natural disasters;

(e)....Countries with areas liable to drought and desertification;

(f)....Countries with areas of high urban atmospheric pollution;

(g)....Countries with areas with fragile ecosystems, including mountainous ecosystems;

(h)....Countries whose economies are highly dependent on income generated from the production, processing and export, and/or on consumption of fossil fuels and associated energy-intensive products; and

(i)....Land-locked and transit countries.

Further, the Conference of the Parties may take actions, as appropriate, with respect to this paragraph.

9.....The Parties shall take full account of the specific needs and special situations of the least developed countries in their actions with regard to funding and transfer of technology.

10....The Parties shall, in accordance with Article 10, take into consideration in the implementation of the commitments of the Convention the situation of Parties, particularly developing country Parties, with economies that are vulnerable to the adverse effects of the implementation of measures to respond to climate change. This applies notably to Parties with economies

that are highly dependent on income generated from the production, processing and export, and/or consumption of fossil fuels and associated energy-intensive products and/or the use of fossil fuels for which such Parties have serious difficulties in switching to alternatives.

ARTICLE 5
RESEARCH AND SYSTEMATIC OBSERVATION

In carrying out their commitments under Article 4, paragraph 1(g), the Parties shall:

(a)....Support and further develop, as appropriate, international and intergovernmental programmes and networks or organizations aimed at defining, conducting, assessing and financing research, data collection and systematic observation, taking into account the need to minimize duplication of effort;

(b)....Support international and intergovernmental efforts to strengthen systematic observation and national scientific and technical research capacities and capabilities, particularly in developing countries, and to promote access to, and the exchange of, data and analyses thereof obtained from areas beyond national jurisdiction; and

(c)....Take into account the particular concerns and needs of developing countries and cooperate in improving their endogenous capacities and capabilities to participate in the efforts referred to in subparagraphs (a) and (b) above.

ARTICLE 6
EDUCATION, TRAINING AND PUBLIC AWARENESS

In carrying out their commitments under Article 4, paragraph 1(i), the Parties shall:

(a)....Promote and facilitate at the national and, as appropriate, subregional and regional levels, and in accordance with national laws and regulations, and within their respective capacities:

(i)....The development and implementation of educational and public awareness programmes on climate change and its effects;

(ii)....Public access to information on climate change and its effects;

(iii)....Public participation in addressing climate change and its effects and developing adequate responses; and

(iv)....Training of scientific, technical and managerial personnel.

(b)....Cooperate in and promote, at the international level, and, where appropriate, using existing bodies:

(i)....The development and exchange of educational and public awareness material on climate change and its effects; and

(ii)....The development and implementation of education and training programmes, including the strengthening of national institutions and the exchange or secondment of personnel to train experts in this field, in particular for developing countries.

ARTICLE 7
CONFERENCE OF THE PARTIES

1....A Conference of the Parties is hereby established.

2....The Conference of the Parties, as the supreme body of this Convention, shall keep under regular review the implementation of the Convention and any related legal instruments that the Conference of the Parties may adopt, and shall make, within its mandate, the decisions necessary to promote the effective implementation of the Convention. To this end, it shall:

(a)....Periodically examine the obligations of the Parties and the institutional arrangements under the Convention, in the light of the objective of the Convention, the experience gained in its implementation and the evolution of scientific and technological knowledge;

(b)....Promote and facilitate the exchange of information on measures adopted by the Parties to address climate change and its effects, taking into account the differing circumstances, responsibilities and capabilities of the Parties and their respective commitments under the Convention;

(c)....Facilitate, at the request of two or more Parties, the coordination of measures adopted by them to address climate change and its effects, taking into account the differing circumstances, responsibilities and capabilities of the Parties and their respective commitments under the Convention;

(d)....Promote and guide, in accordance with the objective and provisions of the Convention, the development and periodic refinement of comparable methodologies, to be agreed on by the Conference of the Parties, inter alia, for preparing inventories of greenhouse gas emissions by sources and removals by sinks, and for evaluating the effectiveness of measures to limit the emissions and enhance the removals of these gases;

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(e)....Assess, on the basis of all information made available to it in accordance with the provisions of the Convention, the implementation of the Convention by the Parties, the overall effects of the measures taken pursuant to the Convention, in particular environmental, economic and social effects as well as their cumulative impacts and the extent to which progress towards the objective of the Convention is being achieved;

(f)....Consider and adopt regular reports on the implementation of the Convention and ensure their publication;

(g)....Make recommendations on any matters necessary for the implementation of the Convention;

(h)....Seek to mobilize financial resources in accordance with Article 4, paragraphs 3, 4 and 5, and Article 11;

(i)....Establish such subsidiary bodies as are deemed necessary for the implementation of the Convention;

(j)....Review reports submitted by its subsidiary bodies and provide guidance to them;

(k)....Agree upon and adopt, by consensus, rules of procedure and financial rules for itself and for any subsidiary bodies;

(l)....Seek and utilize, where appropriate, the services and cooperation of, and information provided by, competent international organizations and intergovernmental and non-governmental bodies; and

(m)....Exercise such other functions as are required for the achievement of the objective of the Convention as well as all other functions assigned to it under the Convention.

3....The Conference of the Parties shall, at its first session, adopt its own rules of procedure as well as those of the subsidiary bodies established by the Convention, which shall include decision-making procedures for matters not already covered by decision- making procedures stipulated in the Convention. Such procedures may include specified majorities required for the adoption of particular decisions.

4....The first session of the Conference of the Parties shall be convened by the interim secretariat referred to in Article 21 and shall take place not later than one year after the date of entry into force of the Convention. Thereafter, ordinary sessions of the Conference of the Parties shall be held every year unless otherwise decided by the Conference of the Parties.

5....Extraordinary sessions of the Conference of the Parties shall be held at such other times as may be deemed necessary by the Conference, or at the written request of any Party, provided that, within six months of the request being communicated to the Parties by the secretariat, it is supported by at least one third of the Parties.

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6....The United Nations, its specialized agencies and the International Atomic Energy Agency, as well as any State member thereof or observers thereto not Party to the Convention, may be represented at sessions of the Conference of the Parties as observers. Any body or agency, whether national or international, governmental or non- governmental, which is qualified in matters covered by the Convention, and which has informed the secretariat of its wish to be represented at a session of the Conference of the Parties as an observer, may be so admitted unless at least one third of the Parties present object. The admission and participation of observers shall be subject to the rules of procedure adopted by the Conference of the Parties.

ARTICLE 8
SECRETARIAT

1....A secretariat is hereby established.

2....The functions of the secretariat shall be:

(a)....To make arrangements for sessions of the Conference of the Parties and its subsidiary bodies established under the Convention and to provide them with services as required;

(b)....To compile and transmit reports submitted to it;

(c)....To facilitate assistance to the Parties, particularly developing country Parties, on request, in the compilation and communication of information required in accordance with the provisions of the Convention;

(d)....To prepare reports on its activities and present them to the Conference of the Parties;

(e)....To ensure the necessary coordination with the secretariats of other relevant international bodies;

(f)....To enter, under the overall guidance of the Conference of the Parties, into such administrative and contractual arrangements as may be required for the effective discharge of its functions; and

(g)....To perform the other secretariat functions specified in the Convention and in any of its protocols and such other functions as may be determined by the Conference of the Parties.

3....The Conference of the Parties, at its first session, shall designate a permanent secretariat and make arrangements for its functioning.

ARTICLE 9

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SUBSIDIARY BODY FOR SCIENTIFIC AND TECHNOLOGICAL ADVICE

1....A subsidiary body for scientific and technological advice is hereby established to provide the Conference of the Parties and, as appropriate, its other subsidiary bodies with timely information and advice on scientific and technological matters relating to the Convention. This body shall be open to participation by all Parties and shall be multidisciplinary. It shall comprise government representatives competent in the relevant field of expertise. It shall report regularly to the Conference of the Parties on all aspects of its work.

2.....Under the guidance of the Conference of the Parties, and drawing upon existing competent international bodies, this body shall:

(a)....Provide assessments of the state of scientific knowledge relating to climate change and its effects;

(b)....Prepare scientific assessments on the effects of measures taken in the implementation of the Convention;

(c)....Identify innovative, efficient and state-of-the-art technologies and know-how and advise on the ways and means of promoting development and/or transferring such technologies;

(d)....Provide advice on scientific programmes, international cooperation in research and development related to climate change, as well as on ways and means of supporting endogenous capacity-building in developing countries; and

(e)....Respond to scientific, technological and methodological questions that the Conference of the Parties and its subsidiary bodies may put to the body.

3....The functions and terms of reference of this body may be further elaborated by the Conference of the Parties.

ARTICLE 10
SUBSIDIARY BODY FOR IMPLEMENTATION

1....A subsidiary body for implementation is hereby established to assist the Conference of the Parties in the assessment and review of the effective implementation of the Convention. This body shall be open to participation by all Parties and comprise government representatives who are experts on matters related to climate change. It shall report regularly to the Conference of the Parties on all aspects of its work.

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2....Under the guidance of the Conference of the Parties, this body shall:

(a)....Consider the information communicated in accordance with Article 12, paragraph 1, to assess the overall aggregated effect of the steps taken by the Parties in the light of the latest scientific assessments concerning climate change;

(b)....Consider the information communicated in accordance with Article 12, paragraph 2, in order to assist the Conference of the Parties in carrying out the reviews required by Article 4, paragraph 2(d); and

(c)....Assist the Conference of the Parties, as appropriate, in the preparation and implementation of its decisions.

ARTICLE 11
FINANCIAL MECHANISM

1....A mechanism for the provision of financial resources on a grant or concessional basis, including for the transfer of technology, is hereby defined. It shall function under the guidance of and be accountable to the Conference of the Parties, which shall decide on its policies, programme priorities and eligibility criteria related to this Convention. Its operation shall be entrusted to one or more existing international entities.

2....The financial mechanism shall have an equitable and balanced representation of all Parties within a transparent system of governance.

3....The Conference of the Parties and the entity or entities entrusted with the operation of the financial mechanism shall agree upon arrangements to give effect to the above paragraphs, which shall include the following:

(a)....Modalities to ensure that the funded projects to address climate change are in conformity with the policies, programme priorities and eligibility criteria established by the Conference of the Parties;

(b)....Modalities by which a particular funding decision may be reconsidered in light of these policies, programme priorities and eligibility criteria;

(c)....Provision by the entity or entities of regular reports to the Conference of the Parties on its funding operations, which is consistent with the requirement for accountability set out in paragraph 1 above; and

(d)....Determination in a predictable and identifiable manner of the amount of funding necessary and available for the implementation of this Convention and the conditions under which that amount shall be periodically reviewed.

4....The Conference of the Parties shall make arrangements to implement the above- mentioned provisions at its first session, reviewing and taking into account the interim arrangements referred to in Article 21, paragraph 3, and

shall decide whether these interim arrangements shall be maintained. Within four years thereafter, the Conference of the Parties shall review the financial mechanism and take appropriate measures.

5....The developed country Parties may also provide and developing country Parties avail themselves of, financial resources related to the implementation of the Convention through bilateral, regional and other multilateral channels.

ARTICLE 12
COMMUNICATION OF INFORMATION RELATED TO IMPLEMENTATION

1....In accordance with Article 4. paragraph 1, each Party shall communicate to the Conference of the Parties, through the secretariat, the following elements of information:

(a)....A national inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, to the extent its capacities permit, using comparable methodologies to be promoted and agreed upon by the Conference of the Parties;

(b)....A general description of steps taken or envisaged by the Party to implement the Convention; and

(c)....Any other information that the Party considers relevant to the achievement of the objective of the Convention and suitable for inclusion in its communication, including, if feasible, material relevant for calculations of global emission trends.

2....Each developed country Party and each other Party included in Annex I shall incorporate in its communication the following elements of information:

(a)....A detailed description of the policies and measures that it has adopted to implement its commitment under Article 4, paragraphs 2(a) and 2(b); and

(b)....A specific estimate of the effects that the policies and measures referred to in subparagraph (a) immediately above will have on anthropogenic emissions by its sources and removals by its sinks of greenhouse gases during the period referred to in Article 4, paragraph 2(a).

3....In addition, each developed country Party and each other developed Party included in Annex II shall incorporate details of measures taken in accordance with Article 4, paragraphs 3, 4 and 5.

4....Developing country Parties may, on a voluntary basis, propose projects for financing, including specific technologies, materials, equipment, techniques or practices that would be needed to implement such projects, along with, if possible, an estimate of all incremental costs, of the reductions of emissions and increments of removals of greenhouse gases, as well as an

estimate of the consequent benefits.

5....Each developed country Party and each other Party included in Annex I shall make its initial communication within six months of the entry into force of the Convention for that Party. Each Party not so listed shall make its initial communication within three years of the entry into force of the Convention for that Party, or of the availability of financial resources in accordance with Article 4, paragraph 3. Parties that are least developed countries may make their initial communication at their discretion. The frequency of subsequent communications by all Parties shall be determined by the Conference of the Parties, taking into account the differentiated timetable set by this paragraph.

6....Information communicated by Parties under this Article shall be transmitted by the secretariat as soon as possible to the Conference of the Parties and to any subsidiary bodies concerned. If necessary, the procedures for the communication of information may be further considered by the Conference of the Parties.

7....From its first session, the Conference of the Parties shall arrange for the provision to developing country Parties of technical and financial support, on request, in compiling and communicating information under this Article, as well as in identifying the technical and financial needs associated with proposed projects and response measures under Article 4. Such support may be provided by other Parties, by competent international organizations and by the secretariat, as appropriate.

8....Any group of Parties may, subject to guidelines adopted by the Conference of the Parties, and to prior notification to the Conference of the Parties, make a joint communication in fulfilment of their obligations under this Article, provided that such a communication includes information on the fulfilment by each of these Parties of its individual obligations under the Convention.

9....Information received by the secretariat that is designated by a Party as confidential, in accordance with criteria to be established by the Conference of the Parties, shall be aggregated by the secretariat to protect its confidentiality before being made available to any of the bodies involved in the communication and review of information.

10....Subject to paragraph 9 above, and without prejudice to the ability of any Party to make public its communication at any time, the secretariat shall make communications by Parties under this Article publicly available at the time they are submitted to the Conference of the Parties.

ARTICLE 13
RESOLUTION OF QUESTIONS REGARDING IMPLEMENTATION

The Conference of the Parties shall, at its first session, consider the

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establishment of a multilateral consultative process, available to Parties on their request, for the resolution of questions regarding the implementation of the Convention.

ARTICLE 14
SETTLEMENT OF DISPUTES

1....In the event of a dispute between any two or more Parties concerning the interpretation or application of the Convention, the Parties concerned shall seek a settlement of the dispute through negotiation or any other peaceful means of their own choice.

2....When ratifying, accepting, approving or acceding to the Convention, or at any time thereafter, a Party which is not a regional economic integration organization may declare in a written instrument submitted to the Depositary that, in respect of any dispute concerning the interpretation or application of the Convention, it recognizes as compulsory ipso facto and without special agreement, in relation to any Party accepting the same obligation:

(a)....Submission of the dispute to the International Court of Justice, and/or

(b)....Arbitration in accordance with procedures to be adopted by the Conference of the Parties as soon as practicable, in an annex on arbitration.

A Party which is a regional economic integration organization may make a declaration with like effect in relation to arbitration in accordance with the procedures referred to in subparagraph (b) above.

3....A declaration made under paragraph 2 above shall remain in force until it expires in accordance with its terms or until three months after written notice of its revocation has been deposited with the Depositary.

4....A new declaration, a notice of revocation or the expiry of a declaration shall not in any way affect proceedings pending before the International Court of Justice or the arbitral tribunal, unless the parties to the dispute otherwise agree.

5....Subject to the operation of paragraph 2 above, if after twelve months following notification by one Party to another that a dispute exists between them, the Parties concerned have not been able to settle their dispute through the means mentioned in paragraph 1 above, the dispute shall be submitted, at the request of any of the parties to the dispute, to conciliation.

6....A conciliation commission shall be created upon the request of one of the parties to the dispute. The commission shall be composed of an equal number of members appointed by each party concerned and a chairman chosen jointly by the members appointed by each party. The commission shall render a recommendatory award, which the parties shall consider in good faith.

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7....Additional procedures relating to conciliation shall be adopted by the Conference of the Parties, as soon as practicable, in an annex on conciliation.

8....The provisions of this Article shall apply to any related legal instrument which the Conference of the Parties may adopt, unless the instrument provides otherwise.

ARTICLE 15
AMENDMENTS TO THE CONVENTION

1....Any Party may propose amendments to the Convention.

2....Amendments to the Convention shall be adopted at an ordinary session of the Conference of the Parties. The text of any proposed amendment to the Convention shall be communicated to the Parties by the secretariat at least six months before the meeting at which it is proposed for adoption. The secretariat shall also communicate proposed amendments to the signatories to the Convention and, for information, to the Depositary.

3....The Parties shall make every effort to reach agreement on any proposed amendment to the Convention by consensus. If all efforts at consensus have been exhausted, and no agreement reached, the amendment shall as a last resort be adopted by a three-fourths majority vote of the Parties present and voting at the meeting. The adopted amendment shall be communicated by the secretariat to the Depositary, who shall circulate it to all Parties for their acceptance.

4....Instruments of acceptance in respect of an amendment shall be deposited with the Depositary. An amendment adopted in accordance with paragraph 3 above shall enter into force for those Parties having accepted it on the ninetieth day after the date of receipt by the Depositary of an instrument of acceptance by at least three fourths of the Parties to the Convention.

5....The amendment shall enter into force for any other Party on the ninetieth day after the date on which that Party deposits with the Depositary its instrument of acceptance of the said amendment.

6....For the purposes of this Article, "Parties present and voting" means Parties present and casting an affirmative or negative vote.

ARTICLE 16
ADOPTION AND AMENDMENT OF ANNEXES TO THE CONVENTION

1....Annexes to the Convention shall form an integral part thereof and, unless

otherwise expressly provided, a reference to the Convention constitutes at the same time a reference to any annexes thereto. Without prejudice to the provisions of Article 14, paragraphs 2(b) and 7, such annexes shall be restricted to lists, forms and any other material of a descriptive nature that is of a scientific, technical, procedural or administrative character.

2....Annexes to the Convention shall be proposed and adopted in accordance with the procedure set forth in Article 15, paragraphs 2, 3 and 4.

3....An annex that has been adopted in accordance with paragraph 2 above shall enter into force for all Parties to the Convention six months after the date of the communication by the Depositary to such Parties of the adoption of the annex, except for those Parties that have notified the Depositary, in writing, within that period of their non-acceptance of the annex. The annex shall enter into force for Parties which withdraw their notification of non-acceptance on the ninetieth day after the date on which withdrawal of such notification has been received by the Depositary.

4....The proposal, adoption and entry into force of amendments to annexes to the Convention shall be subject to the same procedure as that for the proposal, adoption and entry into force of annexes to the Convention in accordance with paragraphs 2 and 3 above.

5....If the adoption of an annex or an amendment to an annex involves an amendment to the Convention, that annex or amendment to an annex shall not enter into force until such time as the amendment to the Convention enters into force.

ARTICLE 17
PROTOCOLS

1....The Conference of the Parties may, at any ordinary session, adopt protocols to the Convention.

2....The text of any proposed protocol shall be communicated to the Parties by the secretariat at least six months before such a session.

3....The requirements for the entry into force of any protocol shall be established by that instrument.

4....Only Parties to the Convention may be Parties to a protocol.

5....Decisions under any protocol shall be taken only by the Parties to the protocol concerned.

ARTICLE 18

RIGHT TO VOTE

1....Each Party to the Convention shall have one vote, except as provided for in paragraph 2 below.

2....Regional economic integration organizations, in matters within their competence, shall exercise their right to vote with a number of votes equal to the number of their member States that are Parties to the Convention. Such an organization shall not exercise its right to vote if any of its member States exercises its right, and vice versa.

ARTICLE 19
DEPOSITARY

The Secretary-General of the United Nations shall be the Depositary of the Convention and of protocols adopted in accordance with Article 17.

ARTICLE 20
SIGNATURE

This Convention shall be open for signature by States Members of the United Nations or of any of its specialized agencies or that are Parties to the Statute of the International Court of Justice and by regional economic integration organizations at Rio de Janeiro, during the United Nations Conference on Environment and Development, and thereafter at United Nations Headquarters in New York from 20 June 1992 to 19 June 1993.

ARTICLE 21
INTERIM ARRANGEMENTS

1....The secretariat functions referred to in Article 8 will be carried out on an interim basis by the secretariat established by the General Assembly of the United Nations in its resolution 45/212 of 21 December 1990, until the completion of the first session of the Conference of the Parties.

2....The head of the interim secretariat referred to in paragraph 1 above will cooperate closely with the Intergovernmental Panel on Climate Change to ensure that the Panel can respond to the need for objective scientific and technical advice. Other relevant scientific bodies could also be consulted.

3....The Global Environment Facility of the United Nations Development Programme, the United Nations Environment Programme and the International Bank for Reconstruction and Development shall be the international entity entrusted with the operation of the financial mechanism referred to in Article 11 on an interim basis. In this connection, the Global Environment Facility should be appropriately restructured and its membership made universal to enable it to fulfil the requirements of Article 11.

ARTICLE 22
RATIFICATION, ACCEPTANCE, APPROVAL OR ACCESSION

1....The Convention shall be subject to ratification, acceptance, approval or accession by States and by regional economic integration organizations. It shall be open for accession from the day after the date on which the Convention is closed for signature. Instruments of ratification, acceptance, approval or accession shall be deposited with the Depositary.

2....Any regional economic integration organization which becomes a Party to the Convention without any of its member States being a Party shall be bound by all the obligations under the Convention. In the case of such organizations, one or more of whose member States is a Party to the Convention, the organization and its member States shall decide on their respective responsibilities for the performance of their obligations under the Convention. In such cases, the organization and the member States shall not be entitled to exercise rights under the Convention concurrently.

3....In their instruments of ratification, acceptance, approval or accession, regional economic integration organizations shall declare the extent of their competence with respect to the matters governed by the Convention. These organizations shall also inform the Depositary, who shall in turn inform the Parties, of any substantial modification in the extent of their competence.

ARTICLE 23
ENTRY INTO FORCE

1....The Convention shall enter into force on the ninetieth day after the date of deposit of the fiftieth instrument of ratification, acceptance, approval or accession.

2....For each State or regional economic integration organization that ratifies, accepts or approves the Convention or accedes thereto after the deposit of the fiftieth instrument of ratification, acceptance, approval or accession, the Convention shall enter into force on the ninetieth day after the date of deposit

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by such State or regional economic integration organization of its instrument of ratification, acceptance, approval or accession.

3....For the purposes of paragraphs 1 and 2 above, any instrument deposited by a regional economic integration organization shall not be counted as additional to those deposited by States members of the organization.

ARTICLE 24
RESERVATIONS

No reservations may be made to the Convention.

ARTICLE 25
WITHDRAWAL

1....At any time after three years from the date on which the Convention has entered into force for a Party, that Party may withdraw from the Convention by giving written notification to the Depositary.

2....Any such withdrawal shall take effect upon expiry of one year from the date of receipt by the Depositary of the notification of withdrawal, or on such later date as may be specified in the notification of withdrawal.

3....Any Party that withdraws from the Convention shall be considered as also having withdrawn from any protocol to which it is a Party.

ARTICLE 26
AUTHENTIC TEXTS

The original of this Convention, of which the Arabic, Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited with the Secretary- General of the United Nations.

IN WITNESS WHEREOF the undersigned, being duly authorized to that effect, have signed this Convention.

DONE at New York this ninth day of May one thousand nine hundred and ninety- two.

ANNEX I AND ANNEX II COUNTRIES

Annex I

Annex I

Australia
Austria
Belarus a/
Belgium
Bulgaria a/
Canada
Czechoslovakia a/
Denmark
European Economic Community
Estonia a/
Finland
France
Germany
Greece
Hungary a/
Iceland
Ireland
Italy
Japan
Latvia a/
Lithuania a/
Luxembourg
Netherlands
New Zealand
Norway
Poland a/
Portugal
Romania a/
Russian Federation a/
Spain
Sweden
Switzerland
Turkey
Ukraine a/
United Kingdom of Great Britain and Northern Ireland
United States of America

a/ Countries that are undergoing the process of transition to a market economy.

Annex II

Australia
Austria
Belgium
Canada
Denmark

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European Economic Community
Finland
France
Germany
Greece
Iceland
Ireland
Italy
Japan
Luxembourg
Netherlands
New Zealand
Norway
Portugal
Spain
Sweden
Switzerland
Turkey
United Kingdom of Great Britain and Northern Ireland
United States of America

[The Convention][The Secretariat] What is Climate Change]CC:INFO Products]
[Official Documents][Country Information] Emissions and other Data]
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SUPPLEMENT 3

KYOTO PROTOCOL

Distr.

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CONFERENCE OF THE PARTIES

Third session

Kyoto, 1-10 December 1997

Agenda item 5

KYOTO PROTOCOL TO THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

The Parties to this Protocol,

Being Parties to the United Nations Framework Convention on Climate Change, hereinafter referred to as "the Convention",

In pursuit of the ultimate objective of the Convention as stated in its Article 2,

Recalling the provisions of the Convention,

Being guided by Article 3 of the Convention,

Pursuant to the Berlin Mandate adopted by decision 1/CP.1 of the

Conference of the Parties to the Convention at its first session,

Have agreed as follows:

Article 1

For the purposes of this Protocol, the definitions contained in Article 1 of the Convention shall apply. In addition:

1. "Conference of the Parties" means the Conference of the Parties to the Convention.

UKY.97-

2. "Convention" means the United Nations Framework Convention on Climate Change, adopted in New York on 9 May 1992.

3. "Intergovernmental Panel on Climate Change" means the Intergovernmental Panel on Climate Change established in 1988 jointly by the World Meteorological Organization and the United Nations Environment Programme.

4. "Montreal Protocol" means the Montreal Protocol on Substances that Deplete the Ozone Layer, adopted in Montreal on 16 September 1987 and as subsequently adjusted and amended.

5. "Parties present and voting" means Parties present and casting an affirmative or negative vote.

6. "Party" means, unless the context otherwise indicates, a Party to this Protocol.

7. "Party included in Annex I" means a Party included in Annex I to the Convention, as may be amended, or a Party which has made a notification under Article 4, paragraph 2(g), of the Convention.

Article 2

1. Each Party included in Annex I in achieving its quantified emission limitation and reduction commitments under Article 3, in order to promote sustainable development, shall:

(a) Implement and/or further elaborate policies and measures in accordance with its national circumstances, such as:

(i) Enhancement of energy efficiency in relevant sectors of the national economy;

(ii) Protection and enhancement of sinks and reservoirs of greenhouse gases not controlled by the Montreal Protocol, taking into account its commitments under relevant international environmental agreements; promotion of sustainable forest management practices, afforestation and-

reforestation;

(iii) Promotion of sustainable forms of agriculture in light of climate change considerations;

(iv) Promotion, research, development and increased use of new and renewable forms of energy, of carbon dioxide sequestration technologies and of advanced and innovative environmentally sound technologies;

(v) Progressive reduction or phasing out of market imperfections, fiscal incentives, tax and duty exemptions and subsidies in all greenhouse gas emitting sectors that run counter to the objective of the Convention and apply market instruments;

(vi) Encouragement of appropriate reforms in relevant sectors aimed at promoting policies and measures which limit or reduce emissions of greenhouse gases not controlled by the Montreal Protocol;

(vii) Measures to limit and/or reduce emissions of greenhouse gases not controlled by the Montreal Protocol in the transport sector;

(viii) Limitation and/or reduction of methane through recovery and use in waste management, as well as in the production, transport and distribution of energy;

(b) Cooperate with other such Parties to enhance the individual and combined effectiveness of their policies and measures adopted under this Article, pursuant to Article 4, paragraph 2(e)(i), of the Convention. To this end, these Parties shall take steps to share their experience and exchange information on such policies and measures, including developing ways of improving their comparability, transparency and effectiveness. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session or as soon as practicable thereafter, consider ways to facilitate such cooperation, taking into account all relevant information.

2. The Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively.

3. The Parties included in Annex I shall strive to implement policies and measures under this Article in such a way as to minimize adverse effects, including the adverse effects of climate change, effects on international trade, and social, environmental and economic impacts on other Parties, especially developing country Parties and in particular those identified in Article 4, paragraphs 8 and 9 of the Convention, taking into account Article 3 of the Convention. The Conference of the Parties serving as the meeting of the Parties to this Protocol may take further action, as appropriate, to promote the implementation of the provisions of this paragraph.

4. The Conference of the Parties serving as the meeting of the Parties to this Protocol, if it decides that it would be beneficial to coordinate any of the policies and measures in

paragraph 1(a) above, taking into account different national circumstances and potential effects, shall consider ways and means to elaborate the coordination of such policies and measures.

Article 3

1. The Parties included in Annex I shall, individually or jointly, ensure that their aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A do not exceed their assigned amounts, calculated pursuant to their quantified emission limitation and reduction commitments inscribed in Annex B and in accordance with the provisions of this Article, with a view to reducing their overall emissions of such gases by at least 5 per cent below 1990 levels in the commitment period 2008 to 2012.

2. Each Party included in Annex I shall, by 2005, have made demonstrable progress in achieving its commitments under this Protocol.

3. The net changes in greenhouse gas emissions from sources and removals by sinks resulting from direct human-induced land use change and forestry activities, limited to afforestation, reforestation, and deforestation since 1990, measured as verifiable changes in stocks in each commitment period

shall be used to meet the commitments in this Article of each Party included in Annex I. The greenhouse gas emissions from sources and removals by sinks associated with those activities shall be reported in a transparent and verifiable manner and reviewed in accordance with Articles 7 and 8.

4. Prior to the first session of the Conference of the Parties serving as the meeting of the Parties to this Protocol, each Party included in Annex I shall provide for consideration by the Subsidiary Body for Scientific and Technological Advice data to establish its level of carbon stocks in 1990 and to enable an estimate to be made of its changes in carbon stocks in subsequent years. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session or as soon as practicable thereafter, decide upon modalities, rules and guidelines as to how and which additional human-induced activities related to changes in greenhouse gas emissions and removals in the agricultural soil and land use change and forestry categories, shall be added to, or subtracted from, the assigned amount for Parties included in Annex I, taking into account uncertainties, transparency in reporting, verifiability, the methodological work of the Intergovernmental Panel on Climate Change, the advice provided by the Subsidiary Body for Scientific and Technological Advice in accordance with Article 5 and the decisions of the Conference of the Parties. Such a decision shall apply in the second and subsequent commitment periods. A Party may choose to apply such a decision on these additional human-induced activities for its first commitment period, provided that these activities have taken place since 1990.

5. The Parties included in Annex I undergoing the process of transition to a market economy whose base year or period was established pursuant to decision 9/CP.2 of the Conference of the Parties at its second session, shall use that base year or period for the implementation of their commitments under this Article. Any other Party included in

Annex I undergoing the process of transition to a market economy which has not yet submitted its first national communication under Article 12 of the Convention may also notify the Conference of the Parties serving as the meeting of the Parties to this Protocol that it intends to use a historical base year or period other than 1990 for the implementation of its commitments under this Article. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall decide on the acceptance of such notification.

6. Taking into account Article 4, paragraph 6, of the Convention, in the implementation of their commitments under this Protocol other than those in this Article, a certain degree of

flexibility shall be allowed by the Conference of the Parties serving as the meeting of the Parties to this Protocol to the Parties included in Annex I undergoing the process of transition to a market economy.

7. In the first quantified emission limitation and reduction commitment period, from

2008 to 2012, the assigned amount for each Party included in Annex I shall be equal to the percentage inscribed for it in Annex B of its aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A in 1990, or the base year or period determined in accordance with paragraph 5 above, multiplied by five. Those Parties included in Annex I for whom land use change and forestry constituted a net source of greenhouse gas emissions in 1990 shall include in their 1990 emissions base year or period the aggregate anthropogenic carbon dioxide equivalent emissions minus removals in 1990 from land use change for the purposes of calculating their assigned amount.

8. Any Party included in Annex I may use 1995 as its base year for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride, for the purposes of the calculation referred to in paragraph 7 above.

9. Commitments for subsequent periods for Parties included in Annex I shall be established in amendments to Annex B to this Protocol, which shall be adopted in accordance with the provisions of Article 20, paragraph 7. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall initiate the consideration of such commitments at least seven years before the end of the first commitment period mentioned in paragraph 7 above.

10. Any emission reduction units, or any part of an assigned amount, which a Party acquires from another Party in accordance with the provisions of Article 6 and of Article 16 bis shall be added to the assigned amount for that Party.

11. Any emission reduction units, or any part of an assigned amount, which a Party transfers to another Party in accordance with the provisions of Article 6 and of Article 16 bis shall be subtracted from the assigned amount for that Party.

12. Any certified emission reductions which a Party acquires from another Party in accordance with the provisions of Article 12 shall be added to the assigned amount for that Party.

13. If the emissions of a Party included in Annex I during a commitment period are less than its assigned amount under this Article, this difference shall, on request of that Party, be added to the assigned amount for that Party for subsequent commitment periods.

14. Each Party included in Annex I shall strive to implement the commitments mentioned in paragraph 1 above in such a way as to minimize adverse social, environmental and economic impacts on developing country Parties, particularly those identified in Article 4, paragraphs 8 and 9, of the Convention. In line with relevant decisions of the Conference of the Parties on the implementation of those paragraphs, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session, consider what actions are necessary to minimize the adverse effects of climate change and/or the impacts of response measures on Parties referred to in those paragraphs. Among the issues to be considered shall be the establishment of funding, insurance and transfer of technology.

Article 4

1. Any Parties included in Annex I that have agreed to jointly fulfil their commitments under Article 3 shall be deemed to have met those commitments provided that their total combined aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A do not exceed their assigned amounts calculated pursuant to their quantified emission limitation and reduction commitments inscribed in Annex B and in accordance with the provisions of Article 3. The respective emission level allocated to each of the Parties to the agreement shall be set out in that agreement.

2. The Parties to any such agreement shall notify the secretariat of the terms of the

agreement on the date of deposit of their instruments of ratification, acceptance, approval or accession. The secretariat shall in turn inform the Parties and signatories to the Convention of the terms of the agreement.

3. The agreement shall remain in operation for the duration of the commitment period specified in Article 3, paragraph 7.

4. If Parties acting jointly do so in the framework of, and together with, a regional

economic integration organization, any alteration in the composition of the organization after adoption of this Protocol shall not affect existing commitments under this Protocol. Any alteration in the composition of the organization shall only apply for the purposes of those commitments under Article 3 that are adopted subsequent to that revision.

5. In the event of failure by the Parties to such an agreement to achieve their total

combined level of emission reductions, each Party to such an agreement shall be responsible for its own level of emissions set out in the agreement.

6. If Parties acting jointly do so in the framework of, and together with, a regional

economic integration organization which is itself a Party to this Protocol, each member State of that regional economic integration organization individually, and together with the regional economic integration organization acting in accordance with Article 23, shall, in the event of failure to achieve the total combined level of emission reductions, be responsible for its level of emissions as notified in accordance with this Article.

Article 5

1. Each Party included in Annex I shall have in place, no later than one year prior to the start of the first commitment period, a national system for the estimation of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol. Guidelines for such national systems, which shall incorporate the methodologies specified in paragraph 2 below, shall be decided upon by the Conference of the Parties serving as the meeting of the Parties to this Protocol at its first session.

2. Methodologies for estimating anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol shall be those accepted by the Intergovernmental Panel on Climate Change and agreed upon by the Conference of the Parties at its third session. Where such methodologies are not used, appropriate adjustments shall be applied according to methodologies agreed upon by the Conference of the Parties serving as the meeting of the Parties to this Protocol at its first session. Based on the work of, *inter alia*, the Intergovernmental Panel on Climate Change and advice provided by the Subsidiary Body for Scientific and Technological Advice, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall regularly review and, as appropriate, revise such methodologies and adjustments, taking fully into account any relevant decisions by the Conference of the Parties. Any revision to methodologies or adjustments shall be used only for the purposes of ascertaining compliance with commitments under Article 3 in respect of any commitment period adopted subsequent to that revision.

3. The global warming potentials used to calculate the carbon dioxide equivalence of anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol listed in Annex A shall be those accepted by the Intergovernmental Panel on Climate Change and agreed upon by the Conference of the Parties at its third session. Based on the work of, *inter alia*, the Intergovernmental Panel on Climate Change and advice provided by the Subsidiary Body for Scientific and Technological Advice, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall regularly review and, as appropriate, revise the global warming potential of each such greenhouse gas, taking fully into account any relevant decisions by the Conference of the Parties. Any revision to a global warming potential shall apply only to those commitments under Article 3 in respect of any commitment period adopted subsequent to that revision.

Article 6

1. For the purpose of meeting its commitments under Article 3, any Party included in

Annex I may transfer to, or acquire from, any other such Party emission reduction units resulting from projects aimed at reducing anthropogenic emissions by sources or enhancing anthropogenic removals by sinks of greenhouse gases in any sector of the economy, provided that:

(a) Any such project has the approval of the Parties involved;

(b) Any such project provides a reduction in emissions by sources, or an enhancement of removals by sinks, that is additional to any that would otherwise occur;

(c) It does not acquire any emission reduction units if it is not in compliance with its obligations under Articles 5 and 7; and

(d) The acquisition of emission reduction units shall be supplemental to domestic actions for the purposes of meeting commitments under Article 3.

2. The Conference of the Parties serving as the meeting of the Parties to this Protocol may, at its first session or as soon as practicable thereafter, further elaborate guidelines for the implementation of this Article, including for verification and reporting.

3. A Party included in Annex I may authorize legal entities to participate, under its responsibility, in actions leading to the generation, transfer or acquisition under this Article of emission reduction units.

4. If a question of implementation by a Party included in Annex I of the requirements referred to in this paragraph is identified in accordance with the relevant provisions of

Article 8, transfers and acquisitions of emission reduction units may continue to be made after the question has been identified, provided that any such units may not be used by a Party to meet its commitments under Article 3 until any issue of compliance is resolved.

Article 7

1. Each Party included in Annex I shall incorporate in its annual inventory of anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol, submitted in accordance with the relevant decisions of the Conference of the Parties, the necessary supplementary information for the purposes of ensuring compliance with Article 3, to be determined in accordance with paragraph 4 below.

2. Each Party included in Annex I shall incorporate in its national communication, submitted under Article 12 of the Convention, the supplementary information necessary to demonstrate compliance with its commitments under this Protocol, to be determined in accordance with paragraph 4 below.

3. Each Party included in Annex I shall submit the information required under

paragraph 1 above annually, beginning with the first inventory due under the Convention for the first year of the commitment period after this Protocol has entered into force for it. Each such Party shall submit the information required under paragraph 2 above as part of the first national communication

due under the Convention after this Protocol has entered into force for it and after the adoption of guidelines as provided for in paragraph 4 below. The frequency of subsequent submission of information required under this Article shall be determined by the Conference of the Parties serving as the meeting of the Parties to this Protocol, taking into account any timetable for the submission of national communications decided upon by the Conference of the Parties.

4. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall adopt at its first session, and review periodically thereafter, guidelines for the preparation of the information required under this Article, taking into account guidelines for the preparation of national communications by Parties included in Annex I adopted by the Conference of the Parties. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall also, prior to the first commitment period, decide upon modalities for the accounting of assigned amounts.

Article 8

1. The information submitted under Article 7 by each Party included in Annex I shall be reviewed by expert review teams pursuant to the relevant decisions of the Conference of the Parties and in accordance with guidelines adopted for this purpose by the Conference of the Parties serving as the meeting of the Parties to this Protocol under paragraph 4 below. The information submitted under Article 7, paragraph 1, by each Party included in Annex I shall be reviewed as part of the annual compilation and accounting of emissions inventories and assigned amounts. Additionally, the information submitted under Article 7, paragraph 2, by each Party included in Annex I shall be reviewed as part of the review of communications.

2. Expert review teams shall be coordinated by the secretariat and shall be composed of experts selected from those nominated by Parties to the Convention and, as appropriate, by intergovernmental organizations, in accordance with guidance provided for this purpose by the Conference of the Parties.

3. The review process shall provide a thorough and comprehensive technical assessment

of all aspects of the implementation by a Party of this Protocol. The expert review teams shall prepare a report to the Conference of the Parties serving as the meeting of the Parties to this Protocol, assessing the implementation of the commitments of the Party and identifying any potential problems in, and factors influencing, the fulfilment of commitments. Such reports shall be circulated by the secretariat to all Parties to the Convention. The secretariat shall list those questions of implementation indicated in such reports for further consideration by the Conference of the Parties serving as the meeting of the Parties to this Protocol.

4. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall adopt at its first session, and review periodically thereafter, guidelines for the review of implementation by expert review teams taking into account the relevant decisions of the Conference of the Parties.

5. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, with the assistance of the Subsidiary Body for Implementation and, as appropriate, the Subsidiary Body for Scientific and Technological Advice, consider:

(a) The information submitted by the Parties under Article 7 and the reports of the expert reviews thereon conducted under this Article; and

(b) Those questions of implementation listed by the secretariat under

paragraph 3 above, as well as any questions raised by Parties.

6. Pursuant to its consideration of the information referred to in paragraph 5 above, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall take decisions on any matter required for the implementation of this Protocol.

Article 9

1. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall periodically review this Protocol in the light of the best available scientific information and assessments on climate change and its impacts, as well as relevant technical, social and economic information. Such reviews shall be coordinated with pertinent reviews under the Convention, in particular those required by Article 4, paragraph 2(d), and Article 7, paragraph 2(a), of the Convention. Based on these reviews, the Conference of the Parties serving as the meeting of the Parties to this Protocol shall take appropriate action.

2. The first review shall take place at the second session of the Conference of the Parties serving as the meeting of the Parties to this Protocol. Further reviews shall take place at regular intervals and in a timely manner.

Article 10

All Parties, taking into account their common but differentiated responsibilities and

their specific national and regional development priorities, objectives and circumstances, without introducing any new commitments for Parties not included in Annex I, but reaffirming existing commitments in Article 4, paragraph 1, of the Convention, and continuing to advance the implementation of these commitments in order to achieve sustainable development, taking into account Article 4, paragraphs 3, 5 and 7, of the Convention, shall:

(a) Formulate, where relevant and to the extent possible, cost-effective national,

and where appropriate regional programmes to improve the quality of local emission factors, activity data and/or models which reflect the socio-economic conditions of each Party for the preparation and periodic updating of national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, using comparable methodologies to be agreed upon by the Conference of the Parties, and consistent with the guidelines for national communications adopted by the Conference of the Parties;

(b) Formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures to mitigate climate change and measures to facilitate adequate adaptation to climate change:

(i) Such programmes would, *inter alia*, concern the energy, transport and industry sectors as well as agriculture, forestry and waste management. Furthermore, adaptation technologies and methods for improving spatial planning would improve adaptation to climate change; and

(ii) Parties included in Annex I shall submit information on action under this Protocol, including national programmes, according to the guidelines laid down in Article 8; and other Parties shall seek to include in their national communications, as appropriate, information on programmes which contain measures that the Party believes contribute to addressing climate change and its adverse impacts, including the abatement of increase in greenhouse gas emissions, and enhancement of and removals by sinks, capacity building and adaptation measures.

(c) Cooperate in the promotion of effective modalities for the development, application and diffusion of, and take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies, know-how, practices and processes pertinent to climate change, in particular to developing countries, including the formulation of policies and programmes for the effective transfer of

environmentally sound technologies that are publicly owned or in the public domain and the creation of an enabling environment for the private sector, to promote and enhance access to, and transfer of, environmentally sound technologies;

(d) Cooperate in scientific and technical research and promote the maintenance and the development of systematic observation systems and development of data archives to reduce uncertainties related to the climate system, the adverse impacts of climate change and the economic and social consequences of various response strategies, and promote the development and strengthening of endogenous capacities and capabilities to participate in international and intergovernmental efforts, programmes and networks on research and systematic observation, taking into account Article 5 of the Convention;

(e) Cooperate in and promote at the international level, and, where appropriate,

using existing bodies, the development and implementation of education and training programmes, including the strengthening of national capacity building, in particular human and institutional capacities and the exchange or secondment of personnel to train experts in this field, in particular for developing countries, and facilitate at the national level public awareness and public access to information on climate change. Suitable modalities should be developed to implement these activities through the relevant bodies of the Convention taking into account Article 6 of the Convention;

(f) Include in their national communications information on programmes and activities undertaken pursuant to this Article in accordance with relevant decisions of the Conference of the Parties; and

(g) Give full consideration, in implementing the commitments in this Article, to Article 4, paragraph 8, of the Convention.

Article 11

1. In the implementation of Article 10, Parties shall take into account the provisions of Article 4, paragraphs 4, 5, 7, 8 and 9 of the Convention.

2. In the context of the implementation of Article 4, paragraph 1, of the Convention, in accordance with the provisions of Article 4, paragraph 3, and Article 11 of the Convention, and through the operating entity or entities of the financial mechanism of the Convention, the developed country Parties and other developed Parties included in Annex II to the Convention shall:

(a) Provide new and additional financial resources to meet the agreed full costs incurred by developing country Parties in advancing the implementation of existing commitments under Article 4, paragraph 1(a), of the Convention that are covered in

Article 10, subparagraph (a); and

(b) Also provide such financial resources, including for the transfer of technology, needed by the developing country Parties to meet the agreed full incremental costs of advancing the implementation of existing commitments in Article 4, paragraph 1, of the Convention that are covered by Article 10 and that are agreed between a developing country Party and the international entity or entities referred

to in Article 11 of the Convention, in accordance with that Article.

The implementation of these existing commitments shall take into account the need for adequacy and predictability in the flow of funds and the importance of appropriate burden sharing among developed country Parties. The guidance to the financial mechanism of the Convention in relevant decisions of the Conference of the Parties, including those agreed before the adoption of this Protocol, shall apply *mutatis mutandis* to the provisions of this paragraph.

3. The developed country Parties and other developed Parties in Annex II to the

Convention may also provide, and developing country Parties avail themselves of, financial resources for the implementation of Article 10, through bilateral, regional and other multilateral channels.

Article 12

1. A clean development mechanism is hereby defined.

2. The purpose of the clean development mechanism shall be to assist Parties not included in Annex I in achieving sustainable development and in contributing to the ultimate objective of the Convention, and to assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments under Article 3.

3. Under the clean development mechanism:

(a) Parties not included in Annex I will benefit from project activities resulting in certified emission reductions; and

(b) Parties included in Annex I may use the certified emission reductions accruing from such project activities to contribute to compliance with part of their quantified emission limitation and reduction commitments under Article 3, as determined by the Conference of the Parties serving as the meeting of the Parties to this Protocol.

4. The clean development mechanism shall be subject to the authority and guidance of the Conference of the Parties serving as the meeting of the Parties to this Protocol and be supervised by an executive board of the clean development mechanism.

5. Emission reductions resulting from each project activity shall be certified by operational entities to be designated by the Conference of the Parties serving as the meeting of the Parties to this Protocol, on the basis of:

(a) Voluntary participation approved by each Party involved;

(b) Real, measurable, and long-term benefits related to the mitigation of climate change; and

(c) Reductions in emissions that are additional to any that would occur in the absence of the certified project activity.

6. The clean development mechanism shall assist in arranging funding of certified project activities as necessary.

7. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session, elaborate modalities and procedures with the objective of ensuring transparency, efficiency and accountability through independent auditing and verification of project activities.

8. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall ensure that a share of the proceeds from certified project activities is used to cover administrative expenses as well as to assist developing country Parties that are particularly vulnerable to the adverse effects of climate change to meet the costs of adaptation.

9. Participation under the clean development mechanism, including in activities mentioned in paragraph 3(a) above and acquisition of certified emission reductions, may involve private and/or public entities, and is to be subject to whatever guidance may be provided by the executive board of the clean development mechanism.

10. Certified emission reductions obtained during the period from the year 2000 up to the beginning of the first commitment period can be used to assist in achieving compliance in the first commitment period.

Article 13

1. The Conference of the Parties, the supreme body of the Convention, shall serve as the

meeting of the Parties to this Protocol.

2. Parties to the Convention that are not Parties to this Protocol may participate as

observers in the proceedings of any session of the Conference of the Parties serving as the meeting of the Parties to this Protocol. When the Conference of the Parties serves as the meeting of the Parties to this Protocol, decisions under this Protocol shall be taken only by those that are Parties to it.

3. When the Conference of the Parties serves as the meeting of the Parties to this Protocol, any member of the Bureau of the Conference of the Parties representing a Party to the Convention but, at that time, not a Party to this Protocol, shall be substituted by an additional member to be elected by and from amongst the Parties to this Protocol.

4. The Conference of the Parties serving as the meeting of the Parties to this Protocol shall keep under regular review the implementation of this Protocol and shall make, within its mandate, the decisions necessary to promote its effective implementation. It shall perform the functions assigned to it by this Protocol and shall:

(a) Assess, on the basis of all information made available to it in accordance with

the provisions of this Protocol, the implementation of this Protocol by the Parties, the overall effects of the measures taken pursuant to this Protocol, in particular environmental, economic and social effects as well as their cumulative impacts and the extent to which progress towards the objective of the Convention is being achieved;

(b) Periodically examine the obligations of the Parties under this Protocol, giving due consideration to any reviews required by Article 4, paragraph 2(d), and Article 7, paragraph 2, of the Convention, in the light of the objective of the Convention, the experience gained in its implementation and the evolution of scientific and technological knowledge, and in this respect consider and adopt regular reports on the implementation of this Protocol;

(c) Promote and facilitate the exchange of information on measures adopted by the Parties to address

climate change and its effects, taking into account the differing circumstances, responsibilities and capabilities of the Parties and their respective commitments under this Protocol;

(d) Facilitate, at the request of two or more Parties, the coordination of measures adopted by them to address climate change and its effects, taking into account the differing circumstances, responsibilities and capabilities of the Parties and their respective commitments under this Protocol;

(e) Promote and guide, in accordance with the objective of the Convention and the provisions of this Protocol, and taking fully into account the relevant decisions by the Conference of the Parties, the development and periodic refinement of comparable methodologies for the effective implementation of this Protocol, to be agreed on by the Conference of the Parties serving as the meeting of the Parties to this Protocol;

(f) Make recommendations on any matters necessary for the implementation of this Protocol;

(g) Seek to mobilize additional financial resources in accordance with

Article 11, paragraph 2;

(h) Establish such subsidiary bodies as are deemed necessary for the implementation of this Protocol;

(i) Seek and utilize, where appropriate, the services and cooperation of, and information provided by, competent international organizations and intergovernmental and non-governmental bodies; and

(j) Exercise such other functions as may be required for the implementation of this Protocol, and consider any assignment resulting from a decision by the Conference of the Parties.

5. The rules of procedure of the Conference of the Parties and financial procedures of the Convention shall be applied *mutatis mutandis* under this Protocol, except as may be otherwise decided by consensus by the Conference of the Parties serving as the meeting of the Parties to this Protocol.

6. The first session of the Conference of the Parties serving as the meeting of the Parties to this Protocol shall be convened by the secretariat in conjunction with the first session of the Conference of the Parties that is scheduled after the date of the entry into force of this Protocol. Subsequent ordinary sessions of the Conference of the Parties serving as the meeting of the Parties to this Protocol shall be held every year and in conjunction with ordinary sessions of the Conference of the Parties unless otherwise decided by the Conference of the Parties serving as the meeting of the Parties to this Protocol.

7. Extraordinary sessions of the Conference of the Parties serving as the meeting of the

Parties to this Protocol shall be held at such other times as may be deemed necessary by the Conference of the Parties serving as the meeting of the Parties to this Protocol, or at the written request of any Party, provided that, within six months of the request being communicated to the Parties by the secretariat, it is supported by at least one third of the Parties.

8. The United Nations, its specialized agencies and the International Atomic Energy

Agency, as well as any State member thereof or observers thereto not party to the Convention, may be represented at sessions of the Conference of the Parties serving as the meeting of the Parties to this Protocol as observers. Any body or agency, whether national or international, governmental or non-governmental, which is qualified in matters covered by this Protocol and which has informed the secretariat of its wish to be represented at a session of the Conference of the Parties serving as the

meeting of the Parties to this Protocol as an observer, may be so admitted unless at least one third of the Parties present object. The admission and participation of observers shall be subject to the rules of procedure, as referred to in paragraph 5 above.

Article 14

1. The secretariat established by Article 8 of the Convention shall serve as the secretariat of this Protocol.

2. Article 8, paragraph 2, of the Convention on the functions of the secretariat, and

Article 8, paragraph 3, of the Convention on arrangements made for the functioning of the secretariat, shall apply *mutatis mutandis* to this Protocol. The secretariat shall, in addition, exercise the functions assigned to it under this Protocol.

Article 15

1. The Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation established by Articles 9 and 10 of the Convention shall serve as, respectively, the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation of this Protocol. The provisions relating to the functioning of these two bodies under the Convention shall apply *mutatis mutandis* to this Protocol. Sessions of the meetings of the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation of this Protocol shall be held in conjunction with the meetings of, respectively, the Subsidiary Body for Scientific and Technological Advice and the Subsidiary Body for Implementation of the Convention.

2. Parties to the Convention that are not Parties to this Protocol may participate as observers in the proceedings of any session of the subsidiary bodies. When the subsidiary bodies serve as the subsidiary bodies of this Protocol, decisions under this Protocol shall be taken only by the Parties to this Protocol.

3. When the subsidiary bodies established by Articles 9 and 10 of the Convention exercise their functions with regard to matters concerning this Protocol, any member of the Bureaux of those subsidiary bodies representing a Party to the Convention but, at that time, not a party to this Protocol, shall be substituted by an additional member to be elected by and from amongst the Parties to this Protocol.

Article 16

The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, as soon as practicable, consider the application to this Protocol of, and modify as appropriate, the multilateral consultative process referred to in Article 13 of the Convention, in the light of any relevant decisions that may be taken by the Conference of the Parties. Any multilateral consultative process that may be applied to this Protocol shall operate without prejudice to the procedures and mechanisms established in accordance with Article 17.

Article 16 bis

The Conference of the Parties shall define the relevant principles, modalities, rules and guidelines, in particular for verification, reporting and accountability for emissions trading. The Parties included in

Annex B may participate in emissions trading for the purposes of fulfilling their commitments under Article 3 of this Protocol. Any such trading shall be supplemental to domestic actions for the purpose of meeting quantified emission limitation and reduction commitments under that Article.

Article 17

The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session, approve appropriate and effective procedures and mechanisms to determine and to address cases of non-compliance with the provisions of this Protocol, including through the development of an indicative list of consequences, taking into account the cause, type, degree and frequency of non-compliance. Any procedures and mechanisms under this Article entailing binding consequences shall be adopted by means of an amendment to this Protocol.

Article 18

The provisions of Article 14 of the Convention on settlement of disputes shall apply *mutatis mutandis* to this Protocol.

Article 19

1. Any Party may propose amendments to this Protocol.

2. Amendments to this Protocol shall be adopted at an ordinary session of the Conference of the Parties serving as the meeting of the Parties to this Protocol. The text of any proposed amendment to this Protocol shall be communicated to the Parties by the secretariat at least six months before the meeting at which it is proposed for adoption. The secretariat shall also communicate the text of any proposed amendments to the Parties and signatories to the Convention and, for information, to the Depositary.

3. The Parties shall make every effort to reach agreement on any proposed amendment to this Protocol by consensus. If all efforts at consensus have been exhausted, and no agreement reached, the amendment shall as a last resort be adopted by a three-fourths majority vote of the Parties present and voting at the meeting. The adopted amendment shall be communicated by the secretariat to the Depositary, who shall circulate it to all Parties for their acceptance.

4. Instruments of acceptance in respect of an amendment shall be deposited with the Depositary. An amendment adopted in accordance with paragraph 3 above shall enter into force for those Parties having accepted it on the ninetieth day after the date of receipt by the Depositary of an instrument of acceptance by at least three fourths of the Parties to this Protocol.

5. The amendment shall enter into force for any other Party on the ninetieth day after the date on which that Party deposits with the Depositary its instrument of acceptance of the said amendment.

Article 20

1. Annexes to this Protocol shall form an integral part thereof and, unless otherwise expressly provided, a reference to this Protocol constitutes at the same time a reference to any annexes thereto. Any annexes adopted after the entry into force of this Protocol shall be restricted to lists, forms and

any other material of a descriptive nature that is of a scientific, technical, procedural or administrative character.

2. Any Party may make proposals for an annex to this Protocol and may propose amendments to annexes to this Protocol.

3. Annexes to this Protocol and amendments to annexes to this Protocol shall be adopted at an ordinary session of the Conference of the Parties serving as the meeting of the Parties to this Protocol. The text of any proposed annex or amendment to an annex shall be communicated to the Parties by the secretariat at least six months before the meeting at which it is proposed for adoption. The secretariat shall also communicate the text of any proposed annex or amendment to an annex to the Parties and signatories to the Convention and, for information, to the Depositary.

4. The Parties shall make every effort to reach agreement on any proposed annex or amendment to an annex by consensus. If all efforts at consensus have been exhausted, and no agreement reached, the annex or amendment to an annex shall as a last resort be adopted by a three-fourths majority vote of the Parties present and voting at the meeting. The adopted annex or amendment to an annex shall be communicated by the secretariat to the Depositary, who shall circulate it to all Parties for their acceptance.

5. An annex, other than Annex A or B, that has been adopted or amended in accordance with paragraphs 3 and 4 above shall enter into force for all Parties to this Protocol six months after the date of the communication by the Depositary to such Parties of the adoption or amendment of the annex, except for those Parties that have notified the Depositary in writing within that period of their non-acceptance of the annex or amendment to the annex. The annex or amendment to an annex shall enter into force for Parties which withdraw their notification of non-acceptance on the ninetieth day after the date on which withdrawal of such notification has been received by the Depositary.

6. If the adoption of an annex or an amendment to an annex involves an amendment to this Protocol, that annex or amendment to an annex shall not enter into force until such time as the amendment to this Protocol enters into force.

7. Amendments to Annexes A and B to this Protocol shall be adopted and enter into force in accordance with the procedure set out in Article 19, provided that any amendments to Annex B shall be adopted only with the written consent of the Party concerned.

Article 21

1. Each Party shall have one vote, except as provided for in paragraph 2 below.

2. Regional economic integration organizations, in matters within their competence, shall exercise their right to vote with a number of votes equal to the number of their member States which are Parties to this Protocol. Such an organization shall not exercise its right to vote if any of its member States exercises its right, and vice versa.

Article 22

The Secretary-General of the United Nations shall be the Depositary of this Protocol.

Article 23

1. This Protocol shall be open for signature and subject to ratification, acceptance or approval by States and regional economic integration organizations which are Parties to the Convention. It shall be open for signature at United Nations Headquarters in New York from

16 March 1998 to 15 March 1999. This Protocol shall be open for accession from the day after the date on which it is closed for signature. Instruments of ratification, acceptance, approval or accession shall be deposited with the Depositary.

2. Any regional economic integration organization which becomes a Party to this Protocol without any of its member States being a Party shall be bound by all the obligations under this Protocol. In the case of such organizations, one or more of whose member States is a Party to this Protocol, the organization and its member States shall decide on their respective responsibilities for the performance of their obligations under this Protocol. In such cases, the organization and the member States shall not be entitled to exercise rights under this Protocol concurrently.

3. In their instruments of ratification, acceptance, approval or accession, regional economic integration organizations shall declare the extent of their competence with respect to the matters governed by this Protocol. These organizations shall also inform the Depositary, who shall in turn inform the Parties, of any substantial modification in the extent of their competence.

Article 24

1. This Protocol shall enter into force on the ninetieth day after the date on which not less than 55 Parties to the Convention, incorporating Parties included in Annex I which accounted in total for at least 55 per cent of the total carbon dioxide emissions for 1990 of the Parties included in Annex I, have deposited their instruments of ratification, acceptance, approval or accession.

2. For the purposes of this Article, "the total carbon dioxide emissions for 1990 of the Parties included in Annex I" means the amount communicated on or before the date of adoption of this Protocol by the Parties included in Annex I in their first national communications submitted in accordance with Article 12 of the Convention.

3. For each State or regional economic integration organization that ratifies, accepts or

approves this Protocol or accedes thereto after the conditions set out in paragraph 1 above for the entry into force have been fulfilled, this Protocol shall enter into force on the ninetieth day following the date of deposit of its instrument of ratification, acceptance, approval or accession.

4. For the purposes of this Article, any instrument deposited by a regional economic

integration organization shall not be counted as additional to those deposited by States members of the organization.

Article 25

No reservations may be made to this Protocol.

Article 26

1. At any time after three years from the date on which this Protocol has entered into force for a Party,

that Party may withdraw from this Protocol by giving written notification to the Depositary.

2. Any such withdrawal shall take effect upon expiry of one year from the date of receipt by the Depositary of the notification of withdrawal, or on such later date as may be specified in the notification of withdrawal.

3. Any Party that withdraws from the Convention shall be considered as also having withdrawn from this Protocol.

Article 27

The original of this Protocol, of which the Arabic, Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited with the Secretary-General of the

United Nations.

Done at Kyoto this tenth day of December one thousand nine hundred and

ninety-seven.

Annex A

Greenhouse gases

Carbon dioxide (CO_2)

Methane (CH_4)

Nitrous oxide (N_2O)

Hydrofluorocarbons (HFCs)

Perfluorocarbons (PFCs)

Sulphur hexafluoride (SF_6)

Sectors/source categories

Energy

Fuel combustion

Energy industries

Manufacturing industries and construction

Transport

Other sectors

Other

Fugitive emissions from fuels

Solid fuels

Oil and natural gas

Other

Industrial processes

Mineral products

Chemical industry

Metal production

Other production

Production of halocarbons and sulphur hexafluoride

Consumption of halocarbons and sulphur hexafluoride

Other

Solvent and other product use

Agriculture

Enteric fermentation

Manure management

Rice cultivation

Agricultural soils

Prescribed burning of savannas

Field burning of agricultural residues

Other

Waste

Solid waste disposal on land

Wastewater handling

Waste incineration

Other

Annex B

Party	Quantified emission limitation or reduction commitment (percentage of base year or period)
Australia	108
Austria	92
Belgium	92
Bulgaria*	92
Canada	94
Croatia*	95
Czech Republic*	92
Denmark	92
Estonia*	92
European Community	92
Finland	92
France	92
Germany	92
Greece	92
Hungary*	94
Iceland	110
Ireland	92
Italy	92
Japan	94
Latvia*	92
Liechtenstein	92
Lithuania*	92

Luxembourg 92

Monaco 92

Netherlands 92

New Zealand 100

Norway 101

Poland* 94

Portugal 92

Romania* 92

Russian Federation* 100

Slovakia* 92

Slovenia* 92

Spain 92

Sweden 92

Switzerland 92

Ukraine* 100

United Kingdom of Great Britain and Northern Ireland 92

United States of America 93

* Countries that are undergoing the process of transition to a market economy.

SUPPLEMENT 4

LIST OF ABBREVIATIONS AND ACRONYMS

ENPEP	-	Energy and Power Evaluation Program
GDP	-	Gross Domestic Product
GHG	-	Greenhouse gases
IEA	-	International Energy Agency
IPCC	-	Intergovernmental Panel on Climate Change
KazNIIMOSK	-	Kazakh Institute for Environmental Monitoring and Climate
NCAR	-	National Center for Atmospheric Research
UKMO	-	United Kingdom Meteorological Office
UNDP	-	United Nations Development Programme
UNFCCC	-	United Nations Framework Convention on Climate Change
USAID	-	United Stated Agency for International Development
WMO	-	World Meteorological Organization

CAA – Clean Air Act. Акт о чистом воздухе.	SHA – Occupational Safety and Health Act (Administration). Акт о профессиональной езопасности здравоохранении (и соответствующее управление)
CWA – Clean water Act. Акт о чистой воде.	PIRG – Public Interest Research Group. Группа исследования общественных интересов.
EPA – Environmental Protection Agency. Агентство охраны окружающей среды.	PSI – Pollution Standards Index. Стандартный индекс загрязнения.
FDA – Food and Drug Administration. Управление по контролю за качество пищевых продуктов, медикаментов и косметических средств.	PURPA – Public Utilities Regulatory and Policies Act. Акт о регулировании и политике в области коммунальных услуг.
FIFRA – Federal Insecticide, Fungicide and Rodenticide Act. Федеральный акт об инсектицидах, фунгицидах и родентицидах.	RCRA – Resource Conversation and Recovery Act. Акт об охране и восстановлении ресурсов.
NEPA – National Environmental Policy Act. Акт о национальной политике в области окружающей среды.	SARA – Superfund Amendments and Reauthorization Act. Акт о реорганизации Суперфонда. («Акт о праве на информацию»).
NOAA – National Oceanic and Atmospheric Administration. Национальное управление по исследованию океанов и атмосферы.	SCS – Soil Conversation Service. Служба охраны почв.
NRC – Nuclear Regulatory Comission. Комиссия по контролю за ядерной энергией.	SDWA – Safe Drinking Water Act. Акт о безопасности питьевой воды.
NRDC – Natural Resources Defence Council. Совет охраны природных ресурсов.	TSCA – Toxic Substances Control Act. Акт о контроле над токсичными веществами.

SUPPLEMENT 5

STRUCTURAL VARIATION OF GROSS DOMESTIC PRODUCT IN THE REPUBLIC OF KAZAKHSTAN

	1990	1992	1994	1995	1996	1997	1998
GDP	100	100	100	100	100	100	100
Including							
Industry	20.5	30.9	29.1	23.5	24.5	20.7	22.0
Agriculture	34.0	23.1	14.9	12.3	12.4	11.0	8.4
Construction	12.0	8.7	9.7	6.5	4.4	4.2	4.4
Services	24.0	29.9	35.1	47.0	47.0	59.0	60.2
Including transport and communications	9.4	7.5	11.2	10.7	11.7	10.7	11.1
Net taxes on products and import						5.1	5.0

[Source: Report of the Work Group headed by K.B. Berentayev, April 1999]

SUPPLEMENT 6

CHEMICAL SYMBOLS

CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
N_2O	nitrous oxide
NO_x	nitrogen oxides
NH_3	ammonia
NH_2-	organic nitrogen of animal and plants
$CO\ (NH_2)_2$	carbamide
O_2	oxygen
O_3	ozone
SO_2	sulfur dioxide (gas)
SO_3	sulfuric anhydride//
H_2O	water
$C_6H_{12}O_6$	glucose

SUPPLEMENT 7

UNITS OF MEASUREMENT

°C	degree Celsius
W	watt
ha	hectare
GW	gigawatt
Gg	gigagram
kWh	kilowatt hour
km	kilometer
km^2	square kilometer
m	meter
m/s	meter per second
m^3	cubic meter
MW	megawatt
t	ton
toe	ton of oil equivalent
tce	ton of coal equivalent
TW	terawatt

SUPPLEMENT 8

METRIC SYSTEM AND EQUIVALENT ENGLISH UNITS

LINEAR MEASURE	1 centimeter (cm) * 10 = 1 cm = 0.39 inch 1 inch = 2.54 cm	1 decimeter (dm) * 10 = 1 dm = 3.94 inch 1 foot = 3.05 dm	1 meter (m) * 1,000 = 1 m = 1.09 yard 1 yard = 0.91 m	1 kilometer (km) 1 km = 0.62 mile 1 mile = 1.61 km
SQUARE MEASURE	Area of a square with a side of 1 cm equals 1 cm^2 1 cm^2 = 0.155 $inch^2$ 0.155 $inch^2$ = 6.45 cm2	Area of a square with a side of 1 m equals 1 m^2 1 m^2 = 10.8 $foot^2$ 1 m^2 = 1.20 $yard^2$ 1 $yard^2$ = 0.836 m^2	Area of a square with a side of 100 m equals 1 ha 1 ha * 100 = 1 km^2 1 ha = 2.47 acre 1 acre = 0.405 ha	Area of a square with a side of 1 km equals 1 km^2 1 km^2 = 0.39 $mile^2$ 1 $mile^2$ = 2.59 km^2
CUBIC MEASURE	Volume of a cube with a side of 1 cm equals 1 cm^3 / 1 milliliter (ml) 1 ml * 1,000 = 1 l 1 ml = 0.203 teaspoon 1 teaspoon = 4.9 ml	Volume of a cube with a side of 1 dm equals 1 dm^3 / 1 liter (l) 1 l * 1,000 = 1 m^3 1 l = 1.06 quart 1 quart = 0.95 l	Volume of a cube with a side of 1 m equals 1 m^3 1 m^3 = 264.2 gallon 1 m^3 = 36.5 $foot^3$ 1 m^3 = 28.4 bushel (dry) 1 m^3 = 1.31 $yard^3$ 1 $yard^3$ = 0.76 m^3	
WEIGHT MEASURE	Weight of 1 ml of water at 4 °C equals 1 gram (g) 1 gram = 0.035 ounce 1 ounce = 28.4 g	Weight of 1 l of water at 4 °C equals 1 kilogram (kg) 1 kg = 2.2 pound 1 pound = 0.45 kg	Weight of 1 m^3 of water at 4 °C equals 1 ton (t), long ton 1 t = 2,200 pounds 1 t = 1.1 short ton 1 short ton (2,000 pounds) = 0.91 t	

SUPPLEMENT 9

ENERGY UNITS AND EQUIVALENTS

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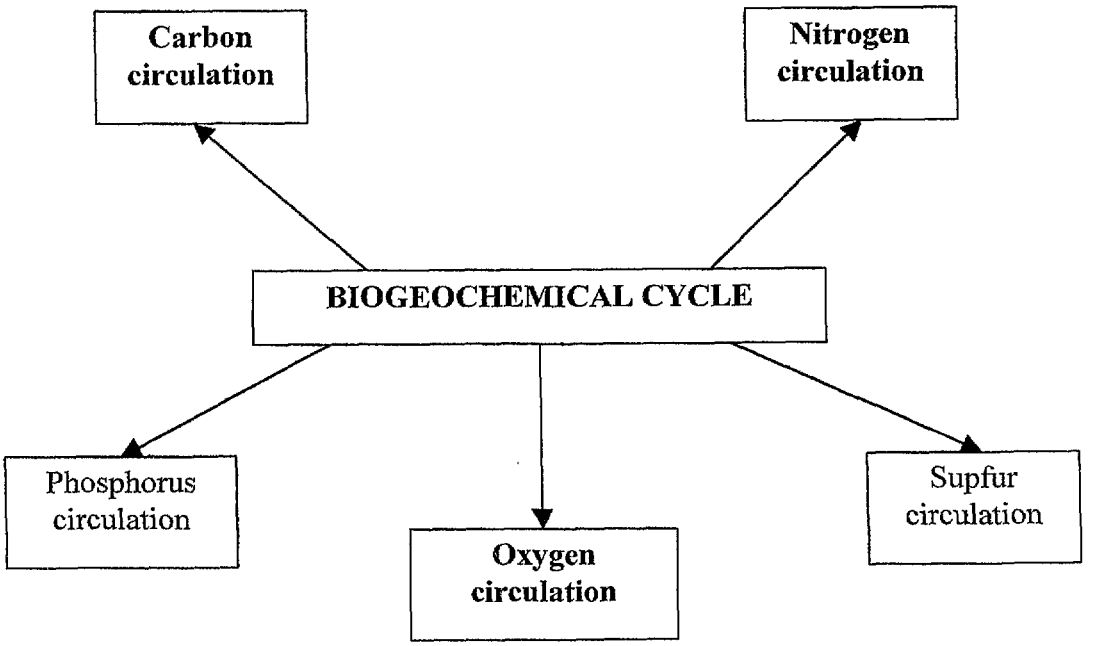
1 large calorie, food calorie, or kilocalorie (kcal) – amount of heat required to raise the temperature of 1 kg of water by 1 degree Celsius (1 °C).
1 BTU (British thermal unit) – amount of heat required to raise the temperature if 1 pound water by 1 degree Fahrenheit (5/9 °C).
1 kcal = 3.968 BTU
1 BTU + 0.252 kcal
1 therm = 100,000 BTU
1 quad = 1 quadrillion BTU
1 watt (W) = standard unit of electrical power
1 watt/hour (Wh) = 3.413 BTU
1 kilowatt (kW) = 1,000 BTU
1 kilowatt/hour (kWh) = 3,413 BTU
1 megawatt (MW) = 1,000,000 W
1 megawatt/hour (MWh) = 34.13 therms
1 gigawatt (GW) = 1,000,000,000 W = 1,000 MW
1 gigawatt/hour (GWh) = 34,130 therms
1 horsepower (hp) = 0.7457 kW; 1 hp/hour = 2,545 BTU
1 foot^3 of natural gas (methane) under atmospheric pressure = 1,031 BTU
1 gasoline gallon = 125,000 BTU
1 gallon of fuel oil # 2 = /// 140,000 BTU
1 short ton of coal = 25,000,000 BTU
1 oil barrel = 42 gallons

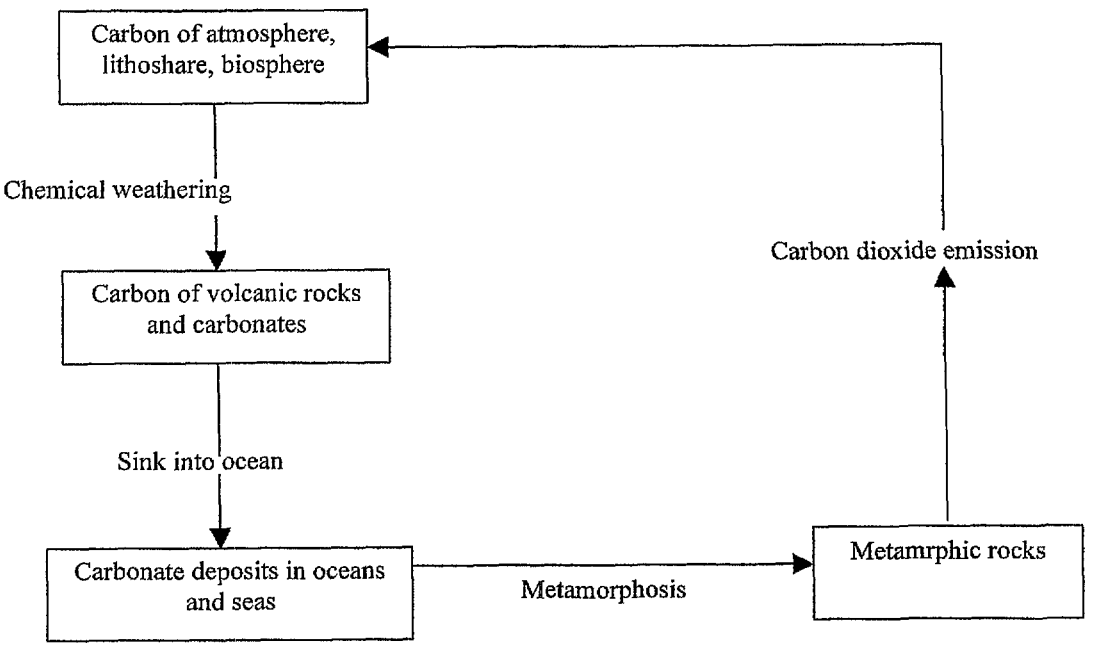
Long ton used in the USA is 1,016.047 kg, and short ton – 07.185 kg.

SUPPEMENT 10

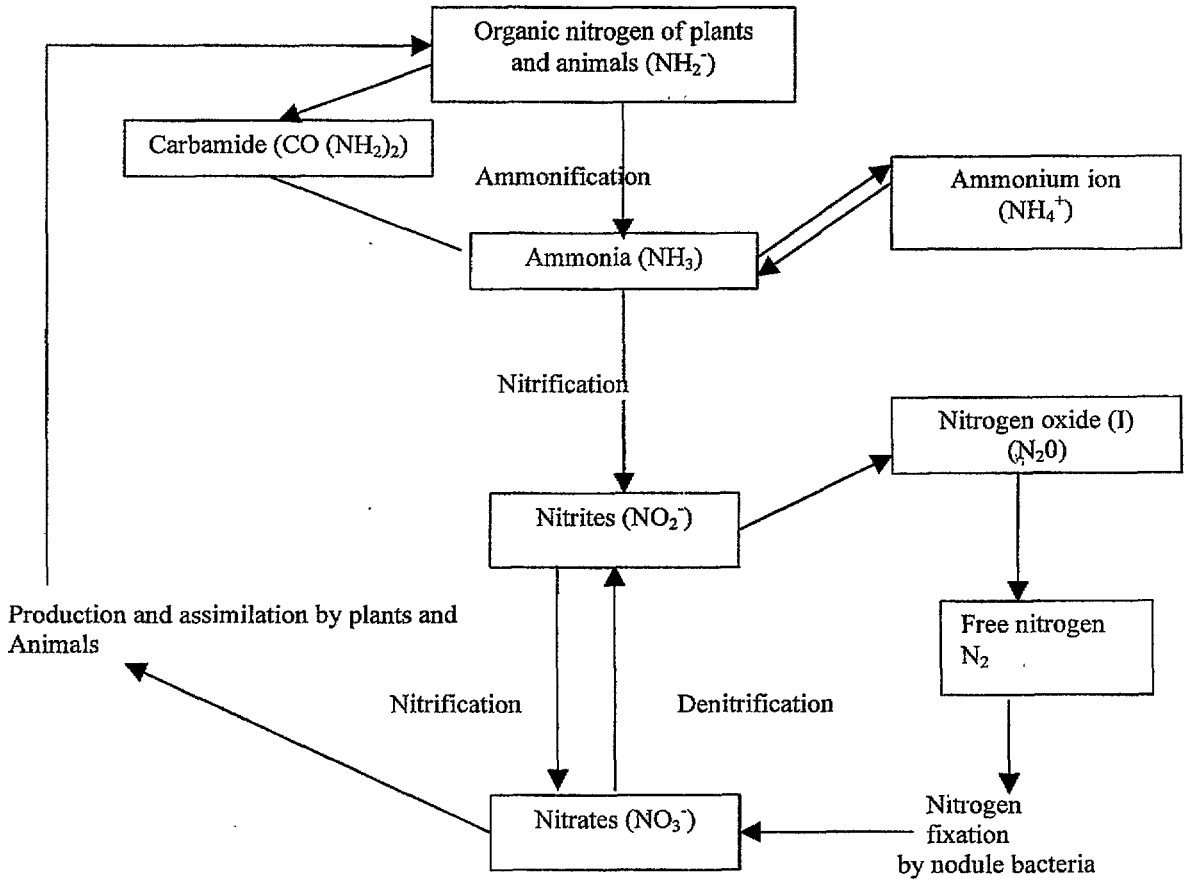
BIOGEOCHEMICAL CYCLE
[Source: G.V. Staditsky, A.I. Rodionov. Ecology, Saint Petesberg: Khimiya (Chemistry), 1995]



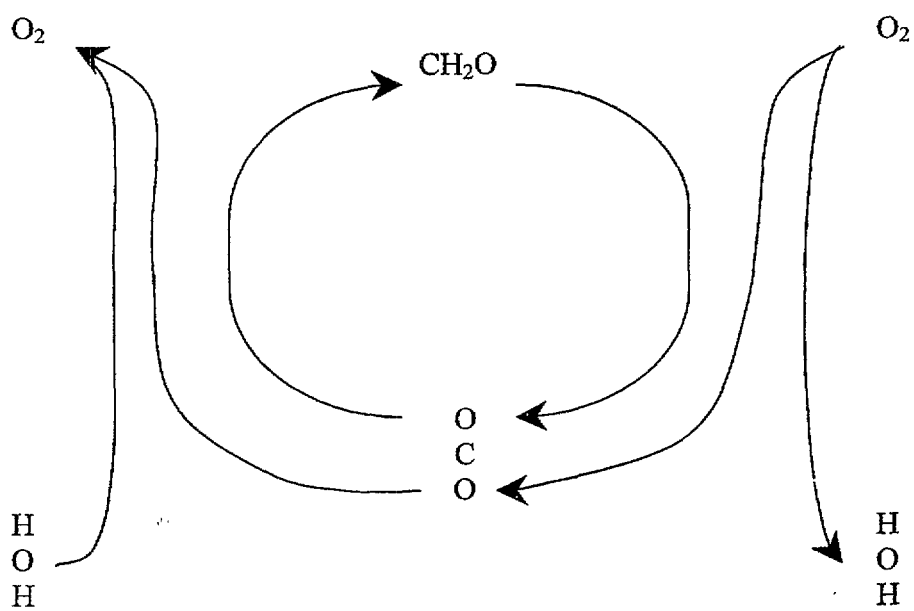
Great Circulation of Carbon



Nitrogen Circulation



Oxygen circulation



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