GLOBAL ENVIRONMENT FACILITY

Regional

Asia Least-Cost Greenhouse Gas Abatement Strategy (ALGAS) Project

Project Document

This Project Document has been edited to facilitate public dissemination. The original is on file in the GEF Office at UNDP Headquarters in New York.

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ABBREVIATIONS

AIT	Asian Institute of Technology
APCTT	Asian and Pacific Centre for Transfer of Technology
APDC	Asian and Pacific Development Centre
ADB	Asian Development Bank
ADB-OE	Asian Development Bank - Office of Environment
ASEAN	Association of South-East Asian Nations
CERI	Cost of emission reduction initiatives
CFC	Chlorofluorocarbon
FCCC	Framework Convention on Climate Change
GEF	Global Environment Facility
GHG	Greenhouse gas
GWP	Global warming potential
IIEC	International Institute for Energy Conservation
IPCC	Intergovernmental Panel on Climate Change
IRRI	International Rice Research Institute
MDB	Multilateral development bank
NCA	National Coordinating/Counterpart Agency
NGO	Non-governmental organization
NIC	National Implementing Committee
NPC	National Project Coordinator
OECD	Organization for Economic Cooperation and Development
PACE-E	Programme for Asian Cooperation on Energy and Environment
RBAP	Regional Bureau for Asia and the Pacific (of the United Nations Development Programme)
RPC	Regional Project Coordinator
RPRB	Regional Project Review Board
RSAP	Regional Scientific Advisory Panel
SARC	South Asian Regional Committee
STAP	Scientific and Technical Advisory Panel
START	Systems for Analysis, Research and Training
TCDC	Technical cooperation among developing countries
TERI	Tata Energy Research Institute
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
WMO	World Meteorological Organization
WRI	World Resources Institute

UNITED NATIONS DEVELOPMENT PROGRAMME

GLOBAL ENVIRONMENT FACILITY

Regional Project

Title:	Asia Least-Cost Greenhouse Gas Abatement Strategy (ALGAS) Project
Number:	RAS/92/G33
Duration:	Two years
Project Site:	Bangladesh, China, Democratic People's Republic of Korea, India, Indonesia, Mongolia, Myanmar, Pakistan, Philippines, Republic of Korea, Thailand and Vietnam
UNDP Sector:	Environment
Subsector:	Environmental Planning and Policy
Government Implementing Agencies:	The Governments of Bangladesh, China, Democratic People's Republic of Korea, India, Indonesia, Mongolia, Myanmar, Pakistan, Philippines, Republic of Korea, Thailand and Vietnam
Executing Agency:	Office for Project Services (OPS) of the United Nations Development Programme (UNDP) and the Asian Development Bank (ADB)
UNDP Approval:	August 1993
Estimated Starting Date:	February 1994
Government Inputs:	In kind (to be determined)
UNDP/GEF Inputs:	US$ 9.5 million (US$ 3.5 million in cofinancing to be provided by Australia

Brief Description:

The project will assist the twelve participating Asian countries in: (i) preparing an inventory of non-natural emissions and sinks of greenhouse gases (GHGs); (ii) evaluating the costs and effectiveness of measures available to reduce GHG emissions or enhance sinks; and (iii) developing the national action plan and policy responses required to implement the measures that are identified. The project will also enable institutions in the region to meet training needs under the Framework Convention on Climate Change (FCCC).

A. CONTEXT

1. Description of subsector

The Framework Convention on Climate Change

At the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro, Brazil, in June 1992, 154 countries signed the FCCC. The convention recognized the threat to development posed by climate change, and the need for countries to work together to reduce future emissions of GHGs, which have been identified as the primary cause of global climate change. The FCCC specifically outlined, in Article 4, a number of commitments for all parties, both developed and developing countries, to the convention. These commitments are intended to mitigate rapid climate change and, where impacts are negative, adapt to it. The developed country parties are also held to commitments to assist the developing country parties in meeting their obligations under the convention.

Ten general commitments are outlined in Article 4, paragraph 1, for which all parties are responsible:

- Developing national inventories on sources and sinks of all GHGs
- Formulating, implementing, and publishing national and regional programmes to mitigate climate change
- Promoting and cooperating in the development, application, and transfer of technologies, practices, and processes that control, reduce, or prevent GHG emissions
- Promoting sustainable management, and conserving and enhancing sinks and reservoirs of GHGs
- Cooperating in the adaptation to impacts of climate change
- Taking climate change considerations into account in relevant social, economic and environmental policies
- Promoting and cooperating in research and data development to understand and reduce the potential impacts of climate change
- Promoting and cooperating in the exchange of technical, scientific, socioeconomic and legal information related to the climate system and climate change
- Promoting and cooperating in education, training, and public awareness related to climate change
- Communicating to the Conference of Parties of the FCCC information related to implementation of the convention's commitments.

In addition to these general commitments for which all parties are responsible, the FCCC outlines a number of specific commitments for the developed country parties listed in Annex II of the FCCC. Most notable are the commitments of the developed country parties to:

- 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 (i.e., developing a national inventory of GHG sources and sinks, and national environmental action plans).

- Provide such financial resources, including those for 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 Article 4, and that are agreed between a developing country party and the international entity (i.e., the Global Environment Facility (GEF)) referred to in Article 11, in accordance with that article.

- Assist the developing country parties that are particularly vulnerable to the adverse effects of climate change in meeting the costs of adaptation to those effects.

- Promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and expertise to other parties, particularly developing country parties, to enable them to implement the provisions of the convention. In the process, the developed country parties shall support the development and enhancement of endogenous capacities and technologies of developing country parties.

This project is formulated within the context of the commitments of the developing country parties under the FCCC, and the commitments of the developed country parties to provide technical and financial resources to help the developing countries achieve their goal. The long-term objective of this project is to assist in the development and implementation of least-cost GHG emissions reduction plans in Asia. Once the government of each signatory country ratifies the FCCC, the country is obligated to assemble an official inventory of its GHG emissions. These inventories will serve as: the concrete starting points for ongoing international negotiations on reduction of GHG emissions; the baseline from which future emissions reductions (or increases) can be determined; and the basis for national planning in the sectors with GHG-emitting activities. These national inventories will also provide the basis for countries to begin the process of formulating least-cost GHG reduction strategies, promoting sustainable resource management, and conserving and enhancing GHG sinks and reservoirs.

Gases affecting climate change

The primary gases of anthropogenic origin that affect global climate can be divided into two groups. First are GHGs that have a direct effect on climate: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and a number of chlorine compounds (such as chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), and hydrofluorocarbons (HFCs)). The contribution to climate change of a particular GHG, for example, methane, depends on several factors, including its thermal

absorptive capacity, its expected lifetime in the atmosphere, its relative concentration in the atmosphere, and a number of other chemical, physical and dynamic factors. The global warming potential (GWP) of a particular gas is thus defined as a measure of its relative impact on global warming as compared to that of a similar mass of carbon dioxide, which is assigned a GWP of one. Thus, the GEF's Scientific and Technical Advisory Panel (STAP) has reported that the GWP for methane is 11; for nitrous oxide it is 270; for CFC-11 it is 3,400; and for CFC-12 it is 7,100.[1]

The second group of gases affecting the climate is made up of gases that have a negligible direct greenhouse effect, but that indirectly affect climate through their impact on chemical and physical processes in the atmosphere, and thereby on the GHGs that are affected by chemistry. Anthropogenic sources of gases that belong to this group are nitrous compounds (NO_x), carbon monoxide (CO), and non-methane volatile organic compounds (NMVOCs). The impact on climate of this second group of gases is not well known, but the Intergovernmental Panel on Climate Change (IPCC) is presently undertaking studies to improve the knowledge of the impact of these gases on climate.

Large amounts of carbon are continuously transferred between the atmosphere, the ocean, and the terrestrial biosphere. The understanding of the dynamics of these transfers is limited. The ocean is thought to be a net sink of the carbon dioxide released by human activities, but its influence on the dynamics of carbon dioxide absorption is not fully known. Terrestrial biomass is an important carbon sink, but more knowledge is needed to understand the potential of deforestation and reforestation/afforestation as tools for carbon sinks.

Prospects for global climate change

In the activities leading up to UNCED, the IPCC was established to examine the scientific aspects of climate change, to assess the possible impacts of such change, and to identify possible strategies for addressing climate change concerns. The reports of the IPCC Working Groups, first published in 1990, served as important inputs to the international negotiations on climate change. The 1992 IPCC update on *Scientific Assessment of Climate Change* affirmed its earlier findings, including:

- Emissions resulting from human activities are substantially increasing the atmospheric concentrations of the principal GHGs: carbon dioxide, methane, chlorofluorocarbons, and nitrous oxide

- The evidence from the modeling studies, observations, and sensitivity analyses indicates that the sensitivity of global mean surface temperature to doubling carbon dioxide is unlikely to lie outside the range of 1.5^0 to 4.5^0C

- Global mean surface air temperature has increased by 0.3^0 to 0.6^0C over the last 100 years.

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[1] "Analytical Frameworks for Global Warming, Biodiversity and International Waters", STAP, GEF, May 1993, p. 10.

The IPCC Report discusses several scientific factors that lead to uncertainties affecting the timing, magnitude, and regional patterns of climate change. The reduction of these uncertainties requires improvements in our scientific understanding of the processes that drive and mediate climate change, development of better climate models, the prediction of potential climate change impacts, the development of effective abatement measures, and other critical factors such as:

- The development of reliable national inventories of the sources and sinks of GHG emissions
- An improved understanding of the social, technological and economic processes, especially in developing countries, that are necessary to reduce the growth of GHG emissions and increase the preservation of GHG sinks
- An increase in the support for climate research activities across disciplines as well as national borders, with particular emphasis on the full and active involvement of developing countries
- The increased exchange of knowledge and expertise to address the issues of climate change.

GHG emissions from the participating countries

The countries participating in this regional project have a total population of about 2.6 billion—roughly half that of the entire world. Many of these countries are also experiencing economic growth rates among the highest in the world. It is not surprising that their emissions of GHGs are also increasing rapidly. Their active participation in the FCCC programme of GHG reduction is therefore essential for the success of international efforts to stabilize global climate.

Anthropogenic carbon dioxide is the primary GHG accounting for over 50 percent of the annual GWP of all GHGs emitted. The primary sources of anthropogenic carbon dioxide are the production and consumption of fossil fuels, and industrial sources (primarily cement manufacture). Carbon dioxide emissions due to energy production and use from the twelve countries participating in this regional project have been increasing rapidly, and now exceed 3.78 billion tons per year, according to a 1989 World Resources Institute (WRI) estimate. This amount of carbon dioxide represents approximately one-sixth of the world total. Given the relatively faster economic development of the region, this fraction is continuing to increase rapidly and is expected to exceed one-fifth of the global total by the year 2000. Annex 1 provides several tables and graphs that give an overview of total global GHG emissions, and show the contribution of the participating countries to that total. From this information it is evident that the primary activities that contribute to carbon dioxide emissions in the region are the consumption of coal and oil for the production of electric power and process heat. Petroleum consumption for transport is also a rapidly growing source of carbon dioxide emissions in the region.

Although a number of estimates of carbon dioxide emissions from changes in land use (for example, from forests to agriculture) have been made, their reliability remains questionable. Some international compendia indicate substantial emissions of carbon dioxide from land-use changes in

some of the participating countries. Improving the understanding and estimates of carbon dioxide emissions from changes in land use, and of the amount of carbon uptake in forests, must be addressed by the countries of the region if they are to understand and evaluate their options for reducing GHG emissions, and preserving and enhancing GHG sinks.

The contribution of the whole Asian region to global anthropogenic emissions of methane is estimated to be about 48 percent of the global total. The twelve Asian countries participating in this project contribute approximately 40 percent of the global anthropogenic methane emissions. Methane emissions in the region are derived primarily from wet rice cultivation and livestock; estimates of emissions from these sources are also subject to considerable uncertainty. Global anthropogenic methane emissions are estimated to account for over 11 percent of the GWP of GHGs.

In many developing countries, current information on the emissions of CFCs, nitrous oxide, and other minor GHGs is either non-existent or unreliable. There is an immediate need to assist these countries in establishing baseline estimates and growth rates of these GHGs, as a commitment of the parties to the FCCC.

Greenhouse sinks in the participating countries

The primary terrestrial sink of GHGs is forest and woodlands. In 1980, Asia was estimated to have approximately 668.42 million hectares of forests and woodlands, while global forest resources were estimated to be 5,288.56 million hectares.[2] Translating the carbon storage capacity of forests and woodlands is not a direct function of land area, but depends on a number of other variables, including plant species, densities and soil. One important factor to note is that an estimated one-third of the global net area of deforestation for 1981-90 occurred in the Asian region, in spite of the fact that the Asian region accounts for only 12.6 percent of the total forests and woodlands area worldwide. This alarming rate of net deforestation is reducing the terrestrial carbon sink capacity of Asia.

2. Host country/regional strategy

This regional project, hereafter referred to as the Asia Least-Cost Greenhouse Gas Abatement Strategy (ALGAS) project, will assist twelve major developing countries of Asia[3] to formulate least-cost GHG reduction strategies within the context of their individual economic, social and institutional development goals. It will enable them to analyze technological and economic options, and formulate policies for addressing climate change concerns, while allowing for development. It will also assist these countries in developing common, verifiable and acceptable methodologies for assessing all major GHG sources and sinks. The ALGAS project will also contribute to capacity building in the

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[2] *World Resources: 1992-93*. Report by WRI in collaboration with UNDP and UNEP, Oxford University Press, New York, 1992.

[3] While the Republic of Korea will participate in this project, its government will provide the resources to fund its share of project activities.

field of climate change through personnel training for research and analysis related to global climate change, and the strengthening of government and non-governmental organizations (NGOs) working in the area.

Economic development strategies in Asian countries are being modified as environmental awareness in the region grows. The majority of Asian countries, however, continue to have relatively low per capita incomes, along with some of the highest population growth rates in the world. Present development policies promote rapid economic growth rates without concern for sustainability or the global environment. For example, fossil fuel consumption is growing most rapidly in this region. Coal consumption grew by 63 percent in the 1980s and continues to grow even more rapidly in the 1990s, with similarly high growth rates for oil and gas consumption. Deforestation has also been relatively high in the Asian region, from both non-sustainable exploitation of forest resources, as well as pressure for conversion of forest lands to crop and pasture lands to support growing populations.

The developing countries of the Asian region are therefore seeking technical assistance, scientific information, and new technologies to help address the growing environmental and social problems they face. These countries also need help to make informed decisions, and to implement the choices that are ultimately made. The decisions that are beneficial for the global environment are, in most cases, also beneficial for sustainable development, and economical in the national context. Where this is not the case, the incremental costs of such actions need to be identified, and the opportunities for international assistance to meet these incremental costs must be secured. This project provides an excellent opportunity for regional and international cooperation that will be mutually beneficial from a national, regional and global perspective. It will stimulate, support, and accelerate regional cooperation on the critical issues of environment and development, and complement a number of other ongoing national and regional projects addressing other specific elements of environment and development.

The identification of least-cost GHG abatement strategies has many direct benefits for regional economic, social and sustainable development. Specifically, the ALGAS project will promote energy efficiency, development of renewable energy and low-carbon-based energy resources, more productive and energy-efficient industrial processes, better agricultural and land- use practices, and more advanced transport technologies and strategies. Within this context, the ALGAS project will support the development agenda of governments in the Asia region.

3. Prior and ongoing assistance

Ongoing GEF-related assistance

A number of GEF-funded projects on various aspects of climate change have been initiated on a regional or national basis. In addition, UNDP, the World Bank, the Asian Development Bank (ADB), and other multilateral and bilateral funding agencies are also providing technical assistance to several of the countries participating in this proposed regional project. An excellent opportunity to build an institutional framework for regional cooperation therefore exists. The regional or global initiatives of particular importance to the ALGAS project are:

- Global Change Systems for Analysis, Research and Training (START), GLO/92/G31

- The ADB Technical Assistance Regional Project, T.A. No. 5463-Regional, to assess the implications of global climate change in Bangladesh, India, Indonesia, Malaysia, Pakistan, Philippines, Sri Lanka and Vietnam

- The UNDP-supported global Research Programme on Methane Emissions from Rice Fields, GLO/91/G31/A/01/31, undertaken at the International Rice Research Institute (IRRI)

- The UNDP/GEF Global Monitoring of Greenhouse Gases Including Ozone, with the World Meteorological Organization (WMO) as the executing agency

- The UNDP-supported Programme for Asian Cooperation on Energy and the Environment (PACE-E), RAS/92/071

- The UNEP Country Case Studies on Sources and Sinks of Greenhouse Gases, GF/4102-92-01, which covers eleven countries, including China.

In addition to the relevant global and regional projects, a number of national projects on climate change have been initiated during the Pilot Phase of the GEF. Most notable among these are:

- China—Issues and Options in Greenhouse Gas Emissions Control (CPR/93/G32)
- India—Greenhouse Gas Reduction Strategy (IND/93/G31)
- India—Renewable Energy Resources Project (World Bank/GEF)
- Pakistan—Fuel Efficiency in the Road Transport Sector (PAK/92/G31)
- Thailand—Promotion of Electric Energy Efficiency (World Bank/GEF).

Arrangements for collaboration between these projects and the ALGAS project are described in Section B4.

In addition to related ongoing projects in Asia, several similar or related projects are being undertaken in other regions of the world. Specifically, the GEF is supporting regional least-cost GHG reduction strategy projects in the Arab States and in Sub-Saharan Africa, and most likely will support similar efforts in Latin America and the Caribbean. There are also numerous efforts ongoing in countries of the Organization for Economic Cooperation and Development (OECD) to improve techniques for monitoring, measuring and estimating GHG emissions. Most of these programmes are being coordinated by the OECD Expert Group on Estimation of GHG Emissions and Sinks, and the IPCC Working Group I. There are also an increasing number of national programmes throughout the world to address the issue of least-cost reduction strategies for GHGs. The experiences of these programmes will be valuable for this ALGAS project.

Project preparation missions to participating countries

To formulate the ALGAS project, a series of fact-finding missions to each of the participating

countries were conducted by a team of international consultants in late 1992. A mission report compiled for each country provides:

- A review of ongoing activities in the country related to the generation, measurement, and inventory of GHG emissions, and formulation of policies designed to reduce GHG emissions

- A summary of other ongoing bilateral and multilateral projects that were relevant to GHG-related topics

- An identification of the key activities in the country that need to be funded by the project, and the estimated level of funding and other support required, for example, technical assistance from outside consultants.

These fact-finding missions have provided a basis for this Project Document. Each mission is summarized in a detailed report, available from UNDP, prepared by the consultants who visited the participating countries. A brief summary of the key recommendations of each mission relevant to the technical assistance needs and national institutional framework for this project is also available. A summary of the present situation with respect to GHG inventories, reduction strategies, and planning in each participating country is presented below.

- *Bangladesh.* Initial estimates have been made for emissions of carbon dioxide and methane from some sources. No GHG emission measurements have been made so far. Economic analysis of options for reducing future emissions of GHGs has not yet been undertaken.

- *China.* Initial estimates have been completed for emissions of all the major GHGs. Some measurements have been taken for emissions of methane from rice paddies; similar measures have also been initiated for methane from animals. An economic analysis of options for reducing future emissions of carbon dioxide from energy has been initiated.

- *Democratic People's Republic of Korea.* Initial estimates have been made for carbon dioxide and methane emissions from some sources. No GHG emission measurements have been taken so far, nor has an economic analysis of options for reducing future emissions of GHGs been undertaken.

- *India.* Initial estimates have been completed for emissions of all the major GHGs, including methane emissions from rice paddies. The economic analysis of options for reducing future carbon dioxide emissions from the use of energy has been initiated.

- *Indonesia.* Initial estimates have been made for carbon dioxide and methane emissions from some sources. No GHG emission measurements have been made so far. The economic analysis of options for reducing future GHG emissions has been initiated on a limited basis.

- *Mongolia.* Initial estimates have been made for emissions of carbon dioxide and methane from some sources. GHG emission measurements have not been made, nor has an economic analysis of options for reducing future emissions of GHGs been undertaken.

- *Myanmar.* Initial estimates have been made for emissions of carbon dioxide and methane from some sources. GHG emission measurements have not been made, nor has an economic analysis of options for reducing future emissions of GHGs been undertaken.

- *Pakistan.* Initial estimates have been made for emissions of carbon dioxide and methane from some sources. No GHG emission measurements have been made so far. The economic analysis of options for reducing future emissions of GHGs has been initiated on a limited basis.

- *Philippines.* Initial estimates have been made for emissions of carbon dioxide and methane from some sources. Measurements have been made of emissions of methane from rice paddies (the IRRI is located in the Philippines), and from the burning of biomass. The economic analysis of options for reducing future emissions of GHGs has not yet been undertaken.

- *Republic of Korea.* Initial estimates have been completed for emissions of all the GHGs. No GHG measurements have been made so far, although measurements of methane emissions from rice fields have been initiated. The economic analysis of options for reducing future emissions of GHGs has been initiated, particularly for the energy sector.

- *Thailand.* Initial estimates have been made for emissions of carbon dioxide and methane. Emissions of methane from rice paddies have been measured. The economic analysis of options for reducing future emissions of GHGs has been initiated.

- *Vietnam.* Initial estimates have been made for emissions of carbon dioxide and methane from some sources. GHG emission measurements have not been made, nor has the economic analysis of options for reducing future emissions of GHGs been undertaken.

In general, estimates of GHGs are limited to emissions of carbon dioxide from the combustion of fossil fuels, and from cement production. Preliminary estimates of carbon uptake in forests are also available in some countries, as are rough estimates of methane emissions from rice fields. Improving the available estimates, and initiating estimates and measurements (when necessary) in countries where such information does not yet exist, are two of the operational goals of the ALGAS project.

4. Institutional framework for subsector

A number of national and regional institutions deal with environmental issues in Asia. Most of the countries here have environmental departments or ministries within their national government frameworks. Most also have private institutions or NGOs that undertake environmental research. However, the capability and institutional responsibilities for addressing issues of the global environment and climate change are embryonic or, in some cases, non-existent. This situation is further complicated by the fact that climate change issues are cross-sectoral and not restricted to a specific sector. For example, energy production and consumption is one of the major contributors to GHG emissions. In many countries, the responsibility for the energy sector is divided among a number of departments or ministries, which complicates the monitoring of energy-related activities. Similar disparities occur with regard to land use, agriculture, transport, and industry, making it difficult to coordinate national environmental policies and plans.

The preparatory work that was necessary for countries to participate in the IPCC and UNCED, along with the activities of the Pilot Phase of the GEF, have increased the awareness of climate changes issues in many of the developing countries in Asia. Most of the countries in the region have compiled national reports on global environmental issues that were presented at UNCED. Some of these reports outline preliminary strategies and plans for the countries to address climate change issues. Most of these reports, however, are rather broad and do not provide specific actions. The primary constraint identified in most of the country reports has been the lack of accurate and reliable information to assess least-cost GHG reduction strategies.

A number of regional and sub-regional organizations, as well as NGOs in Asia, are presently working to address key issues of climate change. The more prominent among these are the Asian Institute of Technology (AIT) in Bangkok, the Asian and Pacific Development Centre (APDC) in Kuala Lumpur, the Association of South-East Asian Nations (ASEAN) Working Group on the Environment, the Asian and Pacific Centre for Transfer of Technology (APCTT), the International Institute for Energy Conservation (IIEC) in Bangkok, and the Tata Energy Research Institute (TERI) in New Delhi.

In Asia, the national and regional institutional framework for addressing the issues of climate change needs to be strengthened. The ALGAS project can provide a basis to build on this process through the sponsoring of national and regional technical assistance, and the exchange of information and expertise. This institutional strengthening must be accomplished within a strategic framework of creating institutional services that will be supported beyond the life of this project.

B. PROJECT JUSTIFICATION

1. Problem to be addressed and the present situation

The overall objective of this project is to reduce emissions of GHGs in the Asian region. Experts in the region will be trained to:

- Improve their understanding and estimates of the sources and sinks of GHG emissions, and the adverse impacts of climate change

- More effectively assess, based on common and verifiable methodologies, the options for reducing sources and enhancing sinks of GHGs, and adapting to climate change

- Identify and implement cost-effective opportunities for limiting GHG emissions, increasing GHG sinks, and mitigating the adverse impacts of climate change.

The Asia region represents the single largest source of GHG emissions in the world. Asia as a whole is estimated to release 8.41 billion metric tons of carbon dioxide from fossil-fuel use, cement manufacture and land-use changes. This figure represents 30 percent of the 1989 global total of 28.26 billion metric tons of carbon dioxide emissions. Given the present trends of economic development and population growth in the region, the relative contribution of Asia to global GHG emissions will increase rapidly unless concrete action is immediately taken to reduce or reverse current trends.

The twelve participating countries of the ALGAS project account for approximately 69 percent of the total carbon dioxide emissions, and 84 percent of the methane emissions in the region. Within these countries, the major contributors to GHG emissions are China, India, Indonesia, the Republic of Korea, and Thailand, accounting for approximately 17.2 percent of the total GWP emitted in 1989.[4] These countries are responsible for over 57 percent of the carbon dioxide emissions, and 66 percent of the methane emissions, estimated to originate from Asia. When taking only the twelve participating Asian countries as a base, the "big five" countries account for 82 percent of the estimated carbon dioxide emissions, and 79 percent of the estimated methane emissions. By focusing a more intensive effort on these five countries, the ALGAS project would address more than four-fifths of the GWP attributable to these countries.

Emissions of carbon dioxide from fossil-fuel consumption and industrial processes are one of the primary sources of GHG emissions in the region. On a per capita basis, the emissions of these GHGs for the region are 1.93 tons per capita/year. This figure is significantly below the global average of 4.21 tons per capita/year. When viewed from an economic output perspective, however, the Asia region does not fare as well. For example, for every US $1,000 of GNP, China generates 6.08 tons of carbon dioxide; India generates 2.27 tons of carbon dioxide; Indonesia, 1.57 tons of carbon dioxide; and Thailand, 1.96 tons of carbon dioxide. In contrast, for US$ 1,000 of GNP, the former West Germany generated only 0.50 tons of carbon dioxide; Japan generates 0.10 tons of carbon dioxide; and the United States generates 0.93 tons of carbon dioxide. Similar contrasts can be derived for the other GHGs as well. These measures of carbon dioxide emissions per unit of economic output indicate that there is considerable room for economic growth in the Asian countries without necessarily increasing GHG emissions.

Reducing the intensity of GHG emissions while increasing economic development will require increasing the efficiency of energy use, reducing the heavy dependence of the region on fossil fuels, reducing the destruction of forest reserves, and improving agricultural practices to reduce methane emissions. Having reliable information on the sources, sinks, and dynamics of GHG emissions is

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[4] Intergovernmental Panel on Climate Change, *The IPCC Scientific Assessment*, J. Houghton, et al., Cambridge University Press, Cambridge, U.K., 1990.

a necessary precursor to formulating sound policies and strategies for reducing GHG emissions. Key objectives of this project will be to:

- Develop the necessary information on GHG sources and sinks, ensuring its reliability
- Assess, analyze, and verify the information, and report the results to the Secretariat of the FCCC
- Identify, formulate, and evaluate viable GHG reduction strategies and the cost of emission reduction initiatives (CERIs)
- Assist in securing the resources to implement the most cost-effective options.

2. Expected end-of-project situation

The proposed duration of this project is three years. On its completion, it is expected that there will be a significant and recognizable increase in the capacity of the region to assess the sources and sinks of its emissions, and to formulate strategies for the least-cost reduction of such emissions. Specifically, the following achievements should be realized at the end of this project:

- National baseline inventories of anthropogenic GHG emissions and sinks, including historical inventories that relate to past human and economic activities in the participating countries
- Development of common, verifiable, and acceptable methodologies for assessing GHG sources and sinks that also provide inputs to the formulation and adjustment of the IPCC methodology for assessing GHG sources and sinks
- A national/regional ability to apply IPCC methodologies for estimating and measuring existing GHG sources and sinks
- A national/regional ability to analyze the cost-effectiveness of available measures to reduce emissions or enhance sinks
- A national/regional capacity to develop projections of GHG emissions for development sectors
- A capacity to develop national and regional plans and policies to mitigate GHG emissions, and conserve or increase GHG sinks
- A portfolio of potential downstream investments to enhance and sustain institutional and infrastructure capacity to support actions that mitigate GHG emissions, and promote sustainable development
- An ability to implement the resulting national and regional plans to mitigate GHG emissions.

For those countries where more intensive project activities are planned, a comprehensive programme for limiting GHG emissions and increasing GHG sinks should emerge. The information developed should help to identify follow-up investments to support a development strategy that provides economic and social gains, while simultaneously reducing GHG emissions and increasing GHG sinks. This experience can then be transferred to other countries of the region.

3. Target beneficiaries

Projects supported by the GEF are expected to benefit the entire world community. The ALGAS project will make an important contribution to this goal by helping twelve countries (containing about half of the world population) to develop the technical and analytic capacity to explore options for reduction of GHG emissions now and in the future. In meeting its objectives, the project will also allow participating countries to meet the emissions inventory reporting requirements of the FCCC (once it has been ratified at the national level). The project will also identify a pool of cost-effective projects that could qualify for grants or concessional financing via international arrangements to be created by the Conference of Parties (COP) to the FCCC.

The knowledge and expertise gained as a result of this project will benefit participating nations in addressing GHG and climate change problems; it will also train them in analyzing other related issues. For example, the skills obtained in assembling a GHG inventory or measuring GHG emissions can easily be applied to estimating and measuring local air pollutants. The capabilities of institutions participating in the ALGAS project, including NGOs, will also be strengthened through other aspects of the project, such as training, the acquisition of on-the-job skills, networking with international experts, and the access to information provided during project implementation.

The ALGAS project will benefit participating countries by identifying GHG emissions reduction technologies in different sectors, such as the energy sector, that are likely to be justified as cost-saving measures on their own merits, independent of any GHG considerations. As a consequence, the project will point the way to further cost-effective investments that are economically justifiable, whether they are undertaken through private or public spending, with GHG emissions benefits as an added bonus.

4. Project strategy and institutional arrangements

Overall project strategy

The primary strategic objective of the ALGAS project is to reduce the net rate of growth of GHG emissions in Asia. The operational objective of the project is to develop and promote the technical capability to accomplish and sustain net reductions of GHG emissions throughout the region. With these objectives in mind, the major emphasis of project activities is on training, capacity building, information development, and analysis. Project activities will also emphasize the generation of cost-effective, technically feasible, and economically viable actions that will result in net reductions of GHG emissions.

Several larger countries in the region, including China and India, are presently undertaking GHG reduction studies. Thailand and the Republic of Korea are undertaking initiatives to reduce

energy consumption, while Indonesia is evaluating how best to preserve and increase GHG sinks. It is therefore proposed to divide the participating countries in this project into two groups based on their size. The larger participating countries are currently developing models and methodologies for analyzing GHG emissions. This project will build on these efforts and assist these countries in developing common and effective methodologies for assessing both GHG sources and sinks, as well as least-cost strategies for net reductions of GHG emissions. The larger countries—China, India, the Republic of Korea, Indonesia and Thailand— have participated in GHG emission analyses and the development of GHG emission scenarios, given various assumptions of economic and social development. As a result, these countries have more advanced national teams capable of advising their governments on the options and implications of various GHG reduction strategies. These countries, to a greater extent, also have the capabilities to apply the IPCC methodologies for assessing their inventories of GHGs.

The smaller participating countries of the region—Bangladesh, the Democratic People's Republic of Korea, Mongolia, Myanmar, Pakistan, the Philippines and Vietnam—have not initiated detailed GHG assessments. They can benefit from the experience of the larger countries through an inter-regional exchange training programme. The approach of this project will be to have the larger countries complete their GHG inventories and initiate the development of least-cost GHG reduction strategies and CERI curves, while the smaller countries prepare their GHG inventories (i.e, meet the basic commitments of the FCCC). Subsequently, in a process of managed technical cooperation among developing countries (TCDC), the experts of the larger countries will assist and train experts in the smaller countries to develop relevant least-cost GHG reduction strategies and CERI curves. In the process, opportunities for investments in actions and projects that lead to net reductions of GHG emissions will be identified, along with the financing sought to implement these actions and projects.

Regional institutional arrangements

A summary of the ALGAS project's institutional arrangements is presented in Figure 1.

UNDP/Regional Bureau for Asia and the Pacific (RBAP)

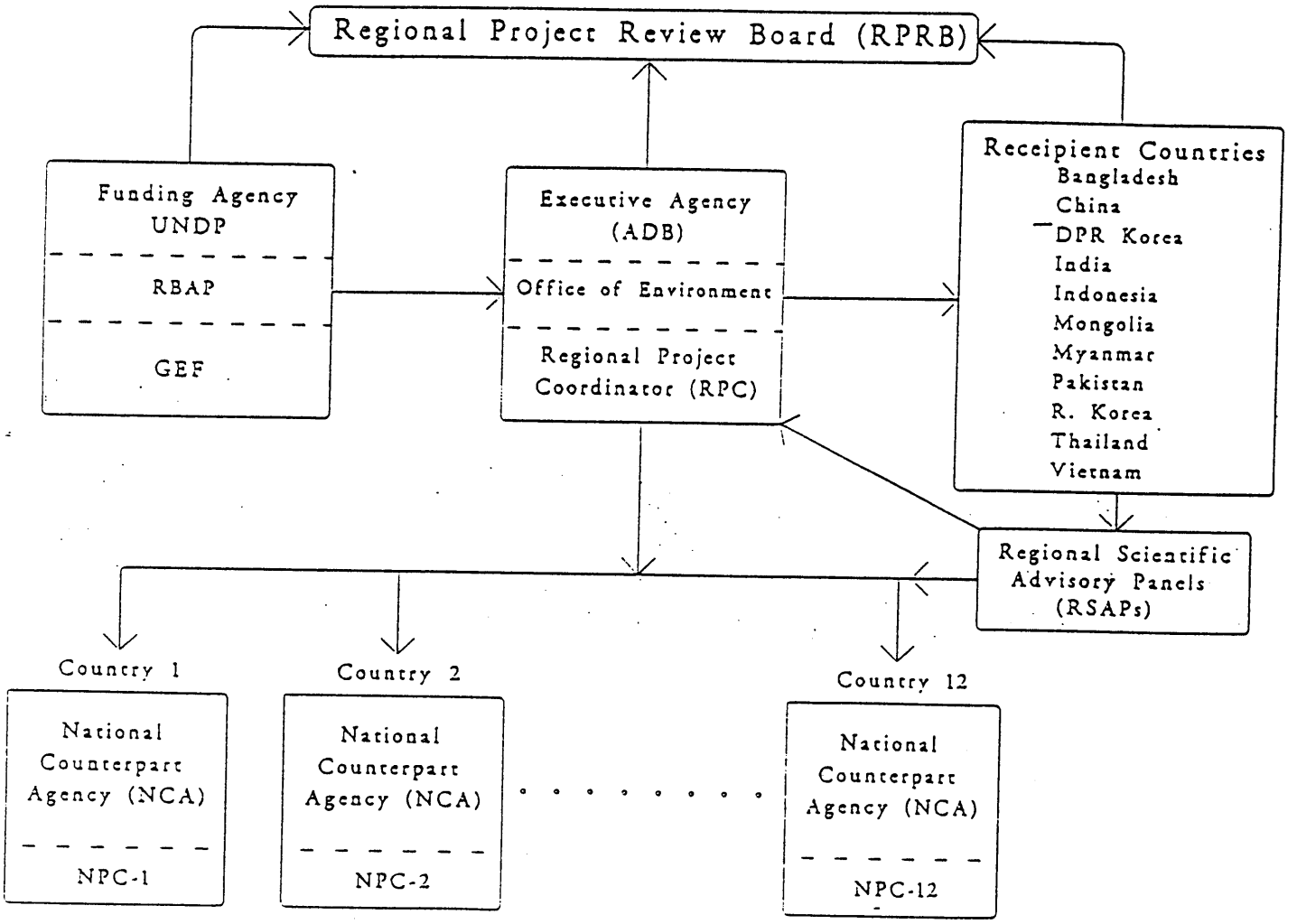
The primary role of UNDP/RBAP will be to provide overall guidance to the project through close collaboration with, and monitoring of, the regional executing agency. In this regard, UNDP/RBAP personnel will be intimately involved in the Regional Project Review Board. They will review and comment on all project outputs, participate in key workshops and training seminars, and provide general inputs and advice to the regional executing agency. In addition, UNDP/RBAP will be responsible for reviewing and approving any future changes or modifications to the ALGAS Project Document. UNDP/RBAP's intimate role in this project recognizes the fact that the outputs of the ALGAS project will significantly influence the Bureau's development of future GEF and other related development projects for the region.

Regional executing agency

The executing agency for this regional project will be the Asian Development Bank (ADB). The ADB works closely with governments of the region and is actively present in almost all of the

countries participating in this project. Its primary role is to assist its developing member countries (DMCs) in economic, social and environmentally sound development. In carrying out its obligations, the ADB maintains strong lines of communications with its DMCs, as well as a continuing dialogue on economic, social and environmental policy reforms. It is for these reasons that the ADB is ideally suited to execute this regional project to develop and implement least-cost GHG reduction strategies that are consistent with national development objectives.

Figure 1: Project organizational chart



The ADB's Office of Environment (ADB-OE) will have primary responsibility for the execution of this project. The ADB-OE has experienced staff familiar with local, national, and global environment and development concerns of the bank's DMCs. The staff of the ADB-OE are also in constant contact with key personnel in the potential national counterpart agencies. The ADB has initiated an eight-country study in Asia dealing with global environmental issues. The study particularly emphasizes estimates of GHG emissions and the likely impacts of climate change on these countries. Thus, the ADB is in an excellent position to provide additional input and support for the ALGAS Project.

Regional Project Coordinator (RPC)

The ADB will have the responsibility of appointing a full-time Regional Project Coordinator (RPC). The RPC should be proficient in all the techniques and methodologies for assessing GHG sources and sinks, as well as in all aspects of GHG reduction strategies. Furthermore, the RPC should be familiar with the countries of the region, and preferably have extensive working experience in the region. Finally, the RPC should be experienced in matters of training, capacity building, project identification and project implementation. The RPC will be based at the headquarters of the ADB to foster day-to-day contact with the operational staff of the ADB. The progress and results of the ALGAS Project can thus be effectively communicated to ADB operational staff, and the inputs of the ADB's staff encompassed within the project. The housing of the RPC at the ADB will also result in leveraging ADB, GEF, and other multilateral development bank (MDB) and bilateral follow-up investments in viable GHG reduction strategies identified by the project.

As executing agency, one of the first tasks of the ADB is to define a detailed three-year work programme to achieve the objectives, goals and outputs of the ALGAS project. This work programme will be subject to review and approval by UNDP and the participating countries. Within guidelines described by the GEF and UNDP, ADB will also have the authority and responsibility to re-allocate project resources to enhance the effectiveness of the project. The final disposition of project resources (for example, specific allocation of funding for in-country consultants, the services of international consultants, and funds for equipment purchase) will be influenced by discussions and negotiations between the ADB RPC and counterpart officials in each participating country. Any revisions to the project budget will require the approval of UNDP.

Regional Scientific Advisory Panels (RSAP)

In order to assist the RPC in the execution of the ALGAS project, a limited number of Regional Scientific Advisory Panels (RSAPs) should be constituted to address specific issues of relevance to the project. The issues to be considered should result in expert panels on:

- Measurement and assessment of GHG sources
- Measurement and assessment of GHG sinks
- Identification, analysis, and implementation of GHG emission reduction policies and strategies.

Regional, rather than national, scientific advisory panels will help foster regional information exchange on topics of mutual interest to the panel members. These RSAPs could also form the

planning and implementing nucleus for conducting workshops and training seminars on topics within their realms of expertise.

Regional Project Review Board

To ensure that the execution of the ALGAS project meets with the objectives of the project sponsor (UNDP/GEF) and the project recipients (the participating countries), a Regional Project Review Board (RPRB) will be constituted. The RPRB will be co-chaired by representatives of the UNDP/RBAP and the ADB's Office of Environment. The members of the RPRB would be the senior representatives of the national counterpart agencies in each of the participating countries. The RPRB will meet at the beginning of each project year to review the results of the previous year, and to review and approve the proposed work programme for the following year. The annual meetings of the RPRB will also serve to identify opportunities for additional technical assistance and investments that are necessary to follow-up on the initiatives of the regional project. The RPRB would also be the venue for the annual tripartite project review that is required for all UNDP technical assistance projects. Finally, the RPRB would meet at the end of the final year of the project to review the results of the project, make recommendations for follow-up actions to support the successful initiatives of the project, and draft plans to carry forward the project's essential services.

National institutional arrangements

National coordinating/counterpart agencies

Although all of the countries in this regional project are signatories of the FCCC, there is a great deal of diversity in each country's arrangements for addressing global climate change. All of the countries have already either designated or proposed organizations (listed below) to be the focal points or National Coordinating/Counterpart Agencies (NCAs) for the ALGAS project. Where the decisions have yet to be made, some of the likely candidate organizations for in-country project coordination are shown in parentheses. In each case, the primary tasks of the NCA will be to act as the contact point for the ADB's RPC, associated staff, and the project's international consultants. The NCA will therefore be the primary national agency responsible for carrying out the project. The national agencies that have been tentatively identified in the project preparation missions are:

Participating country	**Designated (proposed) coordinating agency**
Bangladesh	(Ministry of Environment and Forests)
China	State Science and Technology Commission
Democratic People's Republic of Korea	General Bureau of Environment and Land Administration
India	(Ministry of Environment and Forests; Ministry of Finance)
Indonesia	(Ministry of Population and Environment)
Mongolia	Ministry of Environment and Natural Resources
Myanmar	National Commission for Environmental Affairs
Pakistan	(Ministry of Environment and Urban Affairs)
Philippines	(Interagency Committee on Climate Change)

Republic of Korea	Ministry of Energy and Resources
Thailand	(Ministry of Science, Technology and Environment)
Vietnam	Hydrometeorological Service of Vietnam

National Implementing Committee

In each country, a National Implementing Committee (NIC) will be established with representatives of all agencies in country that will need to be involved in the implementation of project activities, or in the results of the project. The NIC will be coordinated and chaired by the senior representative of the designated NCA. The primary objective of the NIC will be to facilitate national execution of project activities and implementation of the project's results. The NIC will, if practicable, include representatives from all of the primary GHG-emitting sectors of the economy. The NIC will also include representatives of key development, economic, and environmental policy-making institutions, as well as key NGOs that can participate and assist in implementation of the project. The NIC will also review and comment on key national project decisions and outputs.

5. Reasons for GEF assistance

The FCCC, signed by the countries in this regional project, calls on all the countries of the world to cooperate in addressing the threats posed by global climate change. It also recognizes the need for these societies to continue economic development. This regional project will assist these countries in identifying least-cost strategies for reducing projected GHG emissions that are compatible with their goals of economic, social and sustainable development. The project will enable the participating countries to:

- Prepare more accurate inventories of the emissions and absorption (sinks) of GHGs
- Identify technologies that might contribute to reducing future emissions and enhancing future absorption of GHG
- Undertake detailed cost-benefit analyses of the identified technologies.

All of these activities are essential for the formulation of national and regional policies for addressing issues of global climate change without compromising development. The project is therefore well suited to receiving assistance from the GEF.

In work related to the global environment, special attention is needed for capacity building, human resource development, and institutional strengthening. These are all objectives of Agenda 21 where UNDP has the lead responsibility. The UNDP has special advantages for supporting the ALGAS project. Besides being the premier multilateral technical assistance agency, it maintains an effective global network for information exchange, technology transfer, and exchange of expertise. Furthermore, UNDP's field presence in the developing countries can be drawn upon to ensure technical and administrative support, as well as backstopping for the project. Finally, the proposed project meets the guidelines for UNDP participation in the GEF.

The work to be supported by this project would benefit from additional funds. While the amount of support currently available from UNDP and GEF is limited to the level described in this document, the activities undertaken in the course of this project will be attractive to additional bilateral and multilateral donors. Their participation can be expected to augment project funds to broaden and enhance the scope of project activities.

6. Special considerations

There are a number of special considerations associated with the ALGAS project. Foremost amongst them is the project's direct link with the preservation of the global environment. The countries participating in the ALGAS project represent about half the world's population. The region is the fastest-growing in the world in terms of economic development. Global efforts to deal with climate change would have no hope of succeeding without the active participation of these countries.

The countries participating in this project will benefit directly by having better information for policy-making and, by expanding the limited cadre of trained personnel in this area, for the assessment of GHG sources and sinks. The project will result in human resource development, capacity building, and technology transfer. By virtue of its regional activities, the project will promote technical cooperation among developing countries (TCDC). The project also calls for close collaboration with NGOs on a national and regional basis.

Some components of the project will be particularly beneficial to enhancing the role of women in development. For example, the use of firewood for cooking in developing countries results in substantial exposure of the persons, mainly women, to high levels of air pollution. Improvements in energy efficiency, as well as the use of cleaner fuels, would improve the health of this large group of women, in addition to achieving benefits related to global climate change. The enhancing of GHG sinks through increased reforestation should result in better availability of fuelwood, thus reducing the time and effort spent by rural women in gathering fuelwood.

Whenever possible, the project will draw on the expertise of the private sector for information on emissions, alternative technologies, and economic analyses. The project will attempt to forge private-public partnerships to develop strategies for reducing GHG emissions or enhancing GHG sinks.

7. Coordination arrangements

The project will actively seek formal and informal links with appropriate institutions and other projects both within and outside the region. These arrangements will ensure the maximum benefit from information and expertise exchange, and avoid the duplication of activities. Specifically, the ALGAS project will establish information links with the ongoing GHG monitoring and inventories by the Organization for Economic Cooperation and Development (OECD) on behalf of the IPCC. The ADB-RPC will jointly sponsor review workshops and training seminars held by the OECD/IPCC Expert Panel on the estimation of GHG emissions and sinks, especially as they relate to the key issues of the region. To the extent desirable and feasible, the ALGAS project will build on existing operational mechanisms in the region such as those created through the efforts of START, UNEP/RISO and IPCC/OECD. This collaboration would include sponsoring of common

workshops, association with or establishment of common scientific advisory bodies, exchange of technical experts, and exchange of technical reports. Through closer collaboration and direct operational linkages, the ALGAS project will minimize duplication of activities and actively benefit from other ongoing activities in the region. The project will also establish information exchange links with other GEF projects that are specifically related to developing methodologies for inventories or measurement of GHG sources and sinks, including:

- The START programme, particularly for its work in Indonesia, the Philippines and Thailand on the assessment of biological sources and sinks
- The project, Interregional Research Programme on Methane Emissions from Rice Fields, undertaken by International Rice Research Institute (IRRI) in the Philippines
- The project, Global Monitoring of GHGs Including Ozone, undertaken by the World Meteorological Organization (WMO)
- UNEP studies on the monitoring of GHGs and the modeling of its impacts on climate change.

This project will coordinate, primarily for information exchange, with the executing agencies undertaking the regional least-cost GHG reduction strategy projects in the Arab States and Sub-Saharan Africa. It will also attempt to coordinate with ongoing national GEF projects that address climate change issues, particularly those on GHG reduction strategies in China and India. Finally, this project will coordinate, through active participation and information exchange, with a number of the international and regional institutions undertaking related work in the Asian region, including:

- UNDP/ESCAP, in particular the PACE-E project
- Food and Agriculture Organization (FAO), in particular its Regional Wood Energy Development Programme based in Bangkok
- The Asian Institute of Technology (AIT), in particular its training programme on energy efficiency and renewable energy
- The Asia Pacific Development Centre, in particular the results of its energy-environmental policy research
- The environmental committees or working groups of the Association of South-East Asian Nations (ASEAN) and the South Asian Regional Committee (SARC).

8. Counterpart support capacity

The project preparation missions that were undertaken in all the participating countries were assured of the strong desire of all the countries to participate in the ALGAS project. However, the level, ability, and availability of resources for counterpart support varied from country to country. Specific arrangements for counterpart support were not established during these project preparation

missions. The project's executing agency, the ADB, will undertake this responsibility prior to start-up of the project. Arrangements for counterpart support capacity on this project will be formulated during the discussions between ADB and each of the participating countries. The governments of the participating countries will be required to select and support in-country teams to be directly involved in carrying out the project's activities. It is expected that these teams will be composed of government professional staff and in-country consultants, hired using project funds. The governments will also be required to provide the necessary office accommodation, local transportation, support staff, information, and other facilities that are necessary for the effective execution of the project. Governments will also allocate to the project the time of government staff participating in the project, particularly those officials named as National Project Coordinator (NPC) and those participating in the Regional Project Review Board (RPRB). The selected National Coordinating Agency (NCA) and other appropriate government organizations will be responsible for nominating suitable persons for training and study tours associated with the project. These persons will be directly involved in the current project, and in future work on global climate change after completion of this project.

The cost and value of in-kind contributions made by the participating countries will be determined during discussions between the governments and ADB. Due to the eligibility criteria for GEF, the resources for the implementation of the ALGAS project in the Republic of Korea will have to be mobilized by its government.

C. DEVELOPMENT OBJECTIVE

1. Sustainable development

The environmental objectives of this project are to limit the growth of GHG emissions from Asia, and to build a substantial pool of expertise in the region for addressing issues of global climate change. Expertise will be developed in areas such as the estimation and measurement of GHGs, identification of technologies and initiatives for reducing GHGs, and economic and social analyses for identifying cost-effective mitigation options. The activities of this project will contribute to the overall process of introducing sustainable development to the region.

2. Regional cooperation

The ALGAS project emphasizes regional cooperation. Its geographical scope encompasses most of Asia, and its organizational structure is based on the integration of inputs from twelve participating countries. It seeks to enhance regional capabilities in a number of critical environmental and natural resource disciplines which will ultimately allow the nations of the region to more effectively meet their commitments to the FCCC. Asian countries have demonstrated their concern for the global environment by having one of the highest participation rates in global environmental conventions. This project intends to build on this commitment by developing national indigenous capabilities to actively address these environmental issues. The goals of this project are consistent with the development objectives of all the countries in the region.

D. IMMEDIATE OBJECTIVES, OUTPUTS AND ACTIVITIES

1. Project objectives

Long-term objectives

The long-term objectives of this project are to:

- Develop human resources, institutional capability and technologies to understand and address the issues relating to climate change
- Reduce the growth of net GHG emissions in the Asia region.

Short-term objectives

The short-term objectives are to assist the countries in the region to:

- Prepare and present a baseline inventory of natural emissions and sinks of GHGs, and to prepare a historical inventory (where possible) of the indicators that link human activity to these GHG emissions
- Make reliable measurements of GHG emitting and absorbing processes for which the OECD/IPCC emission or absorption factors may be different, thereby providing valid inputs to the formulation or modification of the evolving IPCC methodology
- Develop a common, verifiable, and acceptable methodology for assessing GHG sources and sinks that is particularly suitable for application in the Asia region
- Analyze measures available to reduce emissions or enhance sinks by estimating the costs and effectiveness of these measures
- Develop projections of GHG emissions and absorption based on different economic and social development scenarios
- Formulate regional and national policy responses to mitigate climate change
- Identify and provide the training needs to meet the above objectives.

2. Immediate objectives

IMMEDIATE OBJECTIVE 1

Develop and improve the regional and national capacity to undertake, prepare, and present baseline and historical inventories of GHG emissions and sinks to meet the standards and requirements of the FCCC.

Output 1.1 A draft manual that presents, in straightforward and operational terms, the present state-of-the-art methodology for determining and accounting for GHG emissions and sinks. This output will draw heavily on the IPCC/OECD methodologies that are presently being finalized, translating them into simplified operational terms.

Activities for Output 1.1

1.1.1 Review the literature including the IPCC/OECD Working Group I draft guidelines for estimation of GHG emissions and sinks. Include a review of all other alternative methods that have been proposed, paying special attention to those methods originating and being used in the Asian region.

1.1.2 Assess recently developed inventories, especially those from the region, to determine the methodologies used to derive these inventories. This assessment will determine differences in methodologies that could result in different results from that of the IPCC methodology.

1.1.3 Assemble the information obtained in the previous activities into a useable and practical manual that presents, in a step-by-step format, the process for undertaking, preparing, and presenting inventories for GHG emissions and sinks.

Output 1.2 Establish NCAs in the participating countries that will ultimately be responsible for generating the national GHG inventories.

Activities for Output 1.2

1.2.1 Assess the existing technical capacity and expertise of the NCAs to undertake the national GHG emission and sink inventories.

1.2.2 Conduct national and regional needs assessment for human and technical resources necessary to support the production of GHG emission and sink inventories.

1.2.3 Assist in establishing working cells within the NCAs in participating countries to undertake the GHG inventories. These working cells will be primarily responsible for working with this project to support the in-country activities necessary to produce comprehensive GHG inventories. Staff for the working cells should be drawn from relevant national agencies that represent major sources or sinks of GHGs.

1.2.4 Assist the established working cells in formulating a work programme to generate updated GHG emissions inventories. This work programme will be reviewed annually and modified as necessary.

1.2.5 Conduct national and regional training workshops and seminars to improve the capacity and expertise of the human resources within the established national working cells. Focus more attention on those countries with little or no existing capacity to undertake the GHG inventories, so as to initiate the capacity-building process.

Output 1.3 A regional support network for preparing GHG inventories by developing within carefully selected regional institutions the necessary training and support capacity for the national GHG inventory working cells.

Activity for Output 1.3

1.3.1 Conduct a survey of the GHG inventory expertise and capacity within the existing regional institutions. Give particular priority to regional institutions that have demonstrated prior experience and which are internationally recognized. Consider the possibility of multiple institutions, especially with respect to capacity in GHG inventories versus sinks.

1.3.2 Develop a training programme on the preparation and presentation of GHG inventories. Specifically work with the regional institutions selected in Activity 1.3.1 to develop an appropriate training protocol, handbook, manuals and software.

1.3.3 Conduct regional training workshops and seminars on the preparation of GHG inventories. Organize at least two major regional training workshops on the methodology for the preparation of GHG emission and sink inventories.

IMMEDIATE OBJECTIVE 2

Improve the reliability and reduce the omissions in the GHG emission and sink inventories for the region.

Output 2.1 Delineation of specific areas of the GHG inventory which are considered unreliable, or for which no data exists for countries in the region. This may be particularly true for areas such as methane emissions from rice paddies and livestock and for other GHGs such as CO, N_2O and NO_x. Estimates of GHG sinks are also recognized to be less reliable due to the enormous variations that can exist with regard to the capacity and dynamics of GHG sinks.

Activities for Output 2.1

2.1.1 Identify the specific categories of GHG emissions and sinks considered to be questionable by reviewing the current literature on the subject, and by communicating with the IPCC Working Group I experts.

2.1.2 Identify areas of the GHG inventory methodology for considerable variations for established methodologies. This can be accomplished by comparing the results of the IPCC methodology with the results of other methodologies being applied in the region.

2.1.3 Obtain existing field measurement data on GHG emissions and sinks, especially from the numerous ongoing national and regional projects that are addressing this issue.

Output 2.2 Recommendations for the modification of the GHG inventory methodology, based on a comparison of actual field data and the prescribed methodology.

Activities for Output 2.2

2.2.1 Compare the results of the available field measurements with the results generated by the currently accepted methodologies. Identify those areas where significant deviations exist and attempt to determine the reasons for the deviations.

2.2.2 Convene the RSAPs to review the results of field data compared to the prescribed methodology. Based on the results of the RSAP review, solicit specific recommendations for modifications and improvements in the methodology.

2.2.3 Apply the modified methodologies to the existing GHG inventories. Generate updated inventories and compare them to the previous inventories to determine the degree of deviation.

Output 2.3 Generation of data to replace existing omissions in the GHG inventories. This may require implementing specific field measurements or applying sophisticated methodologies that may not easily be possible on a national basis. In such cases, regional approaches and expertise should be utilized.

2.3.1 Identify specific omissions in the GHG inventories. Create a matrix of countries and GHG categories and identify data on a country-by-country basis.

2.3.2 Determine the primary reasons for the data omissions. Determine if they are specifically due to the lack of secondary data from which estimates are derived, or the lack of capacity and expertise to develop the data.

2.3.3 Define the options for developing the omitted data. Rely on the IPCC methodology if it exists. Where the issue is the lack of national capacity and expertise, outline the steps needed to develop the needed capacity and expertise. Determine if regional support would be more effective.

2.3.4 Undertake the development of the omitted data. Work with the appropriate NCAs and regional institutions to develop the omitted data where possible. Where development of omitted data is not feasible, report these findings to the IPCC.

The following immediate objectives are considered to be applicable primarily, but not exclusively, for the larger participating countries—China, India, Indonesia, the Republic of Korea and Thailand, for the reasons discussed in Section 4).

IMMEDIATE OBJECTIVE 3

Develop national and regional capacities to identify, formulate, and analyze GHG abatement initiatives.

Output 3.1 Taxonomy of feasible GHG abatement initiatives. The taxonomy of feasible GHG abatement initiatives should be based on technically viable and commercially proven options, as well as proven policy options. Furthermore, the taxonomy should focus primarily on initiatives that would be suitable for the Asian region given the political, social, institutional and market framework of countries in the region.

3.1.1 Review the literature to develop a baseline taxonomy of GHG abatement initiatives. Specifically, review the outputs of the GEF Pilot Phase projects in climate change to develop a baseline taxonomy of GHG abatement initiatives. Also review the literature of the more prominent international NGOs that have been working on this subject. Finally, obtain information from the key regional institutions that have also been working in this area.

3.1.2 Convene a workshop of regional experts to review, refine, and expand on the baseline taxonomy of GHG abatement initiatives. Specifically, bring together the RSAP charged with the identification, analysis, and implementation of GHG abatement strategies to work jointly toward developing an acceptable taxonomy of GHG abatement initiatives.

Output 3.2 Methodology for assessment of GHG abatement initiatives. The taxonomy of GHG abatement initiatives developed in the previous output should be subjected to detailed assessments for cost-effectiveness. As such, a methodology to undertake these assessments should be developed by the national and regional experts with the assistance of international experts where necessary. The results of the assessment should provide a basis for prioritizing the initiatives.

Activities for Output 3.2

3.2.1 Work with the international and regional experts to develop an operational methodology for assessing GHG abatement initiatives. Within the scope of the same workshop referred to in Activity 3.1.2 above, develop a methodology that is acceptable and applicable for assessing the range of GHG abatement initiatives. Give particular emphasis to methodologies for assessing cost-effectiveness that have been developed in support of the GEF.

Output 3.3 Specification of cost emission reduction initiative (CERI) curves. Based on the assessment of the GHG abatement initiatives outlined above, develop CERI curves for the participating countries in the region. These curves should convey information on the unit or marginal costs of GHG emission reductions achievable with the application of various levels of each initiative. These curves will play a central role in the assessment of national and regional plans or strategies for GHG abatement. They will also help determine the levels of investment that should be targeted at various GHG abatement initiatives on a national and regional basis.

Activities for Output 3.3

3.3.1 Commission studies to define CERI curves. Work with suitable regional institutions and NGOs to undertake detailed studies to define, as accurately as possible, the coordinates of the highest priority emissions reduction initiatives.

3.3.2 Test the validity of defined CERI curves. Commission a series of tests and evaluations to determine the validity of CERI curves developed within the project. Determine the extent to which the CERI curves are representative of actual conditions. These tests should be undertaken in coordination with the NCAs in the participating countries.

3.3.3 Refine the definition of the CERI curves. Based on the results of field tests, refine the definitions of the CERI curves.

Output 3.4 A regional workshop on the development and application of CERI curves with the primary objective of disseminating, on a regional basis, the information and expertise gained in developing the CERI curves.

Activities for Output 3.4

3.4.1 Conduct a regional training workshop on the development and application of CERI curves. The workshop should include participants from environmental, energy, forestry, agriculture and national development policy agencies. The objective of the workshop will be to increase the analytic capacity of government officials responsible for formulating national development plans.

3.4.2 Prepare documentation on the application and use of CERI curves. The documentation should be drafted as a training tool to be used by national experts attending the regional workshop to train their junior national counterparts.

IMMEDIATE OBJECTIVE 4

Develop and implement national and regional least-cost GHG abatement strategies.

Output 4.1 National response plans will be developed. Each participating country will, in a written report, outline the elements of a least-cost GHG abatement response strategy to address the issues of climate change.

Activity for Output 4.1

4.1.1 Provide assistance to National Coordinating/Counterpart Agencies (NCAs) to draft national response plans based on the information available from the national GHG inventories and the CERI curves. The NCAs will develop these plans with the national response plans and policies formulated by the National Implementing Committees (NICs) that address the challenge of reducing GHG emissions and

increasing GHG sinks. The national response plans should also account for plans for adaptation to climate change.

4.1.2 Develop analytical models to test the sensitivity of specific initiatives within the national response plans. Specifically, utilize existing first generation GHG emission response models to test the sensitivity of key variables within the national response plans. Where feasible, link existing economic and development models to the GHG emission response models to broaden the analytical capabilities.

4.1.3 Conduct national workshops to obtain review and comment on the national response plans. These workshops should be open to public and private sector participation, and should be convened in a format to promote public-private partnerships in the implementation phase. The inputs of national NGOs should also be solicited.

4.1.4 Finalize national response plans. Based on the results of the previous activities, work with the NCAs to finalize the national response plans.

Output 4.2 A pipeline of feasible climate change mitigation and adaptation projects. Based on the national response plans, a number of specific national and regional projects will be identified for submission to the GEF and other multilateral or bilateral agencies for support. Where projects are economically feasible on a national basis, these projects will be submitted to the relevant national agencies for consideration.

Activities for Output 4.2

4.2.1 Work with the NCAs to identify a slate of climate change mitigation and adaptation projects. Where necessary, provide external assistance to the NCAs to achieve the objectives of this activity. Urge the NCAs to work with the private sector and NGOs in the country to ensure that a cross-section of initiatives are identified.

4.2.2 Conduct a preliminary assessment of the proposed slate of projects. Determine the technical, economic, and institutional feasibility of the proposed projects. Suggest modifications to the project concepts where necessary

4.2.3 Develop project briefs for the most suitable projects. A standard format for project briefs should be established, preferably in accordance with the project brief format established for the GEF. Assist the NCAs in drafting project briefs.

4.2.4 Conduct national workshops to review and approve proposed projects. Under the leadership of the NCAs, organize and conduct national workshops, representative of all relevant public and private sectors, to review, comment on, and approve the proposed projects.

Output 4.3 Leverage investments to undertake the feasible climate change mitigation and adaptation projects.

Activities for Output 4.3

4.3.1 Convene a donor conference to review the results of the ALGAS project and present the resulting feasible investment options.

4.3.2 Work directly with the MDBs and the GEF to solicit financial support for the technical assistance and incremental cost components of the approved projects.

Output 4.4 Prepare a final report on the ALGAS project which highlights the investment opportunities identified within the project.

E. INPUTS

1. Participating governments

The participating governments will provide substantial inputs in-kind during the course of this project. First, all participating governments will be required to designate one full-time government staff to serve at the NPC. Supervisory, technical, administrative and support staff at the NCA will also be required, as needed, to undertake the national activities of the project. These government inputs will also be supplemented by inputs of time and effort of all the government members of the NIC. In addition to human resource inputs to the ALGAS project, the participating governments will be requested to provide logistical support for all the activities and in-country missions of the project, including office space and support for project team members and consultants, and transport for field work. The actual monetary value of the participating government inputs are not quantified at this stage, but are expected to be considerable.

2. Regional executing agency

The ADB, which will serve as the regional executing agency, will provide administrative and technical support and backstopping for the ALGAS project. In addition, the ADB is expected to provide office space, administrative and secretarial support, as well as access to all normal modes of communication for the RPC. The in-kind monetary value of ADB inputs to the project are expected to amount to approximately 10 percent of the total project budget, or approximately US$ 900,000.

3. Global Environment Facility

The inputs from UNDP are presented in the budget summary below, and are provided in greater detail in Section J (Budgets). Funds from GEF and UNDP will be used to provide a number of critical resources for the project which are not readily available within the recipient countries.

Project personnel

Two major categories of personnel are provided for under the project budget. A number of international consultants/experts will be engaged to provide technical/expert advice and training, both in the context of regional workshops, and to a limited extent, at the country level. Funds are also

provided for national consultants, to be hired locally in each country to cover project tasks and topics for which participating country governments lack the appropriate or qualified staff. The person-months of input of the local consultants on a country-specific basis will be determined by the ADB at the pre-project preparatory phase. An estimate of the person-months of national consultants is presented in the budget based on the initial country missions that have been conducted (see Section J). An RPC, provided by and based at the ADB, will coordinate all project activities.

Training

Four types of training activities will be carried out under the project:

- *Group training workshops.* These will bring together project personnel from each participating nation to attend workshops on particular topics (e.g., use of IPCC/OECD inventory methodology, preparation of CERI curves, and so on).

- *Study tours.* Project personnel nominated by participating countries will visit installations (in industrialized or developing countries, as appropriate) where technologies to measure or reduce GHG emissions or enhance GHG sinks are already installed. Study tours may also, in some cases, allow project personnel to attend short courses on topics directly related to the project.

- *Regional workshops.* These will bring together National Project Coordinators (NPCs) and key national project staff and experts from each country to share data and project experiences.

- *In-country training.* This will provide funds to train local project personnel (such as government staff, national consultants and NGO representatives) in the tools, techniques, and skills that they will need to carry out the project and to continue their activities after the project has been completed. Specifically, there is a need to develop and enhance national and regional capabilities through the active use, by the ALGAS project, of expertise available in the region. Particular emphasis will be given to drawing on expertise within the existing national and regional development organizations, educational and training institutions, NGOs and private sector entities.

Equipment

Two general types of equipment are provided for under this project.

- *GHG emissions measurement.* This will be made available in instances where measurements are necessary in order to accurately apply the IPCC/OECD methodology to produce GHG inventories. This category includes a variety of different types of research devices and equipment. The research-oriented equipment will be provided only to the regional institutions and selected national institutions that are identified as being capable and in need of such equipment. GHG emission and sink measuring equipment will be provided on a national basis to carry out only "routine" and well established monitoring/measuring procedures, and only if trained personnel to utilize the equipment are available to the project. Where national

measurements are deemed necessary, and where no trained personnel are available to undertake these measurements, a training programme will be initiated in association with trained experts available from the region. UNDP and ADB will work with participating countries to specify exactly which types of equipment will be purchased under the Project to ensure that a common approach to GHG measurement is instituted across countries.

- *Microcomputers.* Microcomputers will also be purchased using project funds to facilitate the data management, analysis, and modeling tasks associated with the project. When microcomputers are provided, they will be provided along with the necessary software to ensure consistency when utilized to develop databases (including the standard database software for the GHG inventory methodology), analyze emissions reduction options, and similar computational activities.

Other

Other costs include outlays for reporting to project sponsors, publishing project documents, miscellaneous project expenses, and contingency funds.

Indirect costs

Indirect costs compensate ADB for its role in coordinating the project.

F. RISKS

Although all of the participating countries have signed the FCCC, there is always the possibility that some of them may not ratify it. In this case, the interest of the country or countries in designing policies to reduce future emissions of GHGs may decrease. The estimated likelihood of this happening is, however, low in most countries and medium in others.

The information to be collected for the ALGAS project, and the analyses to be undertaken, will be of great value to the countries in designing their development plans, even if no formal actions dealing with global climate change are taken. Many of the measures that would be evaluated, such as improving the efficiency of energy use in particular sectors, also have more direct environmental and economic benefits, such as improving local air quality and reducing energy imports. In addition, the personnel trained, and the institutions strengthened during the project, would enhance the country's capability in many related fields. Thus the risk that the output from the ALGAS project will not be useful to the countries is very small.

G. PRIOR OBLIGATIONS AND PREREQUISITES

1. Prior obligations

There are no prior obligations on the part of the participating governments to carry out activities before commencement of the project. As indicated earlier, some of the countries are already carrying out climate change related initiatives. The results of these, when available, will be used and integrated into the present project.

2. Prerequisites

Each participating government will identify an implementing organization within the country, designate counterpart personnel for project activities, and commit the resources described in Section E1 to the project.

The Project Document will be signed by UNDP, and UNDP assistance will be provided only if the prerequisites stipulated above have been fulfilled or are likely to be fulfilled. When anticipated fulfillment of one or more prerequisites fails to materialize, UNDP may, at its discretion, either suspend or terminate its assistance.

H. PROJECT REPORTING, REVIEWS AND EVALUATION

The project monitoring and evaluation activities will be undertaken jointly by all concerned parties (i.e., the participating governments, the Asian Development Bank, GEF, and UNDP). As mentioned in Section B4, the Regional Project Review Board will provide overall guidance to the project. It will convene in conjunction with the yearly tripartite review. Activities producing project reports were described in Section D under "Outputs."

Reporting

Progress reports

National Progress Reports will be prepared semiannually and submitted to the Regional Project Coordinator, and to the Executing Agency. A Summary Regional Project Progress Report will be prepared annually by the RPC and submitted to UNDP, the Executing Agency and the RPRB. Reports will be prepared on the activities of each workshop in order to utilize the experience gained for the improvement of subsequent activities. The Regional Workshop Reports will be distributed to each participating country, as well as to project donors.

Technical and other reports

Brief summary reports will be prepared by the national and international consultants, and by those supported on study tours at the completion of their assignments for evaluation by the Executing Agency.

Terminal report

A Project terminal report will be prepared for consideration at the terminal tripartite review meeting. It shall be prepared in draft sufficiently in advance to allow review and technical clearance by the Executing Agency at least four months prior to the terminal tripartite review.

Tripartite monitoring review

The project will be subject to tripartite review (joint review by representatives of the governments, ADB and UNDP) at least once every twelve months, the first such meeting to be held

within the first twelve months of the start of full implementation. The senior officer of the ADB in charge of the project shall prepare and submit to each tripartite review meeting a Project Performance Evaluation Report (PPER). Additional PPERs may be requested, if necessary, during the project.

I. LEGAL CONTEXT

For each participating country that has signed the UNDP Standard Basic Assistance Agreement (SBAA), the following text, appropriately completed, applies:

> "This programme document shall be the instrument referred to as such in Article 1 of the Standard Basic Assistance Agreement between the Government of the participating countries and the United Nations Development Programme, signed by the parties. The host country implementing agency shall, for the purpose of the Supplemental Provisions to the Programme Document, refer to the Government cooperating agency described in the Supplemental Provisions."

The following types of revisions may be made to this document with the signature of the UNDP Principal Programme Resident Representative (PPRR) only, provided he or she is assured that the other signatories of the document are in agreement with the proposed changes:

- Revision in, or addition of, any of the annexes of the original document
- Revisions which do not involve significant changes in the immediate objectives, outputs, or activities of the programme, but are caused by the rearrangement of inputs agreed to or by cost increases due to inflation
- Mandatory annual revisions which re-phase the delivery of agreed programme inputs or increased expert or other costs due to inflation or take into account agency expenditure flexibility.

J. BUDGET

The total project budget is estimated at US$ 9.5 million over a three-year period. The project budget is attached.

Project Budget Covering UNDP Contribution

(in US Dollars)

Project Number: RAS/92/G33/A/1G/45
Project Title: ASIA LEAST-COST GREENHOUSE GAS ABATEMENT STRATEGY (ALGAS)
Country:
Budget Type: UNDP
Version/Status: PIPELINE-HARD

Code	Description	Total w/m	Total $	1994 w/m	1994 $	1995 w/m	1995 $	1996 w/m	1996 $
10	PROJECT PERSONNEL								
11	INTERNATIONAL EXPERTS								
11.01	Programme Coordinator	36.0	340,000	12.0	108,000	12.0	113,000	12.0	119,000
11.49	SUBTOTAL: EXPERTS	36.0	340,000	12.0	108,000	12.0	113,000	12.0	119,000
11.50	CONSULTANTS								
11.51	International Consultants	108.0	1,296,000	45.0	517,500	36.0	432,000	27.0	346,500
11.98	SUBTOTAL: CONSULTANTS	108.0	1,296,000	45.0	517,500	36.0	432,000	27.0	346,500
11.99	SUBTOTAL: EXPERTS & CONSULTANTS	144.0	1,636,000	57.0	625,500	48.0	545,000	39.0	465,500
15	DUTY TRAVEL								
15.01	D.T. for International Consultants		540,000		225,000		180,000		135,000
15.99	SUBTOTAL DUTY TRAVEL		540,000		225,000		180,000		135,000
16	MISSION COSTS								
16.01			45,000		10,000		15,000		20,000
16.02	Monitoring & Evaluation		180,000		60,000		60,000		60,000
16.99	SUBTOTAL MISSION COSTS		225,000		70,000		75,000		80,000
17	NPPP								
17.01	National Consultants	1590.0	2,862,200	422.0	759,000	527.0	949,000	641.0	1,154,200
17.02	Information & Clearinghouse	36.0	64,800	12.0	20,000	12.0	22,000	12.0	22,800
17.99	SUBTOTAL NPPP	1626.0	2,927,000	434.0	779,000	539.0	971,000	653.0	1,177,000
19	PERSONNEL COMPONENT TOTAL	1770.0	5,328,000	491.0	1,699,500	587.0	1,771,000	692.0	1,857,500
30	TRAINING								
32	STUDY TOURS/GROUP TRAINING								
32.01	Group Training Workshops*		350,000		175,000		175,000		
32.02	Study Tours		300,000		180,000		120,000		
32.03	Regional Workshops		234,000		78,000		78,000		78,000
32.99	SUBTOTAL TOURS/GROUP TRAINING		884,000		433,000		373,000		78,000
33	IN-SERVICE TRAINING								
33.01	In-Country Training		660,000		220,000		270,000		170,000
33.99	SUBTOTAL IN-SERVICE TRAINING		660,000		220,000		270,000		170,000
39	SUBTOTAL TRAINING		1,544,000		653,000		643,000		248,000
40	EQUIPMENT & SUPPLIES								
46	INT. PROCUREMENT OVER $70,000								
46.01	Expendable Equipment		120,000		20,000		50,000		50,000
46.02	Non-Expendable Equipment		1,020,000		340,000		590,000		90,000
46.99	SUBTOTAL INT. PROCUREMENT		1,140,000		360,000		640,000		140,000
49	SUBTOTAL EQUIPMENT & SUPPLIES		1,140,000		360,000		640,000		140,000
50	MISCELLANEOUS								
52	REPORTING COST								
52.01			30,000		10,000		10,000		10,000
52.99	SUBTOTAL REPORTING COST		30,000		10,000		10,000		10,000
53	SUNDRIES								
53.01			95,389		30,000		35,000		30,389
53.99	SUBTOTAL SUNDRIES		95,389		30,000		35,000		30,389
59	SUBTOTAL MISCELLANEOUS		125,389		40,000		45,000		40,389
90	PROJECT TOTAL		8,137,389		2,752,500		3,099,000		2,285,889
93	AGENCY SUPPORT COST – ASDB (13%)		1,057,861		357,825		402,870		297,166
99	GRAND TOTAL (ALL COMPONENTS)		9,195,250		3,110,325		3,501,870		2,583,055
	Preparatory Assistance Phase		304,750						
	TOTAL ALLOCATION		9,500,000						

*Group Training Workshops: 5 Workshops each in Years 1 & 2, with 15 persons in each

Annex 1

BACKGROUND TABLES AND FIGURES

Annual Emissions and Global Warming Potential of Principal Greenhouse Gases

Gas	Symbol	Emissions per year, 1990	Unit	Lifetime (Years)	Global Warming Potential* (Direct)
Carbon Dioxide	CO2	7.4	Gigaton C	~ 120	1
Methane	CH4	506	Teragram	11	11
Nitrous Oxide	N2O	12.9	Teragram N	132	270
CFC-11	CFC-11	#827	kilotons	55	3400
CFC-12	CFC-12	[#total all CFCs]		116	71000

* Using a 100-Year time horizon.

Estimated Methane Emissions from Human Activity

(in million metric tons per year; data are for 1989)

COUNTRY	Rice Paddies	Animals	Coal Mines	Oil & Gas Prodn.	Solid Waste	Total
Bangladesh	5.10	0.97	N.A.	0.06	0.25	6.38
China	19.00	5.30	13.00	0.23	2.60	40.13
India	19.00	11.00	1.60	0.83	1.90	34.33
Indonesia	5.10	0.60	0.01	0.58	0.40	6.69
Korea, Dem. P.R.	0.41	0.05	0.60	N.A.	0.05	1.11
Korea, Rep.	0.64	0.08	0.36	N.A.	0.10	1.18
Mongolia	N.A.	0.25	0.01	N.A.	0.01	0.27
Myanmar	3.10	0.47	N.A.	0.02	0.10	3.69
Pakistan	1.10	1.70	0.00	0.30	0.25	3.35
Philippines	1.50	0.23	0.00	N.A.	0.14	1.87
Thailand	5.70	0.48	N.A.	0.08	0.13	6.39
Vietnam	3.20	0.27	0.08	N.A.	0.15	3.70

Note:

109.09

There is considerable uncertainty regarding these numbers.
A major goal of the Regional Programme is to improve these estimates.

The data are from "World Resources, 1992-93".

Toufiq Siddiqi, East-West Center

Use of Land in Selected Asian Countries

(in million hectares; data are for 1987)

COUNTRY	Forest	Cropland	Pasture	Other	Wilderness	Total
Bangladesh	1.97	9.27	0.60	1.18	0.00	13.02
China	126.85	96.62	319.08	390.10	210.78	1,143.43
India	66.78	169.36	11.92	49.26	1.16	298.48
Indonesia	113.43	21.23	11.80	34.69	11.76	192.91
Korea, Dem. P.R.	8.97	1.99	0.05	1.03	0.00	12.04
Korea, Rep.	6.49	2.13	0.09	1.16	0.00	9.87
Mongolia	13.91	1.36	123.86	17.52	24.13	180.78
Myanmar	32.40	10.04	0.36	22.96	2.55	68.31
Pakistan	3.29	20.77	5.00	48.03	2.74	79.83
Philippines	10.75	7.96	1.22	9.89	0.00	29.82
Thailand	14.37	21.62	0.76	14.33	2.81	53.89
Vietnam	9.36	6.59	0.33	16.27	0.00	32.55

Note:

There may be considerable differences in classification between countries. One goal of the Regional Programme is to improve these estimates.

The data are from "World Resources, 1992-93".

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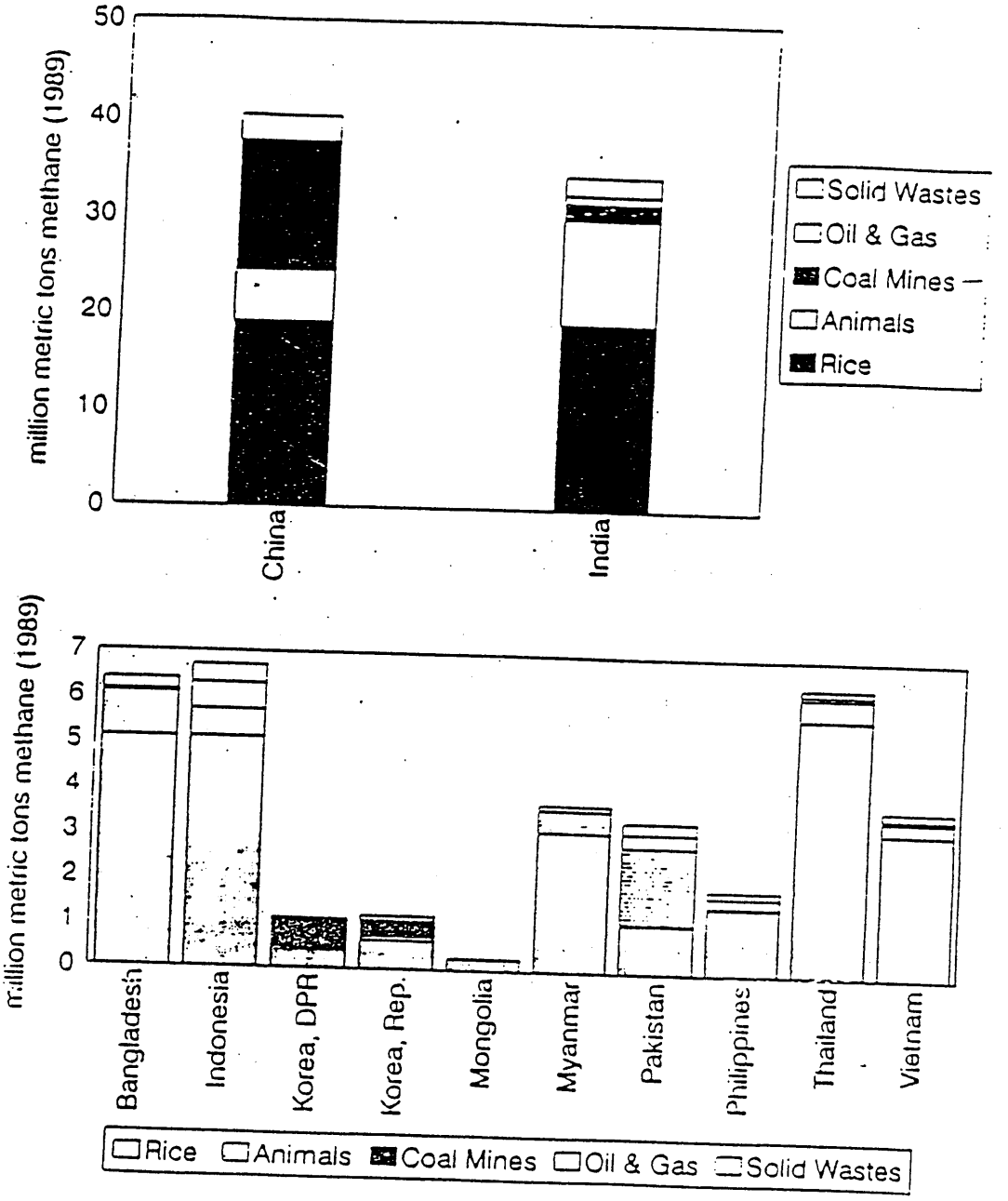
Estimates of methane emissions from anthropogenic sources (I)



Estimates are from "World Resources 1992-93"

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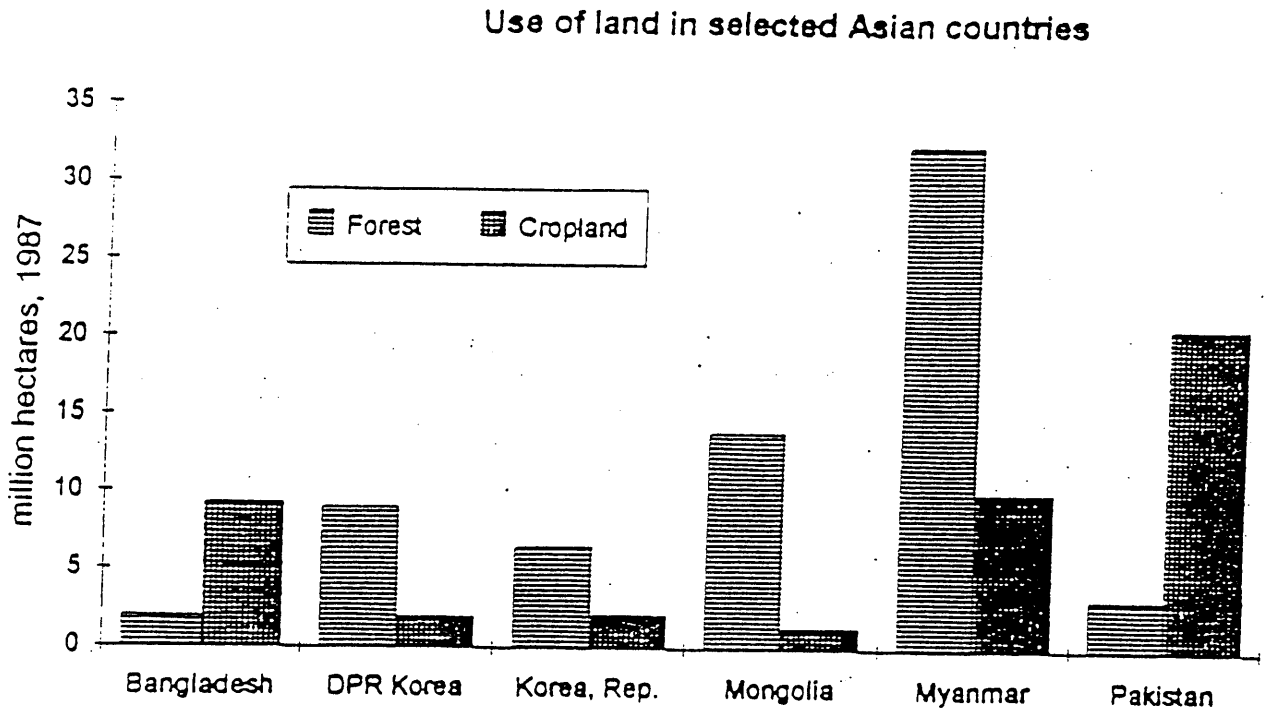
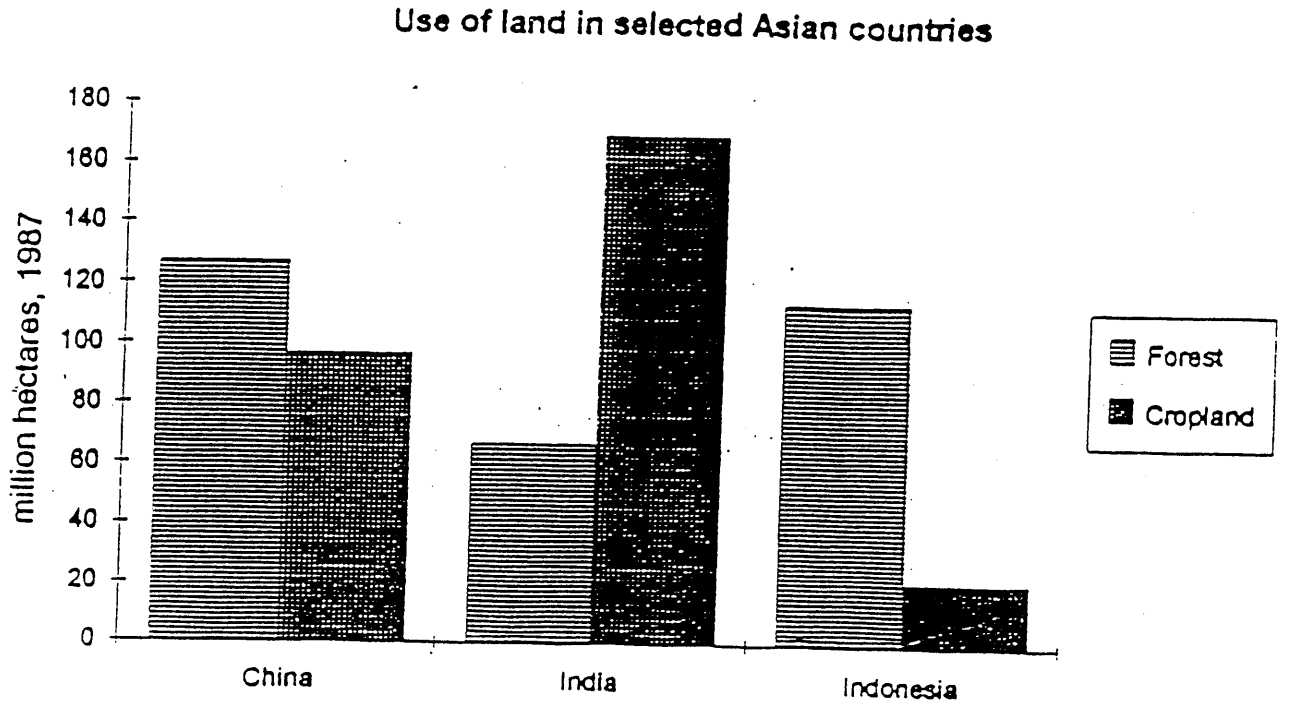

Use of land in selected Asian countries
35
30
25
20
15
10
5
0
million hectares, 1987
Forest
Cropland
Bangladesh
DPR Korea
Korea, Rep.
Mongolia
Myanmar
Pakistan


Use of land in selected Asian countries
180
160
140
120
100
80
60
40
20
0
million hectares, 1987
China
India
Indonesia
Forest
Cropland

Carbon Dioxide Emissions from Fossil Fuels and Cement

(in million tons carbon per year; data are for 1989)

Country	Fossil Fuel use			Gas Flaring	Cement	Total
	Solids	Liquids	Gas			
Bangladesh	0.13	1.65	2.03	0.00	0.05	3.85
China	536.03	79.89	7.87	0.00	28.13	651.92
India	126.04	39.28	4.24	2.64	5.73	177.93
Indonesia	2.46	22.30	4.18	6.73	1.92	37.59
Korea, Dem. P.R.	37.38	2.61	0.00	0.00	1.36	41.35
Korea, Rep.	26.48	28.24	1.48	0.00	4.15	60.35
Mongolia	2.10	0.63	0.00	0.00	0.08	2.81
Myanmar	0.07	0.65	0.56	0.03	0.05	1.37
Pakistan	1.96	7.93	5.25	0.56	0.95	16.64
Philippines	1.39	9.24	0.00	0.00	0.54	11.18
Thailand	2.64	13.81	2.71	0.00	2.04	21.20
Vietnam	3.60	1.14	0.00	0.00	0.22	4.96

Based on data in "World Resources. 1992-93".

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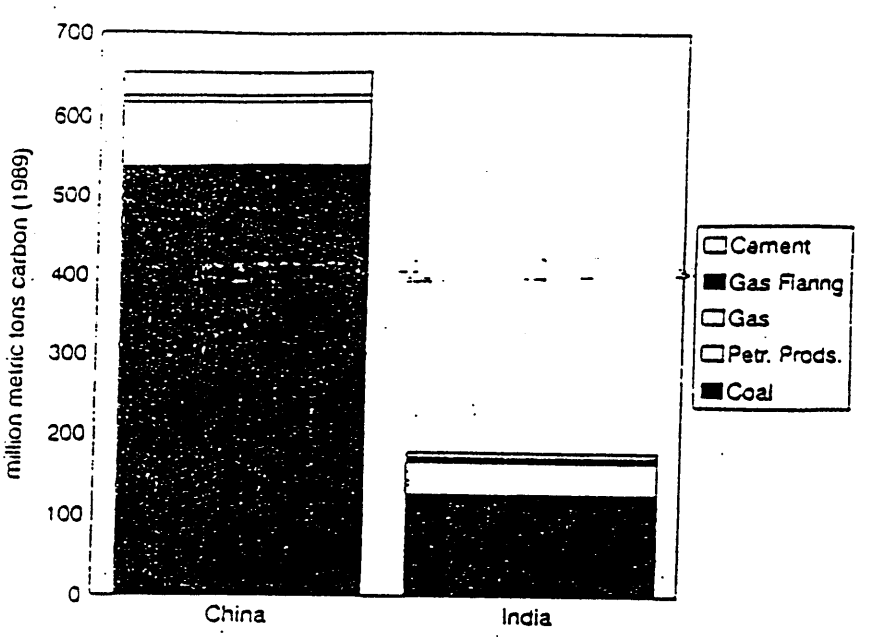
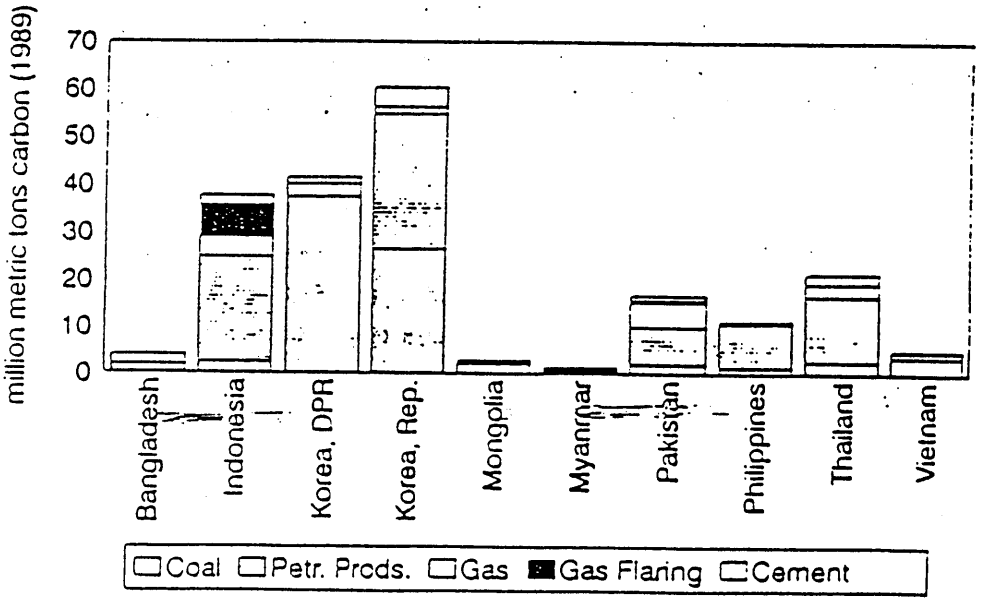
Carbon Dioxide Emissions from Fossil Fuels & Cement





Data from "World Resources 1992-93"

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