

**Global Climate Change:
The USAID Response**

**Prepared for:
Energy Efficiency Project (EEP)
Bureau for Global Programs, Field Support and Research
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United States Agency for International Development**

**Prepared by:
Hagler Bailly Consulting, Inc.
1530 Wilson Boulevard, Suite 900
Arlington, VA 22209 USA
(703) 351-0300**

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We must take the lead in addressing the challenge of global warming that could make our planet and its climate less hospitable and more hostile to human life. Today, I reaffirm my personal, and announce our nation's commitment to reducing our emissions of greenhouse gases to their 1990 levels by the year 2000. I am instructing my administration to produce a cost-effective plan...that can continue the trend of reduced emissions. This must be a clarion call, not for more bureaucracy or regulation or unnecessary costs, but instead for American ingenuity and creativity, to produce the best and most energy-efficient technology.

President Clinton

April 21, 1993

The following are excerpts from President Clinton's Global Climate Change Action Plan (Clinton, 1993).

International Policy:

"Global climate change is a long-term problem that will require years of sustained effort. The time for action is now."

"At the Earth Summit in June 1992, the United States joined other countries in signing the Framework Convention on Climate Change, an international agreement to address the danger of global climate change. The Convention has been signed by 161 countries and has been ratified by 31 of those countries. The objective of the Convention was stated to:

'...achieve...stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner.'

Domestic Policy:

"The Framework Convention on Climate Change challenges the industrial countries of the world to begin a long journey with the proverbial first step -- to return greenhouse gases to 1990 levels by the year 2000. We should strive to do no less; ultimately we will have to do more."

Executive Summary

BACKGROUND AND PURPOSE

The Senate Appropriations Committee has requested the U.S. Agency for International Development (USAID) to describe its planned activities and future strategic approaches to combat global climate change. This report is a response to that request, emphasizing developments since the 1990 Report to Congress entitled *Greenhouse Gas Emissions and the Developing Countries: Strategic Options and the USAID Response (USAID, 1990)*. With the end of the cold war that has dominated the second half of the twentieth century, and the signing of the Framework Convention on Climate Change and other agreements by over 100 Heads of State in Rio in 1992, USAID and the international community can now chart fundamental new directions to face the challenges of the twenty-first century.

USAID's approach to combating environmental threats associated with global climate change is anchored in its post-cold war mandate for sustainable development. Such development is characterized by *economic and social growth that does not exhaust the resources of a host country; that does not damage the economic, cultural, or natural environment; that creates many incomes and chains of enterprises; and that builds indigenous institutions that involve and empower the citizenry*. Equity-among and between generations is at the heart of sustainable development. The Brundtland Commission (Brundtland, 1987) adopted the concept of intergenerational equity when it defined sustainable development as *meeting the needs of the present generation without compromising the needs of future generations*.

This report draws its inspiration from the current initiative to reinvigorate the Agency, and builds upon strategies in four areas that are critical to sustainable development: Population and Health, Economic Growth, Environment, and Democracy (USAID, 1994). These strategies create a new role for USAID that greatly reinforces U.S. foreign and domestic policy, complements the work of other U.S. Government agencies, collaborates closely with international organizations, national governments, universities and non-governmental organizations, and leverages the financial resources of multilateral banks and the private sector.

USAID will pursue two strategic goals in its new approach to protecting the environment:

- Reducing long-term threats to the global environment, particularly loss of biodiversity and climate change; and
- Promoting sustainable economic growth locally, nationally, and regionally by addressing environmental, economic, and sociopolitical practices that impede development and are unsustainable.

Rapid climate change induced by increasing concentrations of carbon dioxide and other greenhouse gases arising from human activities presents a long-term threat to the global environment despite uncertainties surrounding the timing, magnitude and impacts of such change. Scientific advisory committees to the United Nations and the National Academy of Sciences (NAS) have estimated that by the end of the next century, assuming the continuation of current trends, the global mean temperature could rise by 1.5 to 4.5 °C. In comparison, the earth's mean temperature has risen only 0.3 to 0.6 °C in the last century, and probably has not varied by more than 1-2 degrees over the past ten thousand years.

USAID will reduce long-term threats to the global environment and will promote sustainable economic growth by adopting an approach whereby energy efficiency, sustainable land-use management, and a less carbon intensive path to modernization can accelerate economic growth while reducing local, regional and global environmental risks. All nations would find such a path in their economic self-interest, even in the absence of any risk of climate change. To reduce the risk of rapid climate change, developing countries can focus on indigenous capacity strengthening, policy and regulatory innovation, and technological leapfrogging, as central elements of sustainable development.

In signing the United Nations Framework Convention on Climate Change, the international community has embraced the notion of the developed countries assisting developing countries in meeting the terms of the convention. In contributing to the Global Environment Facility (GEF) through parallel activities, USAID has also endorsed the approach of the Climate Convention.

An ambitious long-term goal for the global community is to stabilize the concentration of greenhouse gases by the middle of the twenty-first century. Such stabilization can only occur if the major greenhouse gas emitting nations of the world convert to a predominantly non-fossil energy infrastructure over the next fifty years. Successful conversion to a non-fossil fuel based industrial civilization will require massive innovation on all fronts-technological, policy, financing and institutional.

No single innovative approach or technology can adequately control the growth of greenhouse gas emissions, but by implementing an integrated strategy over the next few decades, significant reductions in emissions can accompany accelerated economic growth in all nations. However, nothing short of bold and innovative efforts on a global scale can simultaneously reconcile vigorous economic growth with stabilization of the global climate system.

LESSONS LEARNED

The most important lesson learned by USAID is that broad access by people to their country's economy and participation in their society's decision making processes, are fundamental to sustained development. Successful and unsuccessful experiences of USAID, other bilateral donors, private foundations and multilateral banks have demonstrated that development assistance works best when it fully takes into account and responds to the priorities and values of the recipient society, whether at the local sector, or national levels. The policy and regulatory changes necessary to open up economies to innovation and investment must be supported by broad elements of the society, or such changes will not be sustained after donor assistance is withdrawn.

To expand the impact and maximize the effectiveness of its programs, USAID must leverage its limited grant resources by creating favorable conditions for development in the host countries, especially in the private sector and in local community organizations. USAID has also learned the importance of collaborating with other bilateral donors, multilateral development banks and indigenous institutions, from project conceptualization through implementation, and from local to international levels of interaction.

STRATEGIC APPROACHES

USAID has identified approximately twenty developing and former communist countries that are, or will become, significant contributors to total global greenhouse gas emissions. Using clearly established selection criteria, USAID will collaborate with a subgroup of these countries to develop and implement plans that reduce sources and increase sinks of greenhouse gases. Through the adoption and enhancement of local and national economic and environmental goals. This subgroup includes, but is not necessarily limited to, Brazil, Central Africa (as a region), India, Indonesia, Kazakhstan, Mexico, Poland, the Philippines, Russia, and the Ukraine. Though China is a pivotal country from a global climate perspective, USAID is not authorized to conduct projects there. Additional countries where USAID will work to address global climate change are identified in Chapter 3. USAID will also help countries that are particularly vulnerable to the effects of climate change to adapt to the effects of such change. Such adaptation measures will form a vital component of sustainable development at the country level, and will be integrated into sound natural resource management strategies and economic growth.

The objectives of future USAID projects and programs are to : 1) promote the implementation of energy efficient technologies, renewable energy facilities and low carbon-emitting energy systems through the private sector and effective public/private partnerships; 2) foster sound forestry and natural resources management practices by limiting deforestation and other carbon-emitting land-use changes; and 3) implement advanced information technologies, including global information and communication networks. To implement these objectives, this report proposes strategic approaches that are anchored in current Agency activities in the area of global climate change. A representative list of current Agency climate change activities is described in Appendix 1.

PROMOTING ENERGY EFFICIENCY, LOW CARBON-EMITTING ENERGY SYSTEMS, AND RENEWABLE ENERGY WHILE EXPANDING PRIVATE AND PUBLIC ENERGY SERVICES.

Most countries are caught in an excruciating "triple-bind" in the energy sectors, characterized by inadequate investment capital, an inhibiting policy environment and lack of institutional capacity, and both local and global environmental constraints. To sever this bind, the report proposes three interconnected global approaches to lower the rate of growth of greenhouse gas emissions while enhancing and

expanding energy services. These approaches will be implemented primarily on a country-by-country basis.

These approaches stress:

- Institutional reform and private sector involvement to improve the efficiency of delivered energy services;
- Environmental technology cooperation; and
- Leveraging multilateral and private sources of capital to promote energy efficiency.

These are described below:

- **Institutional Reform and the Private Sector:** USAID's approach to institutional reform will focus on policy and regulatory reform to implement efficiency measures, environmental standards and private capital investment, integrated resource planning and demand-side management, and innovative training and capacity building involving collaborative programs among U.S. and host country institutions.
- **Environmental Technology Cooperation:** There is a major opportunity for developed and developing countries to accelerate technology transfer and cooperation involving environmentally sound technologies (ESTs). For technologies that are close to commercialization, USAID will build on the successes of its Program to Accelerate Commercial Technology (PACT) and the Program for Acceleration of Commercial Energy Research (PACER). These model programs support the accelerated movement of environmental technology into the global marketplace by providing "conditional grants" to private sector joint ventures of U.S. and developing country firms. The grant converts to a soft loan and is paid back if the venture is successful. USAID will also catalyze industrial and utility partnerships through study tours of the U.S. by foreign institutions, and will foster long-term relationships among industries, utilities, cities and universities.
- **Investing in a Sustainable and Efficient Power Sector:** USAID will help to create the conditions for economically sustainable development, and will provide grants to meet international commitments, including commitments to the pilot phase of the Global Environment Facility (GEF). USAID will complement the work of other U.S. Government agencies, such as EXIM Bank, the Overseas Private Investment Corporation (OPIC), and the Trade and Development Agency (TDA) and will act to leverage multilateral and private sources of equity and loan capital.

PROMOTING SOUND FORESTRY AND NATURAL RESOURCES MANAGEMENT

This objective is promoted through three country-based approaches stressing sustainable land-use, citizen empowerment through participation, and resource and technology assessment and development.

Sustainable Land-Use: Assistance will be provided to host countries to identify the impact of development policies on land use. USAID will promote policies that provide economic incentives for sustainable forest management and will discourage policies that lead to deforestation and unsustainable resource use. Policies that facilitate the sustainable production of goods and services for a rapidly increasing population will be encouraged. Opportunities will be sought to promote cooperation among donors and host countries in evaluating natural resource management policies and avoiding policy inconsistencies.

Empowerment through Participatory Institutions: Activities designed to enhance institutional capacity will include development of incentives that empower women and disadvantaged minorities, and that involve non-governmental organizations and the private sector in natural resource management decisions, and that encourages the transfer of management technologies to those who work on the land. Participatory planning processes that begin with indigenously performed local needs assessments, and that link the knowledge base to the users, will be promoted.

Resource and Technology Assessment and Development: To provide a baseline level of knowledge about the geophysical, climatic and biological production potential of forest, range and agricultural ecosystems, assistance will be provided for countries to determine current land-use practices and assess the current stock of natural resources. Also needed is an understanding of the ecological relationships

among species within natural ecosystems. To complement this knowledge, assessments will be made of traditional uses of forest and trees in agricultural production systems.

IMPROVING INFORMATION COLLECTION AND DISSEMINATION AND GLOBAL ELECTRONIC COMMUNICATIONS

Global Energy and Environment Information Exchange: USAID is currently transforming its internal communications to incorporate linkage to the Internet. The Internet, a rapidly-expanding network of numerous individual data networks worldwide that conform to U.S.-developed standards, is a widespread and cost-effective means for worldwide information delivery. It also is being pursued rapidly by USAID's counterpart organizations, such as the World Bank and the United Nations Development Program (UNDP). Expansion of affordable Internet access will be a high priority throughout USAID's programs, including those addressing global change.

MEASURING RESULTS

The report identifies illustrative quantitative and qualitative indicators for measuring the results of projects in energy, forestry and agriculture. Project evaluations will utilize these indicators to verify whether USAID's sustainable development goals are being met.

In the energy and industry sector, key illustrative targets will be the enactment of policy, regulatory or price reforms, and reductions of energy-related environmental emissions (such as CO₂, NO_x, SO_x, CO, HC, and particulates per kWh, mile traveled, pound of product, or unit of GDP). In the forestry, natural resources and agriculture sectors, the targets could include net reductions in greenhouse gas emissions from deforestation. In the information technology arena, as countries adapt advanced information technology and improve communications with each other, international organizations, NGOs, PVOs, and other U.S. businesses, targets will include the development of capacity to electronically access a wide range of international information.

Chapter 1

Introduction

In 1990, USAID began its Global Warming Initiative (GWI) to combat global warming and the long-term threat that emissions of greenhouse gases pose. Legislation directed USAID to focus its global warming activities in "specific key countries which stand to contribute significantly to global greenhouse gas emissions, and in which actions to promote energy efficiency, reliance on renewable energy resources, and conservation of forest resources, could significantly reduce emissions of greenhouse gases" (P.L. 101-167, section 534).

The exact amount of funding allocated to global climate change activities is difficult to determine. Although accounting records associated with the individual projects are available, it is not clear what fraction of the funding for each project was spent on climate change activities. The coding system currently used to track projects is not designed to provide an accurate and comprehensive accounting of the funding levels associated with major categories such as global climate change, and quite likely provides an overestimate of the actual obligations.

A listing of projects related to climate change issues and the total funding obligation amounts for each project is provided in Appendix 1. Also listed is an estimate of the percentage of the total project funding allocated to climate change activities. This is the value that is uncertain. Subject to this caveat, the cumulative obligation since 1990 totals over \$240 million. Only projects directly intended to address climate change issues are included in the list, although other agricultural and forestry projects may also have an indirect impact on the net emissions of greenhouse gases.

Budget amounts for fiscal year 1994 were not available when this report was prepared. New climate change projects may be designed, and existing projects may be modified if necessary, as Agency restructuring is completed and more detailed planning activities continue.

In December, 1992 the U.S. Senate ratified the Framework Convention on Climate Change (FCCC) that had been signed in June at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil, that same year. The FCCC will structure the international policy debate on the climate issue for the next decade. It establishes several new institutional mechanisms for international cooperation and binds the issues of environmental protection and economic development. The prudent policy response of the international community is contained in the FCCC. USAID will support the implementation of the FCCC, and will continue to assess its strategy in the light of new scientific evidence. This path-breaking international treaty has now been signed by 154 countries, and the treaty entered into force in March 1994.

There are several key elements in the FCCC. The first is Article II, which defines the objective of the Convention to be achieving "*stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.*" It is important to note that the objective is stated in terms of stabilizing *concentrations*, not emissions of greenhouse gases. The timeframe in which this process can occur and the absolute level at which stabilization occurs will depend on many factors including population growth, economic growth rates, power sector fuel mix, deforestation and reforestation rates, and agricultural practices.

Other key elements are found in Article III which states the fundamental principles of the Convention. Several are: "*developed country Parties should take the lead in combating climate change and the adverse effects thereof,*" and "*the Parties have a right to and should promote sustainable development.*"

GLOBAL CLIMATE CHANGE STRATEGY

USAID's new Global Climate Change Strategy (GCCS) is designed to support the fundamental objectives of the FCCC as stated above. The goal of the GCCS is: *To contribute to global efforts to stabilize greenhouse gas concentrations and to assist countries to adapt to the adverse effects of climate change, while maintaining economic growth in developing and post-communist countries.* As clearly stated in this goal, USAID is committed to addressing both mitigation and adaptation aspects of the climate change dilemma.

This report will concentrate on USAID's global greenhouse gas assessment and mitigation program. Mitigation methods, particularly in the energy sector, are generally applicable throughout the world, and therefore it is possible to address this dimension of the climate change problem on a global basis. Vulnerability and adaptation are also significant aspects of the global climate change problem. Because the effects of climate change are manifested on a regional level, they will be addressed in more detail in individual country programs, and will only be covered in general here. Therefore, the key objectives of the GCCS will be to:

- promote efficient energy use and renewable energy implementation while expanding public and private energy services;
- promote sound forest and natural resources management practices; and
- improve information collection and dissemination and global electronic communications.

For USAID's efforts to be effective, these global issues must be approached strategically and collaboratively. This report outlines strategic approaches that have proven effective in on-going projects, and proposes to strengthen collaborative efforts with other bilateral and multilateral development partners. Because of limited human and financial resources, the Agency must focus its efforts on key countries and pivotal issues. USAID will work with key countries to develop appropriate action plans that reflect: the scope of the problems faced in that country; the country's commitment to real change; and the probable impact this effort will have on reducing global greenhouse gas concentrations.

Chapter 2 of this report outlines USAID's global climate change activities since 1990, while Chapter 3 addresses future activities under the GCCS. Global climate change activities of USAID are focused in the energy and industrial, forestry, and agricultural domains. In energy and industrial areas, emissions of carbon dioxide, carbon monoxide, and methane are the primary foci of attention. In the forestry and agriculture sectors, carbon dioxide may be both emitted and sequestered, and nitrous oxide and methane are major emissions. Climate change activities in each of these major sectors can be broadly classified under the headings of policy reform and capacity building, environmental technology cooperation, and investment leveraging. Numerous examples that show the breadth of current Agency programs in the global climate change area are presented in Appendix 1. An overview of the international and U.S. global climate change program is presented in Appendix 2, and the U.S. Global Climate Change Research Program is outlined in Appendix 3. Appendix 4 addresses key country selection criteria for greenhouse gas emissions in the energy and industrial sectors.

Chapter 2

USAID's Operational Approach in Global Climate Change

This chapter presents USAID's guiding principles and operational strategy in the GWI from 1991 through 1993 and summarizes the salient aspects of both greenhouse gas emission reduction and climate change adaptation projects. A representative list of current GWI projects can be found in Appendix 1.

The major principle underlying the present U.S. response to the global climate change ⁽⁴⁾ issue is an approach whereby energy efficiency, afforestation and a less carbon intensive path toward modernization accelerates economic growth while reducing local, regional and global environmental risks. Even though the scientific community is developing a better understanding of the physical phenomenon occurring in the atmosphere, the amount of uncertainty inherent in predictions of future climate patterns dictates that emphasis be placed on those policies and actions that can be justified independently of the timing and magnitude of potential climate changes. USAID's climate change activities over the past several years meet this principle.

The Agency's global climate change activities are mainly focussed on energy and industry, forestry and natural resources, and sustainable agriculture. Within each sector, the strategic approach involves leveraging of financial and intellectual resources, policy reform, institutional and private sector capacity building, and technology cooperation. Experience has demonstrated that all of these major elements must be addressed if sustainable development is to be achieved.

USAID's experience has shown that market reform and sector restructuring require a strategic framework that addresses both the complexity of economic transformation as well as the multi-dimensional character of the problems. USAID has found that assistance efforts such as leveraging, policy reform, capacity building, and technology cooperation can logically be addressed at different levels of interaction - international, national, state, and commercial transaction. Depending on the strategic element being addressed and the specific country and project being considered, interaction may occur at only a single transaction level, or at all levels. For instance, leveraging of financial resources can be effective at either the international level (i.e., with the multilateral development banks (MDBs)), or at the state level (i.e., local banks). Empowerment, or capacity building, can occur at all levels of interaction.

The USAID 1990 Report to Congress indicated that the Agency would try to commit up to \$248 million by 1991 in support of global climate change activities. In the interim the Agency has had to change the level of funds obligated, the key countries, and the types of activities associated with global climate change in light of other major global events. A major change has taken place in the political arena, namely the emergence of the New Independent States (NIS). This event has caused USAID to respond quickly to new U.S. policy and financial commitments. The NIS is a significant greenhouse gas contributor, accounting for 17 percent of the world's total CO₂ output (IPCC, 1991a). USAID has begun a comprehensive program in the NIS under the GWI designed to improve the efficiency of industries and utilities, and to reduce pollution per unit of output from plants. Over the past three years, new activities such as those in the NIS have stretched both human and financial resources to their limits. Specialists who might otherwise have spent their time on those key countries identified in the 1990 report, were reassigned to assist with new activities in the NIS. Of the total FY 1992 funds initially obligated for global climate change, over \$33 million were re-designated for projects in the NIS. In FY 1993, over \$65 million in global climate change funding was obligated to support activities in the NIS.

GLOBAL CLIMATE CHANGE ACTIVITIES ASSOCIATED WITH EMISSIONS STABILIZATION

As discussed in the 1990 Report to Congress, the GWI focuses on specific areas of USAID activity where the Agency can be effective in reducing greenhouse gas emissions and augmenting naturally occurring greenhouse gas sinks. A significant number of new activities launched over the past few years in the energy, forestry, and agricultural sectors were specifically aimed at the development of the political and institutional frameworks necessary to allow greenhouse gas reduction projects to be implemented. In addition, support was provided to U.S. industry to foster technology cooperation between U.S. developers and manufacturers and developing country counterparts.

2.A. Energy and Industry

A paucity of energy services dominates the lives of most people in developing countries. The vast majority of the 2.5 billion people living in villages have no energy services other than their own muscle power and that of domestic animals, and heat from scavenged wood and crop residues. The average per capita consumption of commercial energy sources (oil, gas, coal, etc.) in developing countries is less than one-tenth that of the Organization for Economic Cooperation and Development (OECD) countries; the average American uses 33 times more energy than the average Indian and 295 times more than the average Tanzanian (WRI, 1992).

The rapid expansion of energy services will be essential for the continued economic development of developing and post-communist nations. However, energy services do not equate directly with energy used, and it is possible for services and economies to expand without increasing the supply of energy proportionately.

Developing and post-communist countries do not need to completely repeat the historic experience of most industrialized countries. For many industrialized countries, energy consumption grew faster than the gross domestic product (GDP) initially while the countries built infrastructure and saturated various energy use markets. Then as experience was gained the countries discovered more efficient means of producing goods and materials. Each country participating in the industrial revolution learned from those that had preceded them in the industrialization process. These trends are clearly shown in Figure 2.1 (Reddy, 1990).

In principle, by accessing state-of-the-art technology, developing and post-communist countries can "leapfrog" over the long and resource-intensive development process experienced by most industrialized nations, and achieve high rates of economic growth with lower levels of energy use. USAID has estimated the potential for energy efficiency improvement in developing countries at 25 percent over the next 30 years (Levine, 1991).

Reduction of greenhouse gas emissions has also been achieved through projects which substitute a lower carbon fuel such as natural gas for coal. Combustion of natural gas instead of coal considerably reduces the amount of carbon dioxide produced per unit of electricity delivered. Various renewable energy technologies which produce little or no carbon dioxide are becoming cost effective in a number of applications, particularly when used in remote locations. USAID has an active renewable energy program as a component of its overall global climate change strategy.

2.A.1. Leveraging Investments and Donor Coordination

USAID has learned that leveraging works best if it increases the number of public and private donors and financial backers involved in projects. There have been enormous shifts in wealth during the last twenty years among nations, communities, and individuals. Any successful strategy for development must seek to expand the donor and investment community beyond the traditional sources and particularly in the private sector.

Many of USAID's activities under the GWI involve the leveraging of financing from the MDBs and international finance institutions. By providing pre-investment study and initial design support funds, USAID has assisted lending institutions and developing countries in the preparation of viable innovative projects prior to the loan appraisal stage. The GWI also serves as a focal point for developing and implementing USAID's projects for the GEF, and will continue to assist the World Bank in developing and assessing GEF projects that address global climate change.

USAID must leverage its scarce resources to secure multilateral and private bank funding in order to have an impact in the multibillion dollar energy sector. In India, for example, the Energy Management Consultation and Training (EMCAT) project is a \$20 million USAID project, which is leveraging \$1.5 billion in World Bank, Asian Development Bank, Government of India, and private sector funding for power project development and energy efficiency improvements.

USAID promotes private sector solutions to the energy problems of the developing countries and market economies by providing technical assistance, disseminating market information, and co-funding feasibility studies. Through its private sector program, USAID seeks to increase the supply of reliable, affordable, and environmentally-sound energy from the private sector. Indigenous non-governmental organizations

(NGOs) and private voluntary organizations (PVOs) play an important role in this process. Successful development requires more than money, however. It also requires the skills and talents of individuals trained to handle such situations. USAID believes that every project should "leverage" its personnel, and include a major role for local participants in the planning and execution of the program. By making this kind of leveraging an operational goal, USAID believes it can make empowerment an integral part of the development process.

In Poland, Lithuania, and the Czech Republic, USAID is carrying out demand-side management programs with electricity distribution companies that are helping to create an industrial market for private energy service companies. Through the USAID's Utility Partnership Program with the U.S. Energy Association, leading U.S. utilities are donating the time of their executives and experts to work with sister utilities and help them in their efforts to privatize and adapt to a market economy.

2.A.2. Policy Reform

Energy sector policy has been inadequate in many developing and centrally planned countries. In the power sector, for instance, many government operated utilities are unable to meet the rapidly growing energy needs as the economies expand. Poor financial management and subsidized tariffs have resulted in deteriorating rates of return on power investments and an inability to finance additional facilities. Operating efficiencies are frequently very poor, and even normal maintenance activities are inadequate because of lack of funds or poor training.

To combat the deficiencies in power sector policy, USAID has made energy efficiency, renewable energy, and integrated resource planning key elements of its GWI. Many of the management deficiencies can be addressed through integrated resource planning techniques, and technology and financial management issues can also be incorporated into this planning process.

Much of USAID's energy sector activities have been concentrated in the power sector, both in the supply and demand side. This sector has been selected because there is a reasonably well defined infrastructure and hierarchy of organizations, and the relatively limited resources available to USAID can be used effectively. However, the Agency also recognizes that inadequate planning in the transportation sector is a universal problem, and has begun to address transportation issues in several of its GWI projects.

A component of the policy reform strategy has been the encouragement of private sector participation, particularly in the power sector. Policy guidelines and regulations, and financial incentive mechanisms are required prior to private sector investment. The Agency has found that it is more effective in promoting the adoption of environmentally-sound technologies by assisting in the reform of markets and restructuring of economic sectors, than through the more traditional approach of unsustainable isolated demonstration projects.

As an example of a broad policy driven project, the Agency is supporting an innovative program in Costa Rica to make use of agricultural residues in the sugar industry to fuel on-site private power generation. Part of an 11-year, \$12 million USAID project, this activity focused on the development of a government policy permitting private power hookups, pricing reform, and power sales to the national grid. The project also concentrates on the development of new, privately-owned, biomass-fired power generation units.

2.A.3. Capacity Building

In countries dominated by the public sector, a thriving market economy and private sector cannot be created overnight. New institutions must be created such as those necessary to encourage private sector producers, and old institutions dismantled. A critical aspect of USAID's strategy must be to strengthen private sector capabilities, particularly in the construction and management of efficiently run plants and businesses, and to build the capacity within the public sector to manage market-based decision-making mechanisms.

To support these efforts, increased resources are being devoted to the training of host country officials and experts on energy planning, renewable energy systems, environmental management in the energy sector, energy efficiency, private power participation, and financing. Training opportunities include formal course work, internships with U.S. energy organizations, and visits to U.S. energy facilities, including utilities, manufacturers, architect-engineers and private developers.

In 1990, for example, USAID launched the Global Energy Efficiency Initiative (GEEI) to encourage the incorporation of energy efficiency into the development strategies of developing countries and countries in Eastern and Central Europe. GEEI is a coalition of U.S. government agencies, universities, national laboratories, private companies, environmental and energy organizations, and other nongovernmental groups, and whose primary aim is to build a partnership among such institutions in industrialized and developing countries.

2.A.4. Environmental Technology Cooperation

As part of the GWI, USAID is promoting innovative, market-driven technology cooperation between U.S. and developing country organizations. The U.S. manufactures and exports some of the world's most energy efficient and environmentally-sound energy and information technologies. These technologies include combined cycle power plants, renewable energy technologies, computer-based control systems, heat exchangers, lighting equipment, windows, electric motors, refrigeration and air-conditioning equipment, automotive emissions controls, and expertise from energy services companies. U.S. manufacturers and developers can work with developing country counterparts to develop new environmentally-sound, global information technologies suitable for developing country markets. In addition, through its work on projects with private power developers, USAID can also effect a more immediate transfer of efficient and environmentally-sound energy technologies through the development and construction of projects using these technologies in those countries.

The growing demand for new, efficient power plants and the realization of energy efficiency needs in developing countries create increased export opportunities for U.S. technologies. Imports by developing countries of energy efficiency technology totaled \$4.2 billion in 1990, and are expected to grow by 2 to 3 percent annually. The U.S. market share of these imports was only 10 percent in 1990, however, and is now declining. Close collaboration between developing countries and U.S. industry has helped to improve the competitive advantage of U.S. firms and helped increase U.S. market share in power generation, energy efficiency, and environmental technologies and services.

Coal is a major source of energy for millions of people around the world, accounting for a quarter of total primary energy use worldwide (Holdren, 1992; IPCC, 1991b). Coal is also responsible for about 42 percent of all CO₂ emissions from the energy sector, and approximately 36 percent of CO₂ emissions from all anthropogenic sources (IPCC, 1991c). Coal use for electricity generation is expected to grow substantially in countries such as Indonesia, India, and China over the next several decades, providing a major opportunity for technology cooperation in coal-gasification and other environmentally-sound technologies.

2.B. Sustainable Agriculture

With some 3.2 billion hectares of arable land on the Earth's surface, agriculture is a major sector of human interaction with the environment. The sector is extremely complex, interacting at all levels of human endeavor (production, marketing and consumption) and environmental consequence (air, soil, water, climate, biodiversity, and natural resource base). Priority is now placed on agricultural activities which build on a country's comparative advantage and optimize present and future uses of natural resources in an environmentally-sound manner.

Improvement of the well-being of the world's less advantaged people is based on addressing long-range concerns about food security and the "health" of natural resources. To do this, agricultural programs are now devoting greater attention to developing integrated production systems - systems that enhance the structure and function of the broader agroecosystems. The lack of understanding of the interrelatedness of system components has undermined agricultural sustainability in the past, and failure to consider any one of them fully will inevitably undermine it in the future. A systems approach to agricultural development is necessary if these shortcomings are to be overcome.

The impact of agriculture on global climate change comes in two general forms: 1) global warming through disruption of the carbon cycle and emission of other greenhouse gases such as methane and nitrogenous gases, and 2) disruption of micro and macroclimates (rainfall, temperature, and season length) through human intervention caused by agricultural production, agroforestry, and silvopastoral practices.

The agricultural sector has responded to the challenge of global climate change in two ways: development of an awareness of the causes and implications of climate change; and mitigation of processes and activities considered to be the causes of global climate change. Mitigation has been by far the most important focus area of USAID intervention. For instance, the development of productive economic and sustainable systems of food production in tropical regions is key to reduction of deforestation. Developing an awareness of the causes and implications is an important part of the USAID portfolio. Awareness takes many forms; training, public (and governmental) awareness, and basic research, and usually is integrated as elements of on-going programs.

2.B.1. Leveraging Investments and Donor Coordination

The thrust of USAID's donor coordination has been to find potential collaborators with shared program and technical objectives, and to design and implement programs collaboratively. Multilateral cooperation has had its greatest impact and success in small countries or regions. The problem to be addressed is limited to a manageable size either geographically, socially, or politically. Recently there has been a trend for greater multilateral coordination at the program planning stage. A general acknowledgement by donors is that, in an atmosphere of diminishing resources, better coordination and cooperation is required. Globally, USAID, the Food and Agriculture Organization (FAO), the Rockefeller Foundation, and the World Bank are supporting the International Forum for the Development of Sustainable Land Use Systems (INFORUM) which serves as a communication network among researchers and policy-makers on topics related to sustainable agriculture and global climate change issues.

2.B.2. Policy Reform and Capacity Building

USAID recognizes that the policy environment in many developing countries is responsible for market distortions, discouraging food and agriculture production, and negatively affecting the natural resource base. Before governments can implement agricultural reforms, focused policy analysis is required to help policy decision-makers better understand policy alternatives and impacts. Greenhouse gas emissions by agricultural systems has only recently been added to the list of potential impacts of policy decisions.

The Agricultural Policy Analysis Project (APAP) and the Environmental and Natural Resources Policy and Training Project (EPAT) are programs that provide policy analysis support to USAID Missions. These programs are global in design, and have slightly different policy focus targets. APAP deals only with natural resource issues affected by agricultural systems, while EPAT covers general natural resource and environmental policy issues. Both are relatively new programs which are active in all regions of the world, and both address issues of global climate change.

2.B.3. Environmental Technology Cooperation

USAID's strength in reducing the impact on global climate change has been through its global network of technical cooperation. The relationship of the forest with agriculture, especially in tropical regions that provide productive, economic and sustainable food production systems, is a major key to reducing deforestation.

USAID is the lead donor to the Consultative Group on International Agricultural Research (CGIAR) that sponsors two international centers dedicated to reducing deforestation. The International Rice Research Institute (IRRI) is also undertaking research on methane emissions from rice production.

2.C. Conservation of Forests and Biological Diversity

Forests and other natural terrestrial ecosystems are significant to global climate change for two principal reasons. First, a significant amount of carbon is stored in the biomass of trees, shrubs, and other organisms and the organic matter in the litter and soil. When forests are converted to other land uses, much of the carbon stored in the biomass, litter, and soil is converted to CO₂ and released into the atmosphere, either quickly as the felled biomass is burned to prepare the site for planting, or more gradually as leaves, branches, roots, trunks or processed lumber decay. Secondly, ecosystems will be adversely affected by climate change, because some species within natural communities will be less adapted to survive under an altered climate, thus leading to changes in species composition of communities and ecosystems.

USAID is implementing activities specifically designed to counter CO₂ emissions from tropical deforestation in Latin America and the Caribbean. In Africa, USAID is improving the capacity of institutions to address global climate change by funding resource, policy, and institutional analyses and training. Most of USAID's sustainable forestry and natural resources management activities help to lessen either the rate or the impact of climate change, although they were not designed specifically for either purpose. Presently, the impacts of these activities on the global carbon budget are not being monitored. Conserving tropical forests avoids the net release of CO₂ which would occur otherwise because the carbon sequestered in biomass and soil would be oxidized by burning and decomposition processes. The same policies and institutional capacity that countries require to sustainably manage their forests will also equip them to assess their vulnerability and to adapt to climate change.

In fiscal year 1992, 133 projects in 56 countries were being carried out by USAID to conserve tropical forests and biological diversity. Through these projects, complemented by financial and technical support to other international agencies, NGOs, and scientific research centers, USAID is addressing the root causes of tropical forest and biodiversity loss (ENRIC, 1993).

To attack the root causes of tropical deforestation, USAID assists countries to rationalize policies in all sectors affecting forests, promotes effective government and private sector institutions for policy analysis and technology application through technical assistance and training, develops and adapts sustainable resource management technologies, and coordinates donor assistance in forestry.

2.C.1. Leveraging Investments and Donor Coordination

Many of the investments and institutional reforms required before developing countries are in a position to manage their forests sustainably are beyond the budget capabilities of USAID. However, well-timed and designed interventions by USAID can frequently catalyze or leverage much larger investments by other donors.

In several countries, USAID has used relatively modest sums of money to catalyze cross-sectoral collaboration among the government, national NGOs, the private sector, USAID, and other donors to analyze the interaction of forestry and natural resources management with other environmental issues and to integrate environmental and economic policies through the National Environmental Action Plan (NEAP) process. The success of the NEAP for engaging the participation of a broad cross-section of society in integrating environmental and economic issues has prompted the World Bank to require that countries prepare NEAPs prior to receiving development loans (Ford, 1992).

The Tropical Forestry Action Plan (TFAP) was launched in 1985 by the World Bank, the United Nations Development Programme (UNDP), FAO, and the World Resources Institute (WRI) to counter tropical deforestation by improving coordination among donors and raising increased overseas development assistance for forestry. Soon after the initiation of the TFAP, forestry advisors representing the major donors formed an *ad hoc* consultative group on TFAP called the TFAP Forestry Advisors Group (FA-G). While providing liaison work with FA-G, USAID has participated in the FA-G's evaluation of the effectiveness of the TFAP and helped to develop recommendations for its reform.

2.C.2. Policy Reform

Unsound economic and natural resource policies and inconsistent environmental laws and regulations are among the major causes of environmental degradation in developing countries (USAID, 1992). Forest product prices that do not reflect the full environmental costs of resource use, depletion and degradation, inconsistent tax policies, and insecure and inequitable resource tenure all reduce the value of forested land and promote its conversion to other uses. USAID helps countries analyze and improve their environmental policies both through project-level technical assistance and through non-project assistance policy dialogue. One of the most important policy interventions toward the achievement of sustainable economic growth is democratizing natural resource management by involving local people in management decisions for public lands. USAID achieves this goal through government adoption of incentives such as secure resource tenure, technical assistance, cost-sharing, and favorable tax policies. Governments are also assisted in the identification and reform of regulations for private forest lands that stifle sustainable and productive enterprises. The revised regulations result in the transfer of enforcement to the community level, and regulations that concentrate on activities that affect other landowners and public resources. In East, Central and Southern Africa, the capacity for local staff to effectively manage

protected areas is being increased through training by the Protected Area Conservation Strategy project. Protected area managers will be trained to promote the development of local communities, ecotourism enterprises, and local vigilance of protected areas. Regional training needs assessments are being carried out, and pilot training programs will test training methodologies for protected area staff.

2.C.3. Capacity Building

For countries to sustainably manage their forests, government and non-government institutions must exist that possess the capacity to determine and implement appropriate policies in the forest sector (and other sectors that affect forests). They must be able to assess the natural resource stock, evaluate land use capabilities, and allocate land to sustainable uses through a participatory process. These institutions must also develop or adapt appropriate resource management technologies and make the technologies available to those people managing the land. One of the most common elements of USAID projects is technical assistance designed to develop these capacities in host-country governmental and non-governmental institutions. In the Philippines, the 5-year, \$125 million, Natural Resources Management Program enhances the ecological and economic sustainability of lands managed as primary or secondary forests. The three major components are performance-based sectoral policy reforms, resource protection through a debt-for-nature swap, and support services for technical assistance. NGOs are being funded to assist 20 communities in organizing low-input, labor-based forest management. The government is being assisted to work with the private sector to develop a planning methodology to shift concessions from primary to secondary forests.

2.C.4. Environmental Technology Cooperation

USAID works in partnership with developing countries to fund research, development, and adaptation of sustainable forest management policies and technologies. Frequently, additional funds are leveraged through cooperation with other donors. Assisting the public and private sector in developing countries to access new forest management and forest products technologies, and helping entrepreneurs and producer organizations to adapt these technologies in profit-making enterprises, are important elements of USAID's technology cooperation activities. In Asia and Africa, USAID has been supporting the Forestry/Fuelwood Research and Development Project (F/FRED), ending this year, to increase the capacity of national institutions to carry out and apply research on multi-purpose tree species in woodlots and agroforestry associations that are used for fuelwood and other community needs. Networks of national researchers and institutions have been developed. By developing management systems for rehabilitating degraded forest land, the project will reduce pressure on natural forests, while meeting the needs of indigenous people living in and around these forests. Technologies developed by the project also have the potential for use in establishing forest stands as sinks of atmospheric CO₂.

2.D. Lessons Learned

USAID has learned many valuable lessons regarding the sustainability of development projects. *The most important lesson learned is that for on-the-ground, lasting results, projects must include training components so that host country nationals will be able to manage and maintain the project.* For this to occur, there must be incentives to the would-be host country practitioner of the project to become its manager. These incentives should be in the form of monetary increases or benefits from the host government.

Other lessons learned include the following:

There are four levels of project interaction necessary for successful projects. These levels include international, national, state and commercial transactions.

- International - USAID has been working collaboratively with international partners to create a policy environment that will encourage multilateral lenders, private lenders, and other groups to increase the availability of capital for investments.
- National - Much of the market reform and sector restructuring that will be necessary must take place at this level. This may involve rewriting of national laws and regulations, institutional reorganization and strengthening, privatization of public enterprises including industry and the power sector, price reform, and other measures that clear the way for private sector initiative and create a level playing field in the marketplace. The purpose is to identify and accelerate

sustainable social and economic development by promoting private sector solutions in developing countries and emerging market economies. Private sector participation helps governments to utilize their own resources more effectively, to access new sources of capital, and to capitalize on the technical and managerial expertise of private companies.

- State - In spite of sweeping national reforms, the institutional capability to implement new policies and programs is often lacking at the state or regional level. Certainly this is true in the NIS, where authority is rapidly moving to the regional level and is ahead of the local institutional capability to handle the new responsibilities. Power and other infrastructure regulation often rests at the state or local level in many countries, and significant efforts are necessary at this level to create the understanding and capability to promote and manage private sector options.
- Commercial Transactions - This is where the private marketplace operates. Strong capabilities must be developed at the transaction level that accommodate the needs of both the host-country government and the private sector. These transaction capabilities often exist at only a rudimentary level in many developing countries. Actions at the international, national, and state levels will be ineffective unless sufficient transaction incentives and capabilities exist.

Leveraging works best when all donor partners are present at all stages of a project from its definition and design through its implementation. There is a need to build institutional partnerships in developing countries between donor partners, country officials, and the private sector.

Replicating model projects has proven to be a cost-effective and time-effective means of bringing the successes and lessons learned from one country to another. Care must be taken to tailor the projects to the specific needs of the country.

Projects that are developed jointly by several organizations must be housed within one specific organization. This approach will give one group the ultimate responsibility to supervise the successful implementation of the project.

It is preferable that policies needed for project implementation be in place before the projects are implemented. However, project development and policy/regulation formulation activities can be concurrently implemented. It is important to note, though, that without the appropriate policy environment, projects will not be sustainable.

USAID has learned these and other valuable lessons in developing and implementing projects to combat global climate change. These lessons are an integral part of USAID's suggested GCCS strategy. With a strong foundation in global climate change activities, as seen through the examples in Appendix 1, USAID is ready to lead the U.S. in designing, developing, implementing, and evaluating global climate change activities in developing and post-communist countries.

Figure 2.1 not available in HTML

1. Over the past three years, much has been learned regarding the global climate change issue. Most importantly, if temperatures rise as expected under current practices, other climatic variables will also change adversely, affecting developing countries in both the long- and short-term. Therefore, the term "global climate change" is more descriptive than "global warming". However, for purposes of discussing all past activities from FY 1991-1993, the acronym GWI will often be used as this refers specifically to the Congressional mandate of 1990.

Chapter 3

USAID's Global Climate Change Strategy

USAID will concentrate on the development of national policies and institutions that will lead to the reduction in the rate of growth of greenhouse gas emissions from key developing and former communist countries. As the lead U.S. international development agency, USAID will collaborate closely with other international donors and lending institutions, and with other U.S. agencies who will be instrumental in the implementation of development projects and the promotion of U.S. technologies.

Strategic approaches which have proven successful in past USAID and other international development projects can be used as guidelines for the development and implementation of country specific or more general global programs designed to mitigate the net emission of greenhouse gases. The strategic approaches address three major topical areas - the energy sector, forestry and natural resource management, and information technology and dissemination. The agricultural sector has been included in the forestry and natural resource management sector as a land-use issue.

The strategic elements are policy reform, capacity building, technology cooperation, and financial leveraging. All four elements must be addressed successfully if sustainable development is to be achieved. These strategic elements may be addressed at the international, national, state, and transaction levels. Interactions may occur at a single level, or at all levels depending upon the specific issue or project being addressed and the country involved.

The first two strategic elements involve interaction with national and state agencies within the host countries. Policy reform establishes the foundation for the creation of standards, codes, and regulations, and the formulation of market structure within the economic sector. Capacity building is vital in both the government and private sector if development is to occur and be sustainable. Capacity building may also involve interaction at the international level (e.g., MDBs) and at the transaction level which could involve either public or private sector entities.

Technology cooperation is more than simply technology transfer. The technology cooperation process involves the development and enhancement of institutions and human resources capable of implementing and sustaining new technology. Successful technology cooperation requires an institutional and regulatory framework to foster cost effective infusion of new technologies into an economy. And, it also requires access to financial markets. Successful technology cooperation will typically involve interactions at all four levels.

The remaining strategic element, financial leveraging, is required to provide the linkage between policy development, capacity building, and technology commercialization. Financial leveraging may occur internationally with donor and multilateral development bank partners, or more locally with private sector lending institutions.

USAID will concentrate on the first two strategic elements described above - policy reform and capacity building - which historically have been key foci of Agency attention. One of the major goals of USAID will be to create a favorable political and market climate for the successful adoption and implementation of state-of-the-art, environmentally-sound technologies. The Agency will also collaborate with other donors and MDBs to ensure that the developing countries are provided access to development grants and concessional funding to foster the successful commercialization of new technologies. With its decades of successful experience in these areas, and with a continuing in-country presence, USAID is positioned to lead the U.S. interagency effort in the development of institutional and regulatory frameworks in developing countries which will open the path to widespread utilization of environmentally-sound technologies and methodologies and the creation of economically and environmentally-sustainable economies.

USAID will focus its main attention on the development of country-level greenhouse gas (GHG) mitigation programs. The basis of these activities may be national level efforts to inventory sources and sinks of greenhouse gases, and to develop national action plans and response strategies to reduce greenhouse gas emissions. Currently USAID, along with ten other U.S. agencies, is participating in the U.S. Country

Studies Initiative (CSI) which is providing assistance to developing countries and the NIS in these areas. Close coordination with the host governments will assure that additional USAID efforts in the mitigation area will be complementary in nature. USAID will also coordinate with the appropriate host government agencies to encourage the integration of emission reduction goals in relevant national development policies and goals.

Because of limited availability of funding for climate change activities, USAID must concentrate on a set of key countries. The criteria used to select key countries for mitigation programs include the type and quantity of emissions and the ability to absorb GHGs in natural sinks. Consistent with findings of the Intergovernmental Panel on Climate Change (IPCC), the United Nations Environment Programme (UNEP), and other international global climate change organizations, these should be the most important criteria for selecting a key country. Another important factor to consider includes the ability and willingness of a country to adopt greenhouse gas emission mitigation policies (i.e., its "tractability"). A country that receives high ratings of tractability would be one in which our investments would likely make a positive difference. It is also in the interest of the U.S. to recognize those developing countries that have joined us in signing such international agreements as the FCCC. Other secondary criteria that should be considered are the natural and financial resources available within a particular country.

Evaluating the effectiveness of new sustainable development projects will be a primary goal of USAID as it restructures its foreign assistance program. This will be a major challenge, particularly for projects that concentrate on human development as opposed to implementation of specific technologies. It may be possible, for example, to quantify the amount of carbon dioxide emitted per unit of electricity generated or the amount of methane produced per ton of rice harvested. It will be difficult, however, to attribute a specific reduction to specific measures such as policy reform, capacity building, institutional development, or technology cooperation.

A secondary USAID objective in the climate change arena - and one that is mandated under the terms of the FCCC - is to assist developing countries assess their vulnerability to changes in climate caused by the accumulation of greenhouse gases in the atmosphere, and to assist in the formulation of plans to adapt to climate change if requested by the affected countries. Although USAID will also assist developing countries in the vulnerability assessment and adaptation area, those activities will be conducted on a country-by-country basis, but not as part of a broader global program.

The key objectives of the GCCS will be to: promote efficient energy production, transmission and end usage and renewable energy technologies while simultaneously expanding public and private energy services in developing countries; promote sound forest and natural resources management practices in key countries; and improve information collection and dissemination and global electronic communications. These objectives must also contain achievable targets and criteria for selecting key countries.

The final section of this chapter focuses on measuring results. Illustrative targets are presented for discussion purposes only. The key indicators for success should be selected to indicate whether programs are effective in establishing long range trends that lead to the eventual stabilization of greenhouse gas concentrations in the atmosphere at a level that will not result in unacceptable global climate changes. In the energy and industrial sector the initial goals should be the reduction of greenhouse gas emissions per unit of useful output (e.g., kWh of electricity, passenger mile, ton of steel) through implementation of energy efficiency measures and improved technologies, and the substitution of low carbon emitting fuels such as natural gas for coal or oil. The long range goal should strive toward: the expanded use of renewable energy technologies; commercialization of power sector equipment such as biomass and coal gasifiers; use of fuel cells and high specific energy intensity and storage capacity batteries; restructuring of the transportation sector; utilization of more efficient and creative engineering and architectural designs in the built environment and the industrial sector; and more effective use of information technologies. These short and long term goals acknowledge both the need for developing countries to increase per capita services over the next half century, and the obligation to participate in the global effort to reduce greenhouse gas emissions and stabilize GHG concentrations. In the forestry and natural resource management sectors, including agriculture, global climate change efforts must concentrate on the net reduction of carbon dioxide emissions through appropriate forestry and land use practices, and on the reduction of methane and nitrous oxide in the agricultural sector.

3.A. Promoting efficient energy use and renewable energy while expanding public and private energy services

The energy sector will play a pivotal role in USAID's GCCS since this sector accounts for one half of the potential global warming problem. Because of the importance of the energy sector to economic development, and because of the significant potential for managerial and technological improvements in this sector, USAID has a major opportunity to foster economic growth while simultaneously addressing the greenhouse gas emission problem. In particular, USAID can assist in restructuring the energy sector, promoting the adoption of low and non-carbon emitting technologies and energy efficiency improvements, and fostering conditions that are favorable for investment, particularly from the private sector.

Declining institutional and financial performance has been a major problem in many developing countries. Financial rates of return have been declining since the 1970s, from around 10 percent to as little as 2.8 percent in 1989 (Schramm, 1991). Compounding the problem are artificially low tariffs, now approximately half those in the OECD countries. Inappropriate investment policies have emphasized the construction of new facilities while simultaneously de-emphasizing good operating practices and periodic maintenance procedures. These policies have resulted in nominal capacity margins of 40-59 percent versus a more desirable 15-30 percent in OECD countries. Transmission and distribution losses are up to 20-30 percent versus 7-8 percent in OECD countries. The result has been peak demands which outstrip peak supply by between 10-25 percent in many countries. Rolling blackouts or brownouts are the only immediately available means of coping with the shortfalls.

At the heart of many of these problems are fundamental institutional and management issues (Jhirad, 1992; Schramm, 1991). Most electric utilities are government-owned. They are regulated by a ministry with a politically appointed head and a regulatory body that is not independent. International studies coordinated by the United Nations and the World Bank, such as the *Report on the Stockholm Initiative on Energy, Environment and Sustainable Development (SEED): Strategies for Implementing Power Sector Efficiency* (SEED, 1991) and the *Core Report of the Electric Power Utility Efficiency Improvement Study* (World Bank, 1991), found that many of the utilities suffer from management problems caused by a lack of autonomy from government, and that there was a growing tendency to view public utilities as political patronage machines or as a vehicle for local employment generation.

In the past, power expansion has been financed through internal resources and major loans from multilateral and bilateral development institutions. However, inefficient financial management, combined with the inability of a country to meet the financial commitments necessary to address the growing demand of power expansion, have made investment in power expansion increasingly unattractive to potential investors. With the demand for electricity growing at between 5 and 15 percent per year in most developing countries, the traditional sources of capital are insufficient (Cartselos, et al., 1993). Over the next decade, it is estimated that aggregate capital requirement for the projected 384 gigawatt (GW) sector expansion program will amount to \$1 trillion in current dollars (Moore, et al., 1990). Of the \$100 billion annual requirement, about \$40 billion is required in foreign exchange, and only about \$10 billion per year is projected to be available for developing country expansion projects from all multilateral and bilateral development institutions and external private lenders and investors (Jhirad, 1990).

Developing countries have begun to adopt economic and investment policies that attract private sector investment and capital. Private sector participation helps governments to utilize their own resources more efficiently, to access new sources of capital, and to capitalize on the technical and managerial expertise of private energy companies. Involvement of the private sector in the development of the power sector can accelerate sustainable economic growth and social development in USAID-assisted countries by helping to alleviate these countries' energy shortages. Private sector participation, besides providing needed capital infusion, also helps to strengthen the sector through competitiveness, efficient management techniques, promotion of efficient use of fuel-mix, and timely on-budget completion of environmentally-sound power plants.

Efforts aimed at institutional and policy reforms and at providing capital flows within developing countries should result in increased access to environmentally-sound technologies that are essential for sustainable development. At the present time, however, the "gap between the least technologically developed countries and the rest of the world is accelerating, requiring special attention to their problems" (Gray, 1992). Past efforts to transfer environmentally-sound technologies have often failed because the transfer

was viewed as a single event, was overly focused on hardware, and did not involve a symmetrical relationship between the parties involved. The adaptation and diffusion of energy efficient and renewable, environmentally-sound, energy technologies is best viewed as an on-going process where there are mutual interests in sharing information, know-how and technology, and where technologies are viewed as total systems, including procedures, processes, products and services as well as equipment (U.S. Delegation of Technology Cooperation, 1991). Indeed, the process is more productively and accurately understood as technology "cooperation" as opposed to technology "transfer", with the emphasis on collaboration and accommodation of mutual interests rather than on the simple transfer of equipment.

The problems described above are interconnected in a complex web referred to here as the "triple-bind": insufficient capital; outmoded institutions and policies; and severe environmental constraints. (Jhirad, 1991). The formula necessary to address the triple-bind is a combination of improved investment capabilities, enhanced institutional and individual performance, and increased technology cooperation. The building of indigenous capability to produce and use energy efficient and renewable energy technologies on a significant scale should be the objective of such technology cooperation. A necessary ingredient is increased involvement of the private sector.

3.A.1. Institutional Reform and the Private Sector

USAID's approach toward reforming and enhancing energy and industrial institutions should focus on three areas: 1) institutional restructuring, 2) industrial modernization, and 3) capacity building in both the public and private sectors.

Commercially-autonomous entities governed by politically independent regulatory bodies have proven to be most effective in reforming and retrofitting inefficient and environmentally-unsound power sources and industrial facilities. Pricing reforms should: introduce full-cost pricing for electricity and other energy forms; remove inefficient and ineffective subsidies (except those safety-nets for low-income households); and identify, quantify and include environmental externalities in the price of energy.

The industrial sector accounts for approximately half of commercial energy use in most developing countries. This sector is often characterized by a predominance of a few large, publicly-owned plants, such as steel mills and cement plants, with a large number of smaller, usually privately owned plants. The large public plants are often considered as "employers of last resort", and thus are overstaffed and inefficiently operated. In addition, the prices of both raw materials and components, as well as the end product prices, are often regulated thus removing market incentives to improve efficiency.

Major reforms of the industrial sector include: the introduction of efficiency and emissions standards for common energy consuming equipment such as motors, lighting and boilers; the creation of comprehensive programs aimed at improving the energy efficiency of buildings, including a global effort to promote the adoption of building energy codes and appliance efficiency standards; a broad-based effort to redirect present trends in the transport sectors of key countries, including the introduction of electric vehicles and greater investment in mass transit; and, technology cooperation programs to infuse modern information-intensive manufacturing, quality control, and distribution methodologies and technologies, adapted to local conditions and oriented to address indigenous problems, into developing country industrial sectors.

Revitalization of developing country institutions and the private sector will not succeed unless the capacity exists to take advantage of and properly manage the new market-oriented approaches. Within governments, capacity must be strengthened to regulate the power sector based on true cost (including environmental externalities) considerations. In many cases, basic cost information is not available, not to mention the tools and expertise to use this information for cost-based tariff setting or integrated resources planning. Within the private sector or newly privatized enterprises, management must be retrained regarding everything from identifying products demanded by the market to managing power production facilities for maximum efficiency. Experience has shown that this training is needed at both the state and federal levels to provide in-country officials with appropriate skill to efficiently evaluate, negotiate and interact with private sector investors on proposed projects. Key components of a capacity building program, in response to these needs, should include training, exchange and technical assistance programs directed at:

the power sector, including utility regulation, tariff design, integrated resources planning, demand-side management, competitive bidding and issues related to independent power development and privatization, energy and emissions monitoring, data collection and analysis to facilitate power sector planning, and emissions control; and

the industrial sector, including pollution prevention and control, efficient plant operation and management, transportation planning, use of modern information technology, land use planning, and energy efficient building design.

USAID will also continue its support of the CSI which is primarily engaged in capacity building activities. One of the major objectives of this program is to foster the development of indigenous institutional capabilities for addressing the climate change issue. Through its active participation in the CSI, USAID will seek to ensure coordination of U.S. Government efforts in developing countries.

3.A.2. Environmental Technology Cooperation

There now exists over a decade of experience in technology transfer and cooperation, and several effective programmatic models have emerged. USAID/India's PACER has yielded commercially-viable joint ventures to produce innovative technological solutions to local energy and environmental problems. USAID/Thailand's U.S.-Thai Development Partnership Project is also rapidly stimulating the formation of partnerships that benefit the energy, and other, sectors. These programs, and other USAID experience confirm the six essential building blocks for successful technology cooperation: 1) sound economic conditions, 2) national capacity, 3) an assessment of the country's technology situation, 4) a sound decision-making process, 5) access to information, and 6) an introduction to and encouragement of private sector participation (U.S. Delegation of Technology Cooperation, 1991).

The development, commercialization and widespread diffusion of environmentally-sound technology will be an essential element in the industrial modernization and economic growth strategies of all nations. This common goal provides a major opportunity for global partnerships between developed and developing nations stressing technology cooperation that is both economically productive and environmentally sustainable.

USAID's strategy for broad-based economic growth recognizes the need for productive technology, along with other important factors, such as good governance, adequate investment and savings, and access to education and health care. USAID will emphasize the need for sectoral reforms, and will assist host nations in building indigenous institutions and policies that promote openness to trade and investment.

Information-intensive technologies, based on globally-competitive technological elements but adapted to local conditions and incorporating local skills, offer a special opportunity for technology cooperation having a strong positive environmental impact. In addition, because the United States is a world leader in these technologies, this emphasis offers numerous mutually-beneficial trade and investment opportunities.

In this process, USAID will support the development of an institutional and policy capacity within recipient countries to develop, transfer and adopt technologies that will enhance environmentally-sound growth. This will also entail the strengthening of local markets for environmental technology services and equipment through capacity building, local environmental management, training and information dissemination. Sectorally, this will require the reduction and eventual elimination of environmentally harmful industrial and energy practices. USAID therefore has a unique role in the U.S. Government in creating the conditions for effective technology cooperation and adoption, and will cooperate with other U.S. Government agencies such as TDA, the Department of Commerce (DOC), and the U.S. EXIM Bank and OPIC.

One method whereby USAID may improve its role in environmental technology cooperation is by fostering industrial and utility partnerships. These partnerships will be catalyzed and established through a "Marshall Plan" approach that supports institutional representatives from developing countries and the former communist nations in developing long-term industrial, commercial and private sector educational and cultural links with counterpart organizations in the United States. The plan will support study tours and fellowships in the United States, and will foster sister relationships among universities, industries, utilities and cities focusing on environmental technology in infrastructural investment. It is anticipated that

the element will build on existing programs supported by the U.S. Energy Association and the Sustainable Cities Initiative (SCI). SCI brings together private sector companies involved in environmental technology to focus on creating and implementing models for sustainable development in select cities in the world. USAID will work in partnership with the private sector to ensure that environmentally-sound investments in energy, transportation and buildings are leveraged and implemented. For example, USAID will participate actively in the U.S. Initiative on Joint Implementation announced in the President's Climate Change Action Plan.

In a wide spectrum of developmental situations, the needs for appropriate technology and for accurate and relevant information conjoin to create a demand for information technology. Information and information technology also play crucial direct roles in mitigating the adverse environmental effects of economic activity (see box), and hence constitute a key cross-cutting element of USAID's global environment and climate change strategy. This application of information and information technology is addressed here.

Information Technology in Environmentally Sustainable Economic Development

Information and knowledge are well recognized as powerful forces for economic growth and efficiency. Information also can be a powerful force for mitigating the adverse environmental consequences of economic activity, such as natural resource depletion and climate change. The key tool for using information effectively on an economically significant scale is information technology. Because of the stunning rate of global technological advance, information technology is becoming rapidly more powerful, accessible, and cost-effective. Consequently, it is becoming an essential element of numerous other technologies and processes important for sustainable economic development. Together with pure information technology, these constitute the powerful group of *information-intensive technologies*.

Win-win solutions that employ information-intensive technologies to increase resource consumption efficiency, reduce greenhouse gas emissions, and at the same time create economic value, are arising rapidly throughout such diverse economic sectors as agriculture and food systems, energy production, energy consumption, manufacturing, transport, and recycling.

These developments reflect the underlying scientific principles that energy and matter may be transformed, but not lost, so that consumption or loss of a material resource means conversion to a less useful form, technically speaking a less ordered or higher entropy form. The conversion of electrical energy into waste heat, or petroleum reserves into atmospheric greenhouse gases and more waste heat, are examples. The capacity of information to mitigate the growth of disorder by increasing process efficiency reflects the underlying scientific fact that information and entropy are opposites.

USAID has already begun to take advantage of these dramatic developments in such initiatives as improving electric power plant and district heating efficiencies through sophisticated electronic control systems; many more opportunities exist.

3.A.3. Investing in a Sustainable and Efficient Power Sector

Lenders are only willing to take on commercial risks in developing countries if the political risk is covered by a combination of government guarantees, political risk insurance, multilateral bank participation, and export credit agency guarantees. The Institute for International Finance, which represents over 175 of the world's largest banks, is pressing the World Bank and the IMF to adopt procedures that will cover the political risks of lending to developing countries (Bacon, 1993). Developing country governments clearly want to limit their exposure by restricting the use of government guarantees.

A key factor in a successful investment program is political vision and commitment from the developing country governments, and in particular, from progressive leaders who are willing to serve as champions for the concept. Expanding power sector investments in developing countries will involve a multi-pronged effort that entails close cooperation between country governments, development institutions, and private developers, investors and lenders (Buresch, et al, 1993).

A sustainable development investment strategy in the energy sector will complement its sister strategies in institution building and technology cooperation by providing the necessary financial resources required to make development projects viable. Specific components of effective institutional reform and technology

cooperation strategies were outlined in the preceding two sections. Key aspects of the investment strategy are summarized below.

Agency collaboration with MDBs is necessary to promote additional lending in the areas of energy efficiency, renewable energy systems, and low carbon emitting technologies, and to ensure that climate change objectives are adequately incorporated into lending programs. USAID should also cooperate closely with multilateral and bilateral development institutions to implement policies that more effectively leverage private capital for large environmentally sound infrastructure projects.

USAID should encourage efforts by developing countries to develop investment policies that favor private power generation, and in special cases, wholesale privatization of the electric utility. This includes promoting local currency investments through market reforms and domestic capital market development.

Successful Mission-funded programs should be replicated in other countries. Examples of several successful programs in India include: PACER, that leverages private sector commercialization of new environmentally superior energy technologies; EMCAT, that promotes enhanced capital productivity through financing, technology, and management innovations; and, a project in the Philippines focusing on demand-side management and energy sector restructuring, thereby encouraging the increased use of sustainable, efficient energy technologies in the generation and use of electrical power. A key element in several of these programs is the use of host-country lending institutions as key partners in the program implementation process.

3.A.4. Selection of Key GCCS Countries

The principal criteria used in the selection of key countries in the energy sector are the fraction of total greenhouse gas emissions contributed by a particular country, and the type of greenhouse gas emitted. This set of criteria is consistent with the findings of the IPCC, UNEP, and other international global climate change organizations. Both current and potential future contributions to GHG emissions should be considered. The major type of GHGs include carbon dioxide, methane, nitrous oxide, and chloroflourocarbons (CFCs⁽⁴⁾).

Other criteria include the ability and willingness of a country to address global climate change mitigation and adaptation issues. This is termed a country's "tractability." A country that receives high ratings of tractability will be one in which USAID investments will provide tangible results. In addition, it is in the U.S. interest to recognize those developing countries that have signed the FCCC. Other secondary criteria that should be considered are the natural and financial resources available within a particular country. These criteria were used to screen a number of USAID assisted countries to determine potential candidates for assistance in the global climate change area. Details are presented in Appendix 4.

Based on the above criteria, USAID has identified the countries shown in the box and maps below as major contributors to their energy sector GHG emissions. The first map below in Figure 3.1a shows priority countries excluding those in the NIS. The second map shows the priority countries in the NIS.

Major Contributors to Energy Sector Emissions:

Brazil, India, Indonesia, Kazakhstan, Mexico, Philippines, Poland, Russia, Ukraine

Figure 3.1a - Major Contributors to Energy Sector Emissions – Global Not available inHTML

Figure 3.1b - Major Contributors to Energy Sector Emissions - NIS Not available in HTML

3.B. Reducing Greenhouse Gas Emissions By Promoting Sustainable Land Use In Key Countries

Between 1 and 3 billion tons of carbon per year enter the atmosphere as the biomass present in tropical forests cleared for agriculture is oxidized, either quickly in fires set to prepare planting sites or gradually through the decay of leaves, branches, roots, and trunks (Sundquist, 1993). This is equivalent to between 1/5 and 1/2 of all carbon released from combustion of fossil fuels, and thus represents a major source of greenhouse gases. Forests cover about 3.6 billion hectares, or 28 percent of the earth's land area, and other wooded land such as forest fallows and shrubland total 1.7 billion hectares (World Resources Institute, 1992). The biomass of these forest and woodland ecosystems represents a tremendous sink of carbon.

As a central element of our climate change strategy, USAID will undertake activities to favorably influence the balance between organic and atmospheric carbon through two complementary approaches. The first approach will maintain current carbon sinks by promoting activities to reduce the high rate of tropical deforestation. The second approach will increase carbon sinks by increasing the carbon stored in existing forests and establishing new forests.

Deforestation can be countered by establishing protected areas such as parks and by sustainably managing forests to produce goods to the benefit of rural people. USAID will promote the replacing of policies and economic incentives that motivate rural people to convert forests to other land uses such as farming and grazing with policies and economic conditions that will motivate and empower these people to sustainably manage forest resources for their economic benefit. Such management will not only avoid emissions of greenhouse gases, but will also provide long-term income generation to alleviate poverty among forest-dependant people, in support of USAID's economic growth strategy. Reducing deforestation will also counter the accompanying loss of biological diversity, which limits the present and future ability of many countries to sustainably produce equitable economic benefits from their natural resource base. This component of the Global Climate Change Strategy complements USAID's Biological Diversity Strategy.

New carbon sinks will be established through ecologically, socially, and economically sustainable tree planting. USAID will provide support for the development of tenure policies, reliable accounting procedures, and appropriate technologies to create a favorable environment needed for such reforestation to occur.

USAID efforts in support of sustainable agriculture under the Economic Growth Strategy will also help to avoid deforestation by maintaining and increasing agricultural yields in areas already cleared. Under the Global Climate Change Strategy, USAID will also assist the international regional agricultural research centers and host-country partners to cooperate with U.S. Department of Agriculture (USDA) scientists to develop and apply technologies to reduce per capita methane production from paddy rice and livestock production.

USAID will support efforts to establish a policy environment that will motivate local people to conserve tropical forests and biological diversity and to plant trees. Donor coordination on policies will be an important element of the objective. USAID will support the creation of strong, lean, representative, accountable government and non-government institutions that will empower rural people to sustainably manage forests by promoting their increased participation in natural resources decision-making. USAID will also assist rural people to access, adapt, and/or develop appropriate technical, cultural, and socio-economic information and technologies for sustainable forest resource management.

Appropriate policies, capable institutions, and knowledge are all necessary, but none alone is sufficient, to achieve reduced greenhouse gas emissions by bringing about the sustainable management of forest, range, and agricultural ecosystems. Therefore, USAID must support interventions in all three areas to achieve the objective of sound sustainable land use in key countries.

3.B.1. Sustainable Land Use Policies

USAID will provide assistance to host countries to identify the impacts of development policies on forest use. Sustainable land use policies that provide economic incentives for sustainable resource management and discourage policies that lead to unsustainable resource use, are critical. Policies that facilitate the sustainable production of goods and services for a rapidly increasing population will be encouraged in future activities. In this manner, the GCCS will contribute to and build on activities under the economic growth focal area of USAID. Policies that lead to sustainable agriculture adjacent to forests, and buffer zone management that protects ecosystem processes, will be encouraged. Tenure policies that provide rural inhabitants with secure access and traditional user rights to resources will also be promoted by this strategic approach. Local people's participation in natural resource management decisions will contribute to and build on USAID's democratization focal area.

USAID will promote market incentives for sustainable resource management, including the accurate valuation of non-timber and timber forest resources. Current impediments to full valuation include low prices paid to private and government producers, and concession policies that favor resource mining. National policies, especially in the agricultural sector, that motivate rural inhabitants to convert forests to other uses will be discouraged. Trade barriers, such as tariffs and restrictions on imports and exports, will

be modified and policies which encourage value-added forest and agricultural product processing and open markets will be promoted. Using the strengths of markets to promote sustainable natural resources management is consistent with, and will build on, USAID's economic growth focal area.

Conditions outside of the forest sector also influence natural resources policy. Population growth, another focal area for USAID, will be a central part of the policy dialogue. Foreign currency shortages are frequently offset by increased commodity exports produced through unsustainable resource use. This strategic approach will provide technical assistance and promote policy dialogue to improve natural resources legislation and government administrative procedures. Policy reform will promote sustainable natural resource management through a legal and regulatory framework of market incentives and strengthened enforcement. A policy-making process that bases land use priorities on resource information and available technologies will be encouraged.

3.B.2. Empowerment Through Participatory Institutions

Activities designed to enhance institutional capacity will include incentives that empower women and involve non-governmental organizations and the private sector in natural resources management decisions and provide management technologies to those on the land. Specific institutional skill development areas will include science and technology generation and adaptation, resource and policy monitoring and analysis, and budgeting, accounting, and personnel management. Emphasis will be given to advocacy and access to information. Participatory planning processes that begin with local needs assessments and indigenous knowledge and that link the knowledge base to the users will be promoted.

An effective capacity-building component must include cross-sectoral activities that link sustainable natural resource and protected area management with policy, population, economic growth, and the education of, and participation by, women and disadvantaged minorities.

This strategic approach will complement activities undertaken to meet USAID's democracy focal area by promoting the development of democratic institutions that are empowered to make and implement sound natural resource management decisions.

A strategic approach that emphasizes empowerment through participatory institutions will provide technical assistance and training to local institutions through specific Mission projects, assistance from global bureau projects, and partnerships with other donors and multilateral development banks and technical agencies. USAID technical assistance will complement and leverage investments in host-country infrastructure and commodities by other donors.

3.B.3. Resource and Technology Assessment and Development

USAID will assist host countries to assess the ecological, socio-cultural, and economic trends of current land management practices that affect forests. Our combined efforts will seek to increase public awareness of the causes and effects of the loss of forests and biological diversity. Host countries will be assisted in developing natural resource management systems that maintain biological diversity and ecological processes while allowing people to benefit economically from the resource. Assistance could include the compilation of current information on culturally derived land use systems, indigenous knowledge, and the resource base. Information gaps will be identified, and priorities will be established and funding provided for additional cost-effective assessments of management systems and inventories for biological, water, and soil resources. Identifying indigenous technologies that sustainably manage natural resources will be a central part of this analysis. An assessment of current resource uses is essential to accurately project future needs.

To provide a baseline level of knowledge about the geophysical, climatic, and biological production potential of forest, range, and agricultural ecosystems, assistance will be provided for countries to determine current land use and assess the current stock of natural resources. Assessments will need to be made of traditional uses of forests and of trees in agricultural production systems.

3.B.4 Selection of Key GCCS Countries

Countries in which USAID may focus activities to promote sound forest and natural resources management practices for reducing emissions of greenhouse gases are identified based on their current or potential levels of greenhouse gas emissions from deforestation and agricultural practices. Countries

are also selected because of their potential to sequester carbon through reforestation or afforestation. As discussed in Section III.A.4, additional criteria includes the tractability of USAID working effectively in a country and the signatory status of the country with regard to the FCCC.

Bolivia, Brazil, Ecuador, and Peru are identified because they encompass the Amazon Basin, the largest extent of tropical forest remaining on earth. The forests of central Africa are the second largest extent of tropical forest. This area, called into the Central African Region, includes Cameroon, the Central African Republic, Equatorial Guinea, Gabon, Zaire, and the Congo. Indonesia and Papua New Guinea are identified countries because they are the home of the third largest area of tropical forest. The Mayan forests of southern Mexico and adjacent Belize and Guatemala represent another significant extent of tropical forest. Finally, Russia has the largest extension of remaining temperate and boreal forest.

The countries of Central America and the Philippines are identified as good candidates for the establishment of sinks of carbon through tree planting. India, Indonesia, and the Philippines are also included because of the importance of their extensive rice paddies.

Major contributors to forest and agricultural sources and sinks of GHGs for forestry and agricultural emissions are listed in the box below and are also shown on the following two maps, Figures 3.2a and 3.2b.

Major Contributors to Forest and Agricultural Sources and Sinks of GHGs

Priority Countries: Bolivia, Brazil, Central African Region (Cameroon, Central African Republic, the Congo, Equatorial Guinea, Gabon, and Zaire), Central America, Ecuador, India, Indonesia, Mexico, Papua New Guinea, Peru, the Philippines, and Russia.

3.C. Improving Information Collection And Dissemination And Global Electronic Communications

Agenda 21 addresses the issue of better information flow to and from developing countries. The need for information arises at all levels, from that of senior decision makers at the national and international levels to the grass-roots and individual levels. There is a lack of capacity, particularly in developing countries, and in many areas at the international level, for the collection and assessment of data, for their transformation into useful information, and for their dissemination.

Sustainable development cannot occur in a vacuum, however. It is not enough to reform out-of-date environmental policies and regulations or to leverage the necessary funds to bring plans or projects to fruition. USAID must also help people locate sources of technology, share lessons learned about projects with neighboring countries, and contribute to current databases of global climate change and remote sensing information about their countries. A major part of capacity building is assisting people to be self-reliant. To contribute, and to have ready access to, environmental information will empower developing

Figure 3.2a - Major Contributors to Forest and Agricultural Sources and Sinks of GHGs Not available in HTML

Figure 3.2b - Major Contributors to Forest and Agricultural Sources and Sinks of GHGs Not available in HTML

Technology, capital and institutional reforms are necessary if developing countries are to improve their efficiency and management practices, but these alone are not sufficient. Information regarding new technologies and market reforms is a missing critical ingredient. Increased access by developing countries to information is critical because:

Information is essential for the efficient functioning of free markets; as market reforms take place and industry, power, and forest sectors are privatized, easy access to information will be vital;

Information can move more quickly than technologies, capital or institutions; accelerating the rate of information flows to developing countries is the fastest means of promoting the use of environmentally sound technology, and is an essential preparatory task to the transfer of technology and capital; and,

The U.S. is the world leader in information technologies; it can build on this leadership to the benefit of both the developing world and U.S. businesses by building information highways to the developing world to carry critical energy and environmental information.

3.C.1. Global Energy and Environment Information Exchange

The massive costs of both global environmental monitoring initiatives and the information processing required to produce policy-relevant assessments of the data, together with substantial unresolved scientific uncertainties, preclude more than a marginal role for USAID in either data collection, data interpretation, or development of policy advice. Nevertheless, instances will exist in which USAID can employ available information effectively to advance developmental goals. Developmentally-sound USAID initiatives will exist in the following areas:

- Facilitating developing country access to global monitoring data, especially via the global Internet;
- Providing limited support for data assessments critically needed for developmental or assistance delivery policy decisions;
- Providing limited support for monitoring activities where critically-needed data do not already exist, such as essential local information on certain globally-significant greenhouse gas emission sources; and,
- Building indigenous data assessment capacity to inform local decision-making.

USAID is currently transforming its internal communications to incorporate linkage to the Internet. The Internet, a rapidly-expanding network of more than 5,000 individual data networks worldwide that conform to U.S.-developed standards, is the most widespread and most cost-effective means for worldwide information delivery. It is being pursued rapidly by USAID's counterpart organizations, such as the UNDP and the World Bank. Expansion of affordable Internet access will be a high priority throughout USAID's programs, including those addressing global climate change.

3.D. Assisting Developing And Emerging Countries In Development Of Action Plans For Adaptation To Global Climate Change

Although vulnerability and adaptation issues are discussed in this report, a "global" adaptation strategic approach is not proposed. Instead, USAID will address adaptation responses on a country-by-country basis. In general, adaptation involves responding and adapting to the adverse impacts of climate change.

As a signatory to the FCCC, the United States Government has made a commitment to assist particularly vulnerable developing countries in adapting to the adverse impacts of climate change pursuant to Article 4, paragraph 4. Even though the U.S. has such a commitment, the principal financial mechanism of the convention, the GEF, is not available as a source of assistance for adaptation measures. Under the terms of the GEF, only projects designed to combat *global* climate change will be eligible for financial support. Because adaptation measures generally confer national and local benefits, but not significant global benefits, projects aimed at adapting to climate change will probably not be eligible for funding under the GEF.

One mechanism for assistance is the CSI. USAID is currently working collaboratively with other U.S. Government agencies in the interagency CSI program. The individual country studies are initiated at the request of host country governments. The Missions are working closely with the host country to assure consistency of USAID programs and the CSI activities.

3.D.1 Climate Change Impact Assessment Issues

In developing countries, a changing climate will exert increasing impacts on an environment already stressed by rising population levels. Marked decreases and increases in precipitation could result in drought and flooding, causing drastic reductions in the productivity of traditional agriculture and in water supply for domestic and industrial consumption. Shifting coastlines and rivers could displace homes, industries, and farmland. Increased storm frequency and intensity could affect people and infrastructure along rivers and coastlines and on small islands. Altered natural terrestrial and marine ecosystems could result in loss of biological diversity and impacts on communities dependent on forests and fishing. The

The primary impacts of increased atmospheric concentrations of anthropogenic greenhouse gases, especially carbon dioxide (CO₂) and methane (CH₄), are predicted to be a warming of the atmosphere, changes in the annual amount and timing of precipitation, increased severity and frequency of extreme climate events, and sea level rise. Global circulation models predict a greater warming at the poles than

at the equator, decreases in precipitation in some areas, increases in other areas, and no change in yet other areas. A warmer atmosphere will have an increased capacity to store water, and evaporation and transpiration rates should increase as a consequence.

3.D.2 Criteria for Country Selection

Although countries are not being suggested here, USAID will apply the following criteria in considering assistance in adapting to climate change: the severity of impact on agricultural production systems; the degree to which natural ecosystems and biodiversity are threatened; the susceptibility of low-lying coastal areas and islands from sea-level rise and storms; and the lack of water resource development. Consistent with the findings of the IPCC and other international global climate change organizations, these will be the most important criteria for selecting key countries with respect to vulnerability and adaptation to climate change. Other important factors could include a country's "tractability" -- the extent to which a country is ready for long-term change, both from a political and institutional standpoint. Availability of both indigenous and financial resources will be a consideration. And, finally, countries which have joined the international community in ratifying the FCCC will be eligible for priority treatment.

3.E. Measuring Results And Illustrative Targets

USAID will measure the results of the GCCS by examining both progress in reducing net GHG emissions and improvements in the quality of life for host country peoples. Any targets set must be consistent with the interests and values of the American people and international agreements of which the U.S. is a signatory. For sustainable reform to occur, the targets and results will be based on a number of factors ranging from market price reforms to assisting key countries with the establishment of policy and the implementation of regulatory and institutional reforms. A key performance factor will be the success (or failure) of local capacity building programs.

The following illustrative targets are examples of the type of commitments the Agency will make to address climate change. While these targets are only for illustration, they represent the breadth and depth of the type of targets necessary if a lasting impact in developing countries is to be made. It should be noted that targets, when set, will be part of an Agency-wide goal, and not necessarily goals for individual projects. In addition, a project could encompass several of the targets simultaneously.

Energy and Industry

Target 1: By the year 2005, USAID would have worked with at least 10 key countries to establish and implement pricing policies and regulatory reforms that set efficiency and environmental standards. Policy and regulatory reform are a necessary component of any environmentally sustainable project. To determine if this target has been reached, USAID would look specifically at three factors:

- a) Comparisons of domestic energy prices with "world" or "border" prices, and estimates of the effects of implicit and explicit subsidies, taxes, and other distortions;
- b) Demand-side management utility investment shares of 10-15%; and,
- c) Market shares of energy efficiency and renewable energy technologies.

Target 2: By the year 2005, USAID would have successfully completed 20 pilot projects in key countries using energy efficiency and renewable energy technologies that demonstrate between 15 and 50 percent reductions in greenhouse gas emissions per unit of service delivered. Such projects would include information technologies and information intensive methodologies. Pilot projects have proven to be an effective means of implementing and evaluating development projects for continuation or replication with fewer human and financial resources at stake. Three areas to look at in evaluating pilot projects include:

- a) Specific energy consumption (or energy intensity), by sector and nationally. This is a measure of the energy used per unit of use or output such as kWh, GDP, product, passenger-mile, square mile, or other meaningful measure of output (e.g., kJ/kg of steel output). This can be modified, especially in the power and industrial sectors, to include direct measures of efficiency such as overall generation efficiency or line losses;

b) Specific energy-related environmental emissions, by sector and nationally. Examples include the emissions of CO₂, CO, NO_x, SO_x, HC, and particulates per kWh, mile-traveled, pound of product, unit of GDP, or other important use or output measure; and,

c) Market shares of energy efficiency and renewable energy technologies.

Target 3: By the year 2005, USAID would have leveraged economically and environmentally sustainable public and private sector investments in at least 10 key countries. Investment leveraging is needed to concentrate the plethora of international funds into well-defined projects in developing countries. Focusing financial resources into well-defined projects would encourage donor coordination and participation while meeting the needs of developing countries. To measure the results of this target, USAID needs to quantify the amount of public and private investment in the energy sector (especially electric power, oil products, and gas).

Target 4: By the year 2005, USAID would have taken action to encourage sound industrial pollution prevention practices which reduce greenhouse gases in specific enterprises in key countries by 15-25 percent per unit of output in at least 10 key countries. Strong pollution prevention practices are necessary for any sustainable environmental program. This target would be evaluated using specific energy-related environmental indicators such as emissions of CO₂, CO, NO_x, SO_x, HC, and particulates per kWh, mile traveled, pound of project, unit of GDP, or other important use of output measure.

Forest and Natural Resources Management Practices

Target 1: By the year 2005, USAID would have assisted 10 key countries from among those with the world's highest current or potential deforestation rates to establish and implement policy, regulatory, and institutional reforms that promote full valuation of both commodity and non-commodity forest resources, resulting, if successfully implemented throughout the country, in a 15 percent net reduction in the 1990 levels of CO₂ emissions from deforestation. A concerted effort to promote sustainable forest management in key countries would complement USAID funding through leveraging and donor coordination, improve policies, increase local capacity for management, and make appropriate technologies available and assist with their adaptation to meet local needs. To determine if the target has been reached, USAID would:

a) Assist local governmental and non-governmental institutions to establish a baseline inventory of existing land use, and monitor changes as part of their national environmental planning process. These activities can be accomplished in cooperation with the United Nations Global Forest Assessment coordinated by FAO. In this manner, enhanced national capacity to monitor resource stocks and their drawdown would assist USAID in measuring how well targets are met; and,

b) Assist to key countries evaluate their current policies, institutional capacity, and technology as part of their national environmental planning process. Increased national capacity to analyze policies and develop and adapt technologies through USAID assistance would allow national governmental and non-governmental institutions to evaluate improvements in policies, institutional capacity, and technologies made by the year 2005.

Target 2: By the year 2005, USAID would have assisted key countries in: acquisition of analyzed images from remote sensing; ground verification; and assessment of forest cover data. Among the countries assisted would be the countries identified under Target 1. To measure whether this target has been reached, USAID would:

a) Evaluate the Global Forest Assessment budget to determine the relative contribution of USAID; and

b) Assemble information from missions and regional bureaus about support to countries for acquisition of analyzed images from remote sensing data, ground verification, and assessment of forest cover data.

Target 3: By the year 2005, USAID would have assisted with the development of rice and livestock production systems and products that produce 10 percent less methane per capita from rice and livestock in key countries. USAID would support research in partnership with host country institutions to develop paddy rice production systems that produce less methane. Other possible interventions would contain methane in manure through biogas generation and use for on-farm energy production. Once technologies

have been developed, USAID would assist host country government and non-government institutions with the adaptation of technologies by farmers. To evaluate whether the target has been reached, USAID would:

- a) Determine baseline per capita methane production levels for different rice and livestock production systems through consultation with international experts or through monitoring programs;
- b) Support funding for research programs in rice and livestock production systems that produce less methane at international agricultural research center in partnership with host country institutions;
- c) Assist with the adaptation of reduced-methane rice and livestock production systems by farmers; and,
- d) Monitor per capita methane production levels for different rice and livestock production systems in the year 2005.

Information Dissemination and Electronic Communications

Target 1: By the year 1996, USAID would have established information dissemination plans for all global climate change key countries. As stated in the documents from the Earth Summit, developing countries and, upon request, international organizations should carry out inventories of environmental, resource and developmental data, based on national and global priorities for the management of sustainable development. The first step in this endeavor is to develop a plan of action that takes into account current information dissemination activities and builds new ones depending on the resources available within the developing countries.

Target 2: By the year 2005, USAID would have assisted in electronically linking members of key developing countries with each other and with USAID. As USAID and other international organizations, as well as some developing countries, become electronically linked to energy and environmental information and electronic mail systems, the time to answer questions and respond to emergencies would decrease substantially. Without electronic communication, there would be no gains in the information collection and dissemination realm.

Target 3: By the year 2005, USAID would have trained select personnel in the above key countries to operate and maintain these electronic systems. As countries learn more about the capabilities and advantages to being linked electronically with neighboring countries, international organizations, NGOs, PVOs, and other U.S. businesses, adequate training programs would be established to allow the host country nationals to use and maintain these systems.

Target 4: By the year 2005, USAID would have trained host country personnel in at least 10 key developing countries to assist in "ground-truthing" remote sensing satellite data of deforestation and agricultural areas. Ground-truthing, the process of physically verifying satellite-based data, is a necessary step in remote sensing. Agenda 21 (UNCED, 1992) calls for all countries to set up continuous and accurate information systems and make use of geographic information systems, expert systems, models and a variety of other techniques for the assessment and analysis of data. These steps would be particularly relevant, as large quantities of data from satellite sources would need to be processed in the future.

Technical criteria are not the only criteria by which to measure the results of the GCCS. To address sustainable development in particular, USAID's projects must also have criteria that focus on: creating jobs and increasing incomes; improving air and water purity; slowing loss of soil and soil fertility; increasing adaptability of a country to climate change; utilizing both men and women in identifying problems and solutions; involving host country people, NGOs, PVOs, and the donor community in defining, designing, implementing and evaluating projects; sharing information and lessons learned concerning projects; and transferring ownership and operation of projects to the host countries. These criteria cross all sectors and borders and are critical components to all USAID projects.

1. CFCs are covered under the Montreal Protocol, and are not addressed further in this report.

List of Acronyms and Nomenclature

AFOS Agriculture, Forestry and Other Human Activities Subgroup of IPCC Working Group III
APAP USAID's Agricultural Policy Analysis Project
ARS USDA's Agricultural Research Service
BEST USAID's Biomass Energy Systems and Technology Project
BIA DOI's Bureau of Indian Affairs
BIO NSF's Directorate for Biological Sciences
BLM DOI's Bureau of Land Management
BOM DOI's Bureau of Mines
BOR DOI's Bureau of Reclamation
BSP USAID's Biodiversity Support Program
°C Degrees Celsius
C Carbon
CDE Corporación Dominicana de Electricidad
CEES Committee on Earth and Environmental Sciences
CGIAR Consultative Group on International Agricultural Research
CFCs chlorofluorocarbons
CIFOR USAID's Center for International Forestry Research
CILSS USAID's Permanent Inter-State Committee for the Campaign Against the Drought in the Sahel
CH₄ methane
CO carbon monoxide
CO₂ carbon dioxide
COP Conference of the Parties
CP centrally planned
CRREL DOD's Cold Regions Research and Engineering Laboratory
CRSP USAID's Trop Soils Collaborative Research Support Program
CSI U.S. Country Studies Initiative
CSRS USDA's Cooperative State Research Service
DOC U.S. Department of Commerce
DOD U.S. Department of Defense
DOE U.S. Department of Energy
DOI U.S. Department of Interior
EC European Commission
EEC European Economic Commission
EEP USAID's Energy Efficiency Project
E/GCC USAID's Environment/Global Climate Change Project
EIS Energy and Industry Subgroup of IPCC Working Group III
EJ exajoule
EMCAT USAID's Energy Management Consultation and Training Project
ENERCON Pakistan's National Energy Conservation Centre
EOS NASA's Earth Observing System
EPA U.S. Environmental Protection Agency
EPAT USAID's Environmental and Natural Resources Policy and Training
EPDAC USAID's Energy Policy Development and Conservation Project
ERS USDA's Economic Research Service
ESTs environmentally sound technologies
ETIP USAID's Energy Technology Innovation Project
ETP USAID's Energy Training Project
EXIM Export-Import Bank of the United States
FA-G Forestry Advisors Group
FAO Food and Agriculture Organization
FCCC Framework Convention on Climate Change
FCCSET Federal Coordinating Council for Science, Engineering, and Technology
F/FRED USAID's Forestry/Fuelwood Research and Development Project
FONAMA Bolivia's National Fund for the Environment

FRM USAID's Forest Resources Management Project
 FS USDA's Forest Service
 FSP USAID's Forestry Support Program
 FUNEA Fundación Mexicana para la Educación Ambiental
 FWS DOI's Fish and Wildlife Service
 FY fiscal year
 GCCS USAID's Global Climate Change Strategy
 GCDIS global change data and information system
 GCMs general circulation models
 GDP gross domestic product
 GEEI USAID's Global Energy Efficiency Initiative
 GEF Global Environment Facility
 GEO NSF's Directorate for Geosciences
 GFA FAO's Global Forest Assessment
 GOI Government of India
 GOP Government of Pakistan
 GT gigatonne
 GtC gigatonnes carbon
 GWI USAID's Global Warming Initiative
 GWP global warming potential
 HC hydro-carbon
 HCFCs hydrochlorofluorocarbons
 HFCs hydrofluorocarbons
 HHS U.S. Department of Health and Human Services
 IBPGR International Board for Plant Genetic Resources
 IC SI's International Center
 ICLARM International Center for Living Aquatic Resources Management
 ICRAF International Center for Research on Agroforestry
 ICRISAT International Crops Research Institute for the Semi-Arid Tropics
 ICSU International Council of Scientific Unions
 IDB Inter-American Development Bank
 IGBP International Geosphere-Biosphere Programme
 IGCC integrated gasification combined cycle
 ILCA International Livestock Center for Africa
 IMF International Monetary Fund
 INC Intergovernmental Negotiating Committee
 INFORUM International Forum for the Development of Sustainable Land Use Systems
 IPCC Intergovernmental Panel on Climate Change
 IPPI USAID's India Private Power Initiative
 IRRRI International Rice Research Institute
 IS-92a IPCC Scenario 1992, alternative "a"
 IS-92b IPCC Scenario 1992, alternative "b"
 IS-92c IPCC Scenario 1992, alternative "c"
 IS-92d IPCC Scenario 1992, alternative "d"
 IUCN International Union for Conservation of Nature and Natural Resources
 IWGDMGC Interagency Working Group on Data Management for Global Change
 kg kilogram
 kJ kilojoule
 kt kilotonne
 kWh kilowatt-hour
 MDBs multilateral development banks
 MDS Multi-donor Secretariat of the World Bank
 MMT million metric tonnes
 MTPE NASA's Mission to Planet Earth
 N nitrogen
 N₂O nitrous oxide

NAS National Academy of Sciences
NASA National Aeronautics and Space Administration
NASM SI's National Air and Space Museum
NEAP National Environmental Action Plan
NGOs non-governmental organizations
NIEHS HHS's National Institute of Environmental Health Sciences
NIS New Independent States
NMNH SI's Natural Museum of Natural History
NO nitric oxide
NO₂ nitrogen dioxide
NOAA DOC's National Oceanographic and Atmospheric Administration
NOx nitrogen oxides
NPS DOI's National Park Service
NRC U.S. Nuclear Regulatory Commission
NRM natural resource management
NSF National Science Foundation
NZP SI's National Zoological Park
O₃ ozone
OECD Organization for Economic Cooperation and Development
OEP Egyptian Office for Energy Planning
OH hydroxyl radical
OHER DOE's Office of Health and Environmental Research
ONR DOD's Office of Naval Research
OPIC U.S. Overseas Private Investment Corporation
OPPE EPA's Office of Policy and Program Evaluation
ORD EPA's Office of Research and Development
ORNL Oak Ridge National Laboratory
OS DOI's Office of the Secretary
OSTP Office of Science and Technology Policy
PACER USAID's Program for the Acceleration of Commercial Energy Research
PACT USAID's Program to Accelerate Commercial Technology
PARTS USAID's Policy, Analysis, Research and Technical Support Project
PC conventional pulverized coal
ppbv parts per billion by volume
ppmv parts per million by volume
PRINCE Program for Measuring Incremental Costs to the Environment
PSED USAID's Private Sector Energy Development Project
PVOs Private Voluntary Organizations
RBO TVA's River Basin Operations
REAT USAID's Renewable Energy Applications and Training
REPSOs Renewable Energy Project Support Offices
S sulfur
SANREM USAID's Sustainable Agriculture and Natural Resources Management
SAO Smithsonian Astrophysical Observatory
SAVEM USAID's Sustainable Approaches via Environmental Management Project
SBE NSF's Directorate for Social, Behavioral, and Economic Sciences
SCI USAID's Sustainable Cities Initiative
SCS USDA's Soil Conservation Service
SEB India's State Electricity Board
SERC Smithsonian Environmental Research Center
SI Smithsonian Institution
SO₂ sulfur dioxide
SOx sulfur oxides
STAP GEF's Scientific and Technical Advisory Panel
STRI Smithsonian Tropical Research Institute
TDA U.S. Trade and Development Agency

TFAP Tropical Forestry Action Plan
Tg teragrams
TgN teragrams nitrogen
TOGA NSF's Tropical Oceans/Global Atmosphere
TVA Tennessee Valley Authority
UNCED United Nations Conference on Environment and Development
UNDP United Nations Development Programme
UNEP United Nations Environment Programme
USAID U.S. Agency for International Development
USDA U.S. Department of Agriculture
USGCRP U.S. Global Change Research Program
USGS DOI's U.S. Geological Survey
USIJI U.S. Initiative on Joint Implementation
WDC World Data Centers
WEATS Wind Energy Applications and Training Symposium
W/m² watts per meter squared
WMO World Meteorological Organization
WRI World Resources Institute
WWF World Wildlife Fund

Glossary Of Terms⁽¹⁾

Climate System

The interactive components of our planet that determine the climate. This includes the atmosphere, oceans, land surface, sea ice, snow, glaciers, clouds and the biosphere. Climate change can be measured in terms of any part of the system, but it is most convenient to use surface air temperature.

General Circulation Model (GCM)

A computer model of the Earth's climate based on equations that describe the conservation of energy, momentum, and mass, and which explicitly calculate the distribution of wind, temperature, precipitation, and other climatic variables.

Global Warming Potential (GWP)

A concept originally utilized by the Intergovernmental Panel Climate Change to put the relative ability of different greenhouse gas emissions to affect climate on a common basis. The GWP accounts for differences in molecular structure and atmospheric lifetime of the various greenhouse gases, and expresses their radiative forcing relative to that of CO₂. Being replaced with better models.

Greenhouse Gases

Greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, and certain man-made chemicals that absorb and re-radiate some of the heat radiated from the earth's surface. In a rough sense, these gases trap some of the heat that would normally escape as radiant energy into space; hence, the analogy to a greenhouse.

Radiative Forcing (also called "external forcing")

A change imposed on the climate system, as opposed to generated by the internal dynamics of the climate system, that modifies the radiative balance of the climate system. Examples include: changes in the output of the sun or the orbit of the Earth about the sun, and increased concentrations of particles in the atmosphere due to volcanoes or human activity. Radiative forcing of the surface-troposphere system has been adopted as a simple and convenient way to estimate the potential climatic effects of various greenhouse gas species. It is often specified as the net change in energy flux at the troposphere (W/m²) or the equilibrium change in surface temperature (°C) in the absence of feedbacks.