U.S. Government Climate Change Assistance For the Developing World

Making a Difference in People's Lives: USAID's Climate Change Initiative 1998–2002

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Introduction

For more than 40 years, the United States Agency for International Development (USAID) has served as the foreign assistance arm of the U.S. government. Working in collaboration with developing nations and partner organizations, the Agency provides humanitarian aid and assistance, encourages sustainable development, helps secure peace and stability, and advances U.S. foreign policy goals. The Agency supports these goals through programs that work to raise incomes, end hunger, improve health, and equip institutions and people with the knowledge and skills to build equitable and sustainable economies and societies. Integral to the success of the Agency are programs that address environmental challenges to sustainable development. Global climate change is one of the most important of these challenges. From 1998 to 2002, the primary vehicle through which the Agency worked to realize positive impacts in the area of climate change was the Climate Change Initiative (CCI).

This document summarizes the progress and results of the CCI over its 5-year history. The first section discusses the challenge posed by global climate change and summarizes the current state of knowledge regarding climate change and its likely impact on developing and transition countries. The second section highlights the impact of the CCI and explains its results via sector and country case studies. The final section outlines the future of USAID climate change assistance.

The Challenge of Global Climate Change

The Global Climate

Weather can best be understood as the state of the atmosphere at any given time and location on the planet. Climate, like weather, is typically expressed through a number of measures, such as temperature, rainfall, wind, humidity, cloudiness, and sea surface temperature. However, unlike weather, climate is a long-term phenomenon—the average state of the atmosphere in a given region over time scales of a season or more. Unlike weather, our picture of the climate develops slowly as we watch scores of seasons pass. Some winters bring unusual warmth, while some springs are drier than people can remember in years. Only by comparing measurements taken over many years and decades can we detect the shifting patterns of climate.

Climate change may refer to any change in climate over time, whether due to natural variability or human activity. Three major sources of natural variability affect climate: changes in the Earth's orbit, changes in ocean currents due to the shifting of continents or large-scale melting of continental ice, and changes in the composition of the global atmosphere, especially water vapor and other gases, such as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Changes in climate are nothing new. Millions of years ago during the ice ages, most of the surface of the planet was locked under snow and ice.

The Greenhouse Effect and Greenhouse Gas Emissions

Many chemical compounds found in the Earth's atmosphere act as "greenhouse gases" (GHGs). There are those that occur naturally in the atmosphere, such as water vapor, CO_2, CH_4, and N_2O, and those that are man-made, such as chlorofluorocarbons, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Each of these gases has the ability to trap heat energy. Naturally, about 30 percent of the radiation from the sun that reaches the Earth is reflected back into space by the atmosphere, clouds, and snow, with the Earth's atmosphere, oceans, and continents absorbing what remains. This energy, after warming the surface of the planet, is re-emitted as heat back toward space. GHGs tend to absorb this infrared radiation, or heat energy, as it is re-emitted, trapping the heat near the surface.

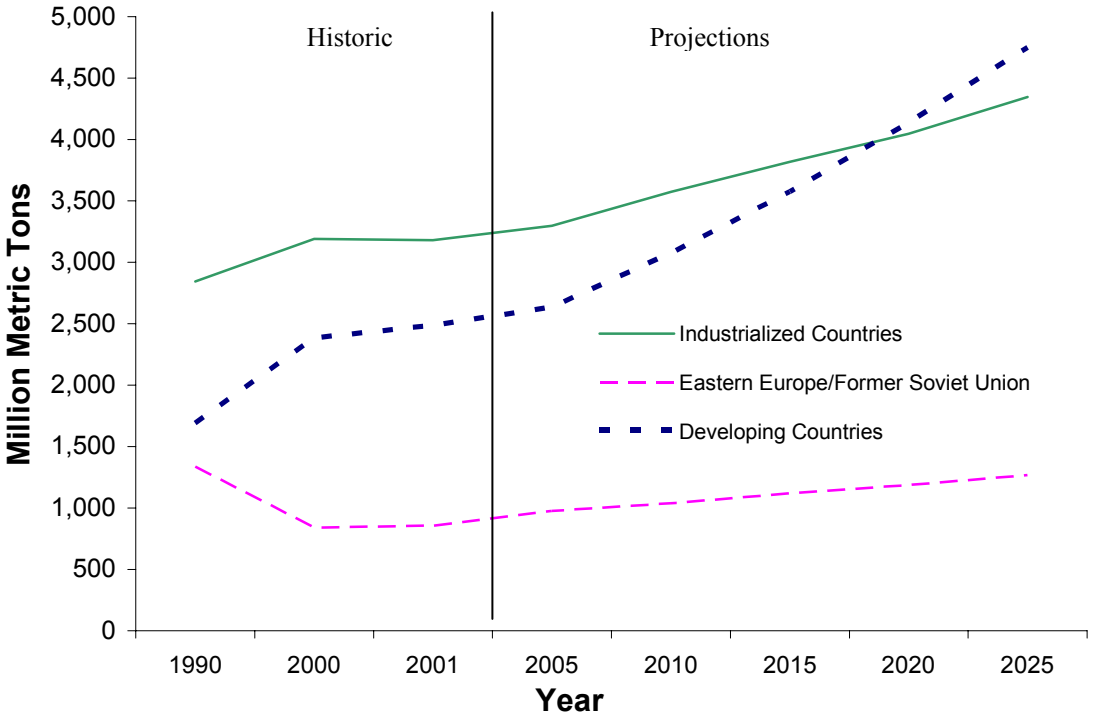
Photo courtesy of PADCO, Inc.

This natural process is important because it helps keep the planet's temperature where it needs to be to support life as we know it. For example, when scientists calculated what the surface temperature of the planet would be without the impact of GHGs, they discovered that the whole planet would be a frozen wasteland, colder than today by about 60 degrees Fahrenheit (33 degrees Celsius), on average. The process that keeps this from happening is the "greenhouse effect," which acts like a natural blanket—surrounding the planet and keeping it warm by retaining some of the sun's energy in the form of heat.

When we discuss the greenhouse effect today, we are most often talking about global climate change that is brought about largely due to human actions that alter the composition of the Earth's atmosphere. Energy, industrial, agricultural, and transport systems are contributing GHGs—such as CO_2—to the atmosphere at a faster rate than they are being absorbed, or sequestered, by ecosystems,

such as forests. According to the U.S. Department of Energy, if economic growth trends continue as projected, global CO_2 emissions from the burning of fossil fuels will rise from 6.5 billion metric tons in 2001 to more than 10 billion metric tons by 2025 (see Box 1).

Box 1. World CO_2 Emissions by Region 1990–2025



U.S. Department of Energy, International Energy Outlook 2003, http://www.eia.doe.gov/oiaf/ieo/index.html.

Industrialized countries have contributed the largest share of GHGs to the atmosphere, and their current emissions exceed those of developing countries. However, recent economic expansion in developing countries has resulted in significant increases in their emissions profile, as demonstrated above. As a result, by the year 2020, developing countries could surpass industrialized countries in total annual emissions.

If GHGs continue to accumulate in the atmosphere, scientists expect that global temperatures could increase 2.5–10.4 degrees Fahrenheit (1.4–5.8 degrees Celsius) by 2100, relative to 1990.[1] This predicted increase in average surface temperature will, in turn, affect global climate around the world.

Global Impacts

Forecasts of climate-related impacts are much less certain than predicted temperature increases. However, most scientists agree that global climate change will affect the planet and the way we live.

[1] Climate Change Science: An Analysis of Some Key Questions. Committee on the Science of Climate Change. National Academy of Science's National Research Council, 2001.

Impacts will vary from region to region and country to country, and within countries as large as the U.S., scientists predict that areas of the country will be affected in different ways at different times.

Among the predicted global effects from increasing temperatures is a rise in sea level, which could put more than 100 million people around the world at risk from flooding and storm surges. Although the scientific evidence is still inconclusive, there is also concern that extreme events—tropical cyclones, tornadoes, and El Niño, for example—may become more frequent and more severe because of global climate change. In addition, changes may occur in storm tracks, exposing new and different areas to the impacts and risks associated with severe storms.

Photo courtesy of PADCO, Inc.

It is anticipated that the Earth's precipitation patterns also will be affected. In general, research suggests that the additional heat energy in the atmosphere will accelerate the hydrologic cycle, increasing average global precipitation—although rainfall levels will vary from region to region—which will, in turn, increase the danger of floods. However, increased total precipitation may not always mean wetter conditions; in many regions, the net result may be drier conditions, as evaporation due to increased temperature more than compensates for increases in precipitation. Changes are expected to occur in the seasonal patterns and variability of precipitation as well.

Changing regional climate patterns could have other effects, too. Elevated temperatures and extended heat waves could exacerbate periodic and chronic shortfalls of water, particularly in arid and semi-arid areas of the world. Thus, crop yields and forest productivity may decline dramatically in some areas, while increasing in others. Nonetheless, impacts can be expected across a number of sectors, including coastal and water resources, agriculture and food security, biodiversity, urban infrastructure, and human health.

International Efforts to Combat a Challenge That Knows No Borders

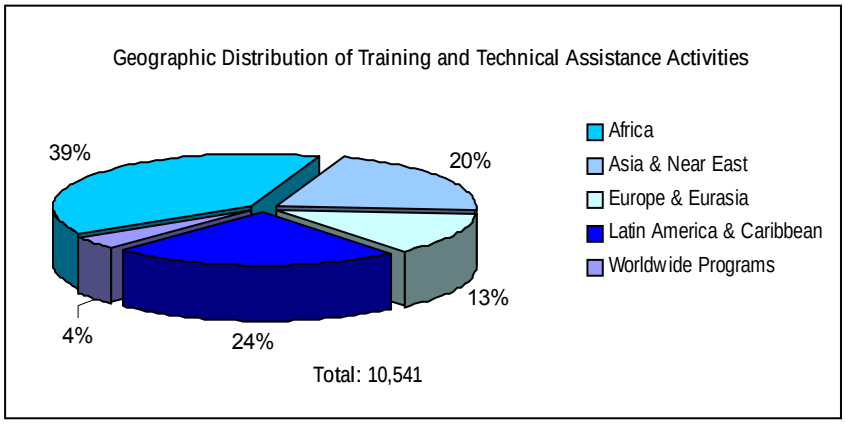
The predicted long-term warming trend poses risks to the global economy and environment, and, as a result, there is potential for considerable social and political impact. Effects from global climate change are expected to be particularly severe in those countries with dense populations, low-lying coastal areas, limited water resources, and/or economies particularly dependent on climate-sensitive sectors, such as subsistence agriculture. USAID is therefore working closely with developing and transition countries to help them better address the issue of climate change.

Mitigation and Adaptation: The CCI in Action

In 1998, USAID began its most ambitious climate change program since it began addressing climate issues in 1990. Known as the Climate Change Initiative, USAID sought to provide $1 billion over a 5-year period to help developing nations and countries in transition to reduce the rate of growth of their GHG emissions, increase carbon sequestration, and expand their participation in the United Nations Framework Convention on Climate Change (UNFCCC). This commitment signaled a strengthened U.S. government resolve to collaborate with developing and transition countries to address global climate change while promoting sustainable development in those countries.

Through the CCI, the Agency worked to mitigate climate change and to help countries reduce their vulnerability or increase their adaptive capacity to the potential impacts of climate change. The Initiative accomplished this through human and institutional capacity building, policy reform for market transformation and sector restructuring, technology cooperation, public-private partnerships, demonstration projects, and credit enhancements. To help leverage additional resources and increase the impact of the CCI, USAID coordinated extensively with other U.S. government agencies, bilateral and multilateral agencies, international and local nongovernmental organizations (NGOs), and the private sector. Between 1998 and 2002, USAID helped build capacity through technical assistance and training activities around the world (see Box 2).

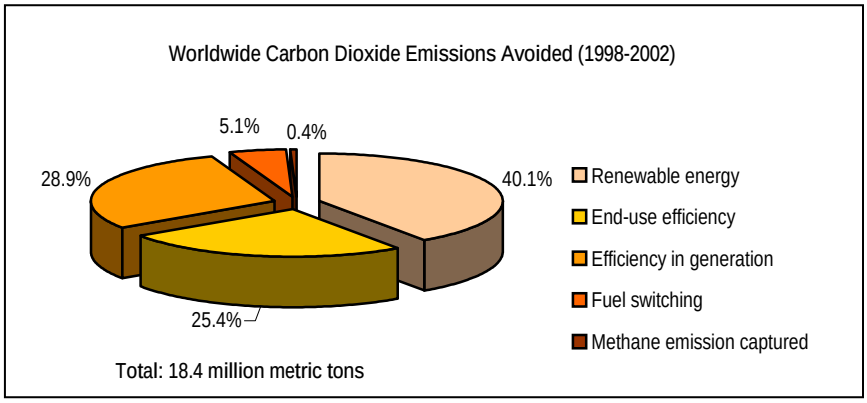
Box 2. USAID's Capacity Building Activities 1998–2002



Fueling Development with Cleaner Energy

In the developing world, more than 2 billion people do not have access to even the most basic modern energy supply, and energy demand is expected to more than double over the next 25 years. As energy consumption grows, GHG emissions will grow as well. To minimize the associated growth in GHG emissions while helping countries develop their economies, USAID targeted climate-friendly interventions in the energy sector through investment in energy efficiency, renewable energy, and cleaner energy production projects (see Box 3).

Box 3. Measuring USAID's Impact in the Energy Sector



Energy for the Rural Poor in the Philippines

In the Philippines, demand for energy services far outstrips available supply. Further complicating the issue is a heavy reliance on inefficient electrical generation and supply systems. The problem is particularly acute in remote rural areas, where it is extremely expensive to extend transmission lines. This lack of dependable energy hampers economic and social development. USAID has therefore worked to provide affordable and reliable energy in remote areas of the Philippines through the Alliance for Mindanao Off-Grid Renewable Energy (AMORE). This Alliance provided sustainable renewable energy systems for 5,000 households spread among 160 remote communities in poverty-stricken areas of the southern island of Mindanao.

Through a unique partnership among USAID, the Government of the Philippines, and the private sector, AMORE has brought renewable energy systems, such as solar-powered battery charging stations and compact fluorescent lights, to Mindanao to provide light to both households and public spaces. As a result, residents now realize a savings of 70 percent over what they used to spend on kerosene each month. The Alliance has also helped strengthen associations and institutions in more than 60 communities. An essential element in the success of the alliance was the organization of village-level institutions responsible for operating and maintaining sustainable renewable energy systems. In provinces throughout Mindanao, the project worked to strengthen local capability to operate, maintain, and expand the energy systems. As a result of project capacity building efforts, many of these institutions have moved on to promote broader community progress.

Importantly, the project also limits the GHG emissions coming from the Philippine energy sector—which account for more than half of the country's total—by making use of the clean and renewable energy systems. Additionally, it is estimated that for every three households electrified under the program, an equivalent ton of CO_2 emissions is avoided, as the new homes are much more energy efficient than their predecessors. With 300 households electrified so far, approximately 100 tons of CO_2 emissions per year have been avoided.

Due to the success of the project, renewable sources of energy will be used to electrify even more remote rural communities. Future activities will explore use of renewable energy for residential and agriculture water supply, telecommunications, and post-harvest activities. In addition to the benefits described above, AMORE also promotes peace and economic growth in some of the poorest areas of the Philippines. With energy comes income generation possibilities, and communities in Mindanao are now actively pursuing sustainable livelihood projects.

Power for the World's Second Most Populous Country

India is the second most populous country in the world, and its population of more than 1 billion people imposes a tremendous strain on the country's infrastructure and environment. For example, India is the world's sixth largest and second fastest growing producer of GHGs, due in large part to its inefficient power sector, which is responsible for approximately half of the country's total carbon emissions.[2] Coal, which is the most carbon-intensive fossil fuel, is India's major energy source. In turn, heavy reliance on coal with high ash content negatively affects human health: Data from India's National Ambient Air Quality Measuring Network indicated that 14 of the country's largest cities had air quality that was dangerous to human health. However, India needed to increase its energy generation capacity to fuel its continued development to meet a growing demand for electric power.

[2] Fossil fuels consist primarily of hydrocarbons, which are made up of hydrogen and carbon. When burned, the carbon combines with oxygen to yield CO_2, one of the GHGs.

Together with key U.S. private and public sector institutions, USAID has worked to help address India's energy shortages in an environmentally friendly way. Specifically, USAID and its partners increased India's energy generating capacity while also reducing pollution by introducing efficiencies throughout the power sector through its Greenhouse Gas Pollution Prevention Project (GEP). Activities under the GEP reduced the volume of emissions of GHGs and air pollutants while also narrowing the gap between power supply and demand by increasing energy sector productivity, introducing environmentally friendly technologies, and promoting the use of alternative energy sources.

Photo courtesy of PADCO, Inc.

Under the GEP, USAID also supported technical assistance and training for India's Center for Power Efficiency and Environmental Protection (CenPEEP), which serves as a model for technology transfer and cooperation between the U.S. and India. CenPEEP staff worked with India's largest power generator, the National Thermal Power Corporation, as well as with state electric utilities, to improve efficiencies at many coal-fired power plants, receiving much of their training from U.S. private and public sector institutions, such as the Southern Research Institute, the Tennessee Valley Authority (TVA), and the U.S. Department of Energy's National Energy Technology Laboratory (NETL). The technology introduced through the program not only limited CO_2 emissions, but also reduced fuel costs and, consequently, the price of electricity.

USAID Partnerships Produce Results

With USAID support, the CenPEEP was created to improve the operating efficiency of the many coal-fired power plants operated by India's National Thermal Power Corporation.

Due to its substantial results, CenPEEP has gained wide recognition for its contribution to mitigating the effects of climate change, winning the International Energy Agency's Climate Technology Award in 2002, as well as the U.S. Environmental Protection Agency's Climate Protection Award in 2003.

USAID's other energy sector programs in India have also paid development dividends. USAID provided technical assistance and training, as well as grant funds, to private Indian sugar industries to set up advanced facilities using bagasse (a sugarcane waste) as fuel for power generation. Using this renewable resource instead of coal or oil for fuel has reduced pollution and cut operating costs. USAID also assisted the Government of India in legislating the Indian Energy Conservation Act, aimed at promoting end-use energy conservation and efficiency improvements.

All told, Agency programs in India have reduced operating costs for business, saving them millions of dollars, which have been passed on to consumers. USAID has also helped reduce the amount of harmful air pollutants in many of India's largest cities—improving public health, while also reducing CO_2 emissions by more than 9.5 million tons over the life of the program.

Preserving the World's Biological Resources

Biological diversity, or biodiversity, is being lost as a result of human activities, such as conversion of natural habitats around the world, over-exploitation of living resources, pollution, and climate change. Conservation of this biological wealth is crucial, however, for our continued well-being. Biological resources are used to meet human needs for food, fuel, fiber, shelter, and medicine. A

healthy, functioning, and biologically diverse environment helps maintain water quality, prevents soil erosion, maintains soil fertility, and reduces GHG emissions through carbon sequestration.

Photo courtesy of Van Ness Feldman.

Biodiversity Conservation in Belize

Located in Central America, Belize is home to lush Mayan tropical rain forest, coastal mangrove forests, offshore cays, and the Meso-American Reef. Much of the country's biological diversity is found in its extensive forestlands, which cover approximately 90 percent of Belize and contain a wide range of animal and plant species, many of which are endangered. However, not long ago, a large tract of the country's largely unspoiled rainforest was in danger of being systematically cleared—threatening the survival of many of these species.

Thanks to efforts by USAID, The Nature Conservancy, and Programme for Belize (PfB, a local NGO), this biological loss was averted. Today, the Río Bravo Conservation and Management Area in Belize protects the biologically rich Mayan rainforest of Belize—part of a million-acre corridor that is key to overall biodiversity conservation in Central America. Covering 4 percent of the total land area of Belize, Río Bravo encompasses 104,892 hectares (260,000 acres) of lush rainforest in northwestern Belize and is home to the endangered black howler monkey and jaguar, numerous migratory birds, and mahogany and other important tree species. Protection of these forests is beneficial to the climate because trees remove CO_2 from the atmosphere and store carbon both above ground and in the soils below.

Río Bravo is now home to ongoing conservation activities, and a plan has been established for the area's long-term protection. To this end, major research activities have been carried out on the land and its resources to arrive at sustainable development plans that cover sustainable timber extraction, agroforestry, carbon sequestration, and ecotourism. All profits from these activities and the operation of the area as an ecotourism destination are redirected back into the conservation of the Río Bravo.[3] Various project activities provide jobs and training in forestry, forest management, and park security for local people, while improved road maintenance and other infrastructure improvements benefit communities that border the area. Thus, by visiting Río Bravo, tourists contribute directly to the conservation, protection, and management of a site of tremendous environmental importance while also benefiting the local populace.

Protecting Forests Helps Create Jobs

Ecotourism is one of the fastest growing sectors in the region. Today, about one in four jobs in Belize is tourism-related, and tourism earns a quarter of the country's foreign exchange. Ecotourism is a key component of a government plan to promote tourism.

Because of the tremendous biodiversity that exists in Río Bravo, ecotourism can be a major source of income for local people while at the same time reducing the pressure put on the forest and its many resources.

Local people now have jobs and an incentive to preserve the forest.

[3] One of the key principles behind the idea of ecotourism is that local people will protect the area when they realize that the forest is worth more to them as a forest than as felled trees.

In addition, through the Río Bravo Carbon Sequestration Pilot Program, PfB, with the help of The Nature Conservancy and U.S. and Canadian energy companies is measuring how much carbon is absorbed and stored by the Río Bravo forest.[4] By demonstrating how forest protection can help alleviate global warming, the participants seek to keep CO_2 from entering the atmosphere over the 40-year life of the project.

Helping Cities Address Climate Change

The developing world is rapidly urbanizing. Urban areas are expected to double in size in the next 30 years—gaining almost 2 billion new residents by the year 2030. Cities are engines of economic growth; they are a nation's primary source of job creation and wealth generation. Yet developing country cities face the challenge of providing basic services to growing populations with scarce resources. In addition, rapidly urbanizing cities contribute large amounts of GHG emissions from their transportation, energy, industrial, and waste disposal sectors. Recognizing the link between sustainable urban development and climate change, the CCI worked with local authorities and organizations to help reduce GHG emissions in cities around the world while improving basic urban services, such as water supply, waste management, housing, sanitation, and savings of scarce municipal resources.

Building Environmentally Friendly Homes in South Africa

A few years ago, South Africa succeeded in building 1.2 million affordable homes for low-income communities as a result of a huge campaign to house the urban poor. While this met an urgent need, many of these homes were built without including energy-efficient elements, such as insulation, or proper orientation with regard to sunlight. While shelter had been provided to thousands, most of the houses did not take into account the long-term living experience of residents. Consequently, people found these houses hot in the summer and very cold in winter. To combat the cold, individuals relied on dirty, unsafe fuels, such as coal or kerosene to heat their homes. This resulted in poor indoor air quality, which threatened the health of residents, drained income from the poor who were forced to purchase expensive fuel, and led to a high incidence of accidental fires. In addition, the large number of indoor heating and cooking fires contributed to high levels of air pollution in these communities, while also releasing GHGs into the atmosphere.

Photo courtesy of International Institute for Energy Conservation.

Housing the Less Fortunate While Reducing CO_2 Emissions

USAID supported the development of two sustainable housing initiatives that link renewable energy use with affordable housing.

As a result of these efforts, many families throughout South Africa's poorer urban areas now have inexpensive, yet state-of-the-art low-CO_2-emission homes to live in.

Working in partnership with local community organizations and the South African Department of Housing, USAID helped address the country's continued housing shortage while also supporting the national government's goal to implement environmentally friendly development projects. Spe-

[4] Companies that supplied financial and other support for this project include Cinergy, Detroit Edison, PacifiCorp, Suncor, Utilitree Carbon Company, Wisconsin Electric/Wisconsin Gas, and American Electric Power.

cifically, two housing initiatives were implemented: EcoHomes and the Sustainable Homes Initiative (SHI). The focus of both these programs was to train lenders, builders, and community groups about incorporating energy and water efficiency, passive solar design, and urban greening principles into new housing standards, and demonstrate how low-cost, environmentally sound, energy efficient design principles could be incorporated into South Africa's housing program.

The programs provided design and engineering assistance to more than 12 communities around the country, influencing the design of more than 63,000 houses through the inclusion of simple measures, such as north-facing windows, roof overhangs, and ceilings. Due in large part to these efforts, the Department of Housing has incorporated sustainable housing design guidelines into the national housing subsidy program, and 10 percent of new housing stock in South Africa now incorporates environmentally sound features. Examples of the success can be seen in Johannesburg, which has adopted a sustainable housing policy that will guide development of future housing in South Africa's largest city, and in the biggest urban renewal project in South Africa, in the former township of Alexandra, which is incorporating eco-design into the 50,000 housing units planned for the community currently dominated by high-density shacks.

As a result of these projects, a national network of communities, professionals, private companies, and public officials continues to build a knowledge base and provide access to technologies to make lower-income housing more comfortable and environmentally friendly for urban residents. In addition, the projects have combined to prevent more than 220 metric tons of CO_2 being released per year. The project will also help avoid an additional 99.4 gigagrams of CO_2 from being released during its 25-year lifespan.

Climate-Friendly Technology for Sustainable Municipal Development in Lviv, Ukraine

In the municipalities of the former Soviet Union, critical public services, such as centralized district heating systems, are plagued by inefficient infrastructure and the associated high levels of GHG emissions. The World Energy Council estimates heat losses of 35–77 percent in district heating systems, spread fairly evenly among heat generation, distribution, and end-use. Serious institutional obstacles (such as tariffs that don't cover the cost of service, and lack of metering and bill collections) impede the implementation of climate-friendly technologies and practices that could contribute to improvements in the quality of life and the environment. Realizing the social and economic development potential of energy efficiency improvements in the region, USAID, through its partner the Alliance to Save Energy, has been working in the Ukraine to implement programs that demonstrate the many benefits of energy efficiency. The Alliance selected a socially vulnerable institution where technological interventions could have a significant impact on the end-users' cost and quality of heat.

The Lviv Boarding School for Children with Cardiovascular Disease. The Lviv Boarding School for Children with Cardiovascular Disease, which provides housing, education, and health care to 370 students from the ages of 7 to 17 with cardiovascular diseases, is one institution that exhibited particular heating end-use inefficiencies. A number of students at the school also suffer from Chernobyl-related diseases, such as rheumatism, congenital heart

Photo courtesy of the Alliance to Save Energy.

Lviv Boarding School, Lviv, Ukraine.

disease, thyroid gland enlargement, and diseases related to their weakened immunity systems.[5] The school itself is very old and the average indoor temperature in the winter was well below the acceptable standard, meaning students would be learning with winter coats on. During very cold winters, the school building would have to close down all together.

The technological interventions to improve the end-use efficiency and ultimately the learning environment for the school were completed in three stages. Through the initial installation of a control system, followed by the addition of weekend and evening temperature setback features, and finally weatherization of the building (including window replacement and the application of weather stripping, caulk, and window and door seals), the school has been able reduce annual heat consumption by 410 megawatt-hours, or 46 percent, and reduce heating costs by $5,000 per year.[6]

At a second pilot site—a 26-unit residential building—low-cost weatherization upgrades for windows and doors in the individual apartment units reduced the heat consumption by 16 percent.

Technology Transfer for Sustainable Development

The Alliance to Save Energy, a USAID partner, worked with Facilities Management Control Services (FMCS), a California-based energy services company to install the state-of-the-art, computerized control heating system for the school—the first of its kind in Lviv. The system improved overall heat regulation and saved money by automatically reducing the temperature on evenings and weekends.

The total reduction in natural gas for the two buildings came to 128,824 m^3 per year, with an annual reduction in CO_2 emissions of 233 tons. In addition to the energy savings, the indoor temperature also rose. As the classrooms were now more comfortable, annual health-related absences decreased by 10–20 percent.

Benefits That Extend beyond the Lviv School and into the Future. The nature of the end-use efficiency improvements and how they have been implemented promise that the benefits of this one program will extend to other parts of Lviv and Ukraine over time. By reaching out to the emerging Ukrainian private sector, for example, through the provision of training to small enterprises in low-cost weatherization techniques, this program is ensuring the long-term viability and duplicability of these technological interventions. Because Lviv has a centralized heating system, another benefit of this work is that saving heat in one building can improve heat flow and comfort in chronically under-heated buildings further down the system, resulting in a circuit-wide improvement in energy management. Finally, these results generated a high level of interest among city officials, who recognized that energy efficiency was perhaps the only way to relieve the burden on the local budget without lowering the quality of municipal services. To continue to relieve the energy burden, the city has installed controls in 12 additional buildings, with more ambitious plans for the future.

[5] Since the Chernobyl tragedy in 1986, the incidence of immune-related diseases in Ukraine has increased and demands on the school have grown. Classrooms have become overcrowded with an average of 38 students per class.

[6] Because Ukrainian buildings have no modern controls, there is no way to regulate heat. Some rooms have no heat; others have too much, requiring occupants to open windows—even in the middle of winter. The control system installed is able to regulate heat better within certain rooms and "zones" in the school.

Sustaining the World's Vulnerable Coastal Zones

More than half of the world's population resides within 60 kilometers (37 miles) of a coastline. Consequently, coastal zones are particularly vulnerable to pressure from expanding urban activity; from growth of industries that operate near shorelines; and from increased activity in certain livelihoods, such as fishing, which frequently over-exploit or otherwise degrade marine resources. These activities result in growing levels of air, freshwater, and ocean pollution, and the overall decline of marine and near-shore resources. The maintenance of coastal and marine natural resources is thus critical from both an environmental and an economic standpoint. This is especially true in the areas of the world USAID operates in, as many communities in the developing world rely heavily on coastal zones for their livelihood and well-being.

Photo courtesy of CRMP-USAID.

Coastal Resources Management in Indonesia

In Indonesia, human activities have contributed to sediment starvation, accompanying beach erosion, and the destruction of more than 44,000 km^2 of mangroves since 1975. Rising sea levels, a potential impact of climate change, will only add to the stress humans are placing on this ecosystem by having a negative impact on the productivity of mangrove forests and slowing down the renewal of wetlands, which act as a biological buffer against storms and serve as breeding grounds for many valuable fish species.[7]

Working in the Indonesian provinces of North Sulawsi, Lampung, and East Kalimantan, USAID's Coastal Resources Management Project (CRMP) enabled coastal communities in Indonesia to manage their coastal resources, totaling some 1,845,000 hectares, in a sustainable manner. The motto of the project, "From Local Action to National Practice," was showcased in the village of Blongko, a small coastal village of 1,250 people on the northwest shore of North Sulawesi, whose populace lives near the water and depends on coastal resources for their food and livelihood. While the community had long recognized the importance of their local fisheries, mangroves, and reefs, they were uncertain as to what actions to take to protect these valuable resources.

In response, USAID's CRMP sponsored an exchange visit to the highly successful marine sanctuary at Apo Island in the Philippines. This and other exchanges exposed Blongko villagers to successful, community-based conservation activities and motivated them to take action locally. In addition, the project success-

Saving Mangroves, Protecting Villages

Efforts to conserve mangroves, a natural buffer system, can improve a coastal village's ability to cope with potential impacts from climate change.

When mangroves are cleared, the survival of aquatic species that nurse in these areas can be threatened, and coastal communities become more vulnerable to the effects of damaging storm and hurricane winds and waves, and floods that may become more prevalent and severe in the future due to climate change.

Flood control, biodiversity conservation, poverty alleviation, and improved carbon storage capacity are examples of the many benefits that accrue from healthy mangrove systems.

[7] Adapted from IPCC's Working Group II: Impacts, Vulnerability, and Adaptation, www.grida.no/climate/ipcc_tar/wg2/442.htm.

fully helped the village government and community develop a long-term plan to protect marine resources. In the process, fishers and farmers were trained in techniques of resource surveying and mapping. Significantly, the local community made all key decisions regarding sanctuary location and usage rules.

By promoting community ownership of the marine sanctuary, USAID has encouraged Blongko's residents to take a more active role and greater responsibility for protecting and sustaining the marine resources that directly affect their day-to-day lives. Today, the village's coastal ecosystem is healthy and productive, and is rimmed by thick mangroves.

Safeguarding the Health of Watersheds

Watersheds are vital to the healthy functioning of the environment. The systems link the land and the sea, thereby creating habitat for a wide variety of animals and plants while also providing critical ecosystem services, including water purification, flood control, nutrient recycling, and soil replenishment. As a source of water, food, and hydropower, and as a means of transportation, watersheds are powerful drivers of local and regional economies in many developing and transition countries.[8] However, due to over-use and exploitation, watersheds are under considerable stress. In turn, many scientists predict that the potential impacts from climate change may intensify the effects of this stress, possibly leading to increased soil erosion, altered ecosystems, and impaired water quality and quantity.

Photo courtesy of USAID/El Salvador.

Live barrier system in Nueva Concepción Chirilagua, El Salvador.

Helping El Salvador Cope with Severe Weather Events

On November 1, 1998, days of constant rains culminated in the emergency release of a wall of water from one of El Salvador's major hydroelectric dams, producing severe flooding and major mudslides in the coastal regions of the Río Lempa and Río Grande de San Miguel. As a result, almost 400 people perished, approximately 55,000 individuals were displaced, and economic damage exceeded $600 million. In terms of agricultural losses, more than 65,000 hectares were badly flooded, and almost 20 percent of the 1998-1999 basic grain harvest was lost. In addition, approximately 300 schools were damaged or destroyed by flooding and landslides, with repair costs exceeding $5 million.

In response, USAID undertook a series of activities throughout the Río Lempa watershed to help the communities in the region better cope with the effects of severe weather-related events in the future. USAID helped develop a management tool for the basin that increased the available information base for disaster management and response. Today, the database contains information on the vegetation and soil types, municipal boundaries, and landslide- and flood-prone areas of the watershed.

In addition, the Agency, in partnership with the Central American Integration System Secretariat, the United States Geological Survey (USGS), and the National Oceanic and Atmospheric Administration (NOAA), installed a National Weather Service Forecast System, which consists of a network of auto.

[8] Watersheds of the World (1998), WRI Press, wri.igc.org/watersheds.

matic river gauges and weather stations, a satellite dish, and a forecast center. A hydrologic model developed for the Río Lempa basin now uses the information provided by the system as an early warning tool—generating forecasts about the likelihood and probable extent of flood events. Further extending this effort, the Agency and its partners also helped enhance the capacity of the region to receive and display rainfall estimates throughout the region on a real-time basis.

The tools developed by USAID and its partners have proven invaluable for policy-level watershed management planning, and have been used to help develop a watershed disaster mitigation plan. Because of these efforts, the Ministers of Environment from Honduras, Guatemala, and El Salvador have signed a prototype "inter-institutional" cooperation agreement to enhance coordination of watershed management and disaster mitigation activity, for the benefit of the peoples of the three countries.

Protecting the World's Forests

The rapid destruction of tropical and temperate forests is of great concern to many people in developing countries. Slash-and-burn agriculture, forest clearing for cattle ranches and new settlements, and unsustainable logging practices all contribute to the problem. Forests provide valuable natural resources for local people; they also maintain much of the world's biological diversity, while absorbing and storing much of the global carbon stock.[9] Thus, deforestation is both a local problem—for populations seeking to use forest resources in a sustainable fashion—and a global concern, because deforestation releases stored CO_2 back into the atmosphere. For example, the United Nations Food and Agriculture Organization estimates that land use changes (primarily deforestation) account for approximately 20 percent of all CO_2 emissions from human activities.[10] Reforestation and forest conservation efforts are therefore important elements in the strategy to combat global climate change. Consequently, a primary goal of CCI is to protect forests, which act as huge storehouses for carbon stocks, while promoting sustainable forest management and biodiversity conservation efforts.

Saving the Rainforest in Brazil

Brazil occupies nearly 50 percent of the South American continent. With an area of 8,511,965 square kilometers (3,290,000 square miles), the country is slightly smaller than the U.S. and ranks fifth in the world in population. More than half of the country is covered with lush forests, including the famed Amazon rainforest, and, as a result, the country's tropical forests comprise one of the largest carbon sinks in the world. However, the Brazilian rainforest is gravely threatened by poor land use practices. For example, the majority of the wood produced in the Amazon is harvested without consideration for the sustainability of the forest. Deforestation, typically on the order of 20,000 to 30,000 km^2 annually, is the leading source of Brazil's GHG emissions.

Photo courtesy of USAID/Brazil.

The world-famous Amazon.

[9] Trees and plants store carbon in their leaves, wood, roots, and soils, and, as they grow, remove CO_2 from the air, storing it as additional carbon in their tissues as part of photosynthesis.

[10] State of the World's Forests 1999.

The potential for further growth of the Brazilian economy—the tenth largest in the world—as well as its high GHG emissions combined to make Brazil a country of focus for the CCI. In response to the particularly important issue of deforestation, USAID sponsored a host of programs that focused on addressing deforestation over the five years of the CCI. These innovative projects drew on the expertise of a number of partners to develop management plans for protected areas, introduce reduced-impact forest management alternatives, and create policies on natural resource management with government officials at all levels.

In collaboration with partner institutions and organizations, USAID carried out numerous forest management activities focused on conservation and preservation.[11] Efforts included forestry-related policy formulation, such as standardization and simplification of forestry management requirements, as well as stricter requirements for deforestation permits. Additionally, the Agency and its partners developed and implemented sustainable forest management and reduced-impact logging practices at various locations throughout the Amazon.[12] As a result of these efforts, USAID and its partners have helped transform the Brazilian timber sector. For example, Agency efforts to raise awareness about the need for a solution to unsustainable timber harvesting spurred a host of the largest Brazilian timber buyers to form the Brazilian Buyers Group of Certified Timber—an important step toward sustainable forest management. As a result, several other large suppliers of Amazon hardwoods are in the process of having their forest holdings certified, reflecting growing recognition that forest integrity is critical to ensuring the region's long-term economic and environmental health.

Sustainable Forest Management

As a result of sustained efforts by USAID and other partners, the private sector is responding to evidence that environmentally sound forest management is a good investment in Brazil. For example, the world's largest producer of tropical plywood, Gethal Amazonas SA, is now operating under full certification by the Forest Stewardship Council (FSC). As a result, the company now meets rigorous worldwide standards for sustainable forest management.

In addition, with support from USAID, BASA (the Bank of Amazonia) is converting its $300 million annual loan portfolio to support reduced-impact forest management while pledging to support only small farmer loans that do not result in net clearing of forests.

Photo courtesy of the University of Maryland.

Forest Conservation in Central Africa

Second in area only to the Amazon, the Congo Basin contains huge expanses of lush tropical rainforest. While much of this forest remains relatively intact, unsustainable timber exploitation, shifting cultivation, urban expansion, and other human stressors are posing increasing threats to this globally significant resource. Poverty, social strife, and conflict centered on the control of natural resources together form a vicious cycle of environmental degradation and social decay that threatens

[11] Partners include the Woods Hole Research Center (WHRC), the Institute of Environmental Research for Amazônia (IPAM), the Amazon Institute for Man and the Environment (Imazon), Instituto Floresta Tropical (IFT), the Brazilian Ministry of the Environment (MMA), and others.

[12] Reduced-impact logging is fast becoming the preferred method of "mining" valuable timber, as it reduces the impact on the surrounding forest by reducing soil erosion, promoting increased survival of residual trees, lowering cost, and limiting wood waste.

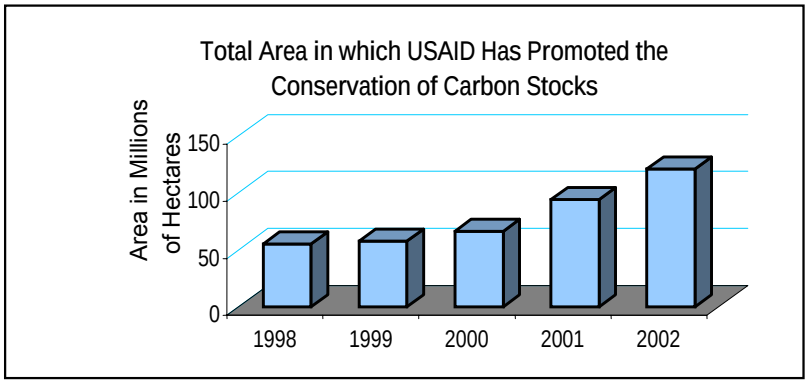
the long-term viability of this forest ecosystem and the livelihoods of the many communities that live within and around the Congo Basin.

The Central African Regional Program for the Environment (CARPE) is a long-term USAID initiative that is addressing the issues of deforestation and biodiversity loss in the Congo Basin of central Africa. The work of CARPE is also important for addressing the problem of climate change. Central Africa, with its vast forest reserves, is the most important sub-region of Africa for storing carbon and reducing CO_2 emissions. As a result, maintaining the carbon sink potential of the region is a key objective of USAID's climate change program. In working toward this objective, CARPE uses local knowledge to identify ways to limit deforestation and preserve the forest.

Since its inception in 1995, CARPE has facilitated dialogue among NGOs, timber companies, and national governments to improve overall forest protection. This effort has resulted in better forest management practices, a decrease in illegal logging, and corporate reform. CARPE has supported studies to determine the effects that climate change might have in the region, with a particular focus on the loss of the forest in the Congo Basin. One of the results that emerged from the work done by CARPE has been the initiation of the Congo Basin Forest Partnership, a collaboration among 29 governments, international NGOs, and the private and public sectors. The U.S. emphasis in this partnership supports a network of national parks, protected areas, and forestry concessions, and assists communities that depend on the conservation of forest and wildlife resources.

USAID's support for CARPE has proven beneficial not only for the countries of Central Africa, but also for the rest of the world. Preserving the vast carbon stocks, particularly in the Congo Basin, is significantly mitigating the effects of climate change and considerably protecting vital reservoirs of biodiversity. As exhibited, USAID has worked with communities and partners to place critical carbon stocks, such as the forests of the Congo Basin, under sustainable management (see Box 4).

Box 4. USAID's Impact on Land Management 1998–2002



Promoting Food Security

Many scientists believe that countries in tropical and sub-tropical regions will be among the most vulnerable to the effects of climate change due to predicted water shortages and the impact these will have on the agricultural sector. The problem is expected to be most severe in Africa, where information dissemination has been poor and technological change has been slow. Even without climate change, there are serious concerns about

Photo courtesy of USAID/Mali.

Women farmers in Djenne village.

agriculture in Africa, due to soil degradation and recurring drought. These issues, when combined with the fact that current farming practices are very basic, means that farmers in Africa are in great need of assistance and training on best agricultural management practices to help them adapt to changing conditions.

Helping Farmers in Mali

Mali is a land-locked Sahelian country with a population of 10.5 million and a literacy rate of less than 30 percent. While the government is successfully implementing policies to liberalize the country's economy, and expanding programs in education and health, there are still many areas where Mali needs assistance. For example, the country is extremely poor, with no significant natural or economic resources, and a per capita income of only $250 per year. In addition, the agricultural sector dominates the country's economy, with most residents relying on agriculture for their livelihood. Therefore, USAID has identified Mali as one of the most compelling cases for development assistance.

In the upper valley of Mali's Niger River, USAID has promoted agricultural best practices to help farmers address the harsh present circumstances while reducing their vulnerability to potential impacts from climate change. As a result of the Agency's Upper Niger River Valley Program (OHVN), an increasing number of farmlands make use of better crop management methods. Specifically, the program has demonstrated that soils with higher rates of organic matter increased the efficiency of fertilizer while also increasing the retention of moisture by the soil. In addition, the technologies that have been introduced and extended by the OHVN program have reduced the danger posed to crops by weeds and disease. The combined effect has led to increased crop yields, while reducing the risk of crop loss.

A side benefit of agricultural intensification that builds both the productive capacity of the soil and increases yields is that farmers are now able to stabilize and reuse their plots of land instead of being forced to continually clear new lands. This work has climate benefits, too, as an increasing number of farmlands now have higher amounts of carbon stored away in their soils.

A recent assessment of results from the OHVN project revealed that the approach could be replicated and that increases in crop yields and carbon sequestration could be expected in many other countries. Today, thanks to the management practices and technologies introduced, farmers of the OHVN region are benefiting from not only increased crop yields, but also increased groundwater availability and decreased soil erosion. As a result, people in the area now feel more secure knowing that their actions give them better control over their future.

The Future of USAID's Climate Change Assistance

USAID's successful approach to climate change—assisting developing and transition countries to address climate-related concerns as an integral part of their development goals—will continue and strengthen over the coming years. In addition to continued support to assist countries in reducing the rate of growth of their GHG emissions, the Agency has decided to expand its programs that help developing and transition countries increase their resilience to potential impacts from climate change. With this combined approach, USAID is further integrating climate change concerns across the broad portfolio of its development programs and ensuring that climate concerns are addressed for many years to come.