USAID Programs That Respond to Climate Change

Philippines Case Study

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Abbreviations and Acronyms

ALGAS	Asia's Least-Cost Greenhouse Gas Abatement Strategy
CDIE	Center for Development Information and Evaluation (USAID)
CCIC	Climate Change Information Center
DENR	Department of Environment and Natural Resources
IACCC	Inter-Agency Committee on Climate Change
IEMP	Industrial Environmental Management Project
IPCC	Intergovernmental Panel on Climate Change
NRMP	Natural Resources Management Program
PCCMP	Philippines Climate Change Mitigation Program
PCF	Prototype Carbon Fund
PPP	purchasing power parity
RRDP	Rainfed Resources Development Project
SALT	sloping agricultural lands technology
SOAG	strategic objective agreement
TTEM	Technology Transfer for Energy Management project
UNFCCC	UN Framework Convention on Climate Change

Scientific Terms and Units of Measurement

BOD	biological oxygen demand
BOE	barrels of oil equivalent
Btu	British thermal unit
C	carbon
CaCO	lime
$CaCO_3$	calcium carbonate
CH_4	methane
CO_2	carbon dioxide
COD	chemical oxygen demand
dm	dry matter
ha	hectare
HCl	hydrochloric acid
kg	kilogram
kha	thousand hectares
kt	thousand metric tons
kV	thousand volts
kWh	kilowatt-hour
MCF	methane conversion factor
MMPC	maximum methane producing capacity
mt	metric ton
MWh	megawatt-hour
N_2O	nitrous oxide
NO_x	nitrogen-oxygen compounds
SO_2	sulphur dioxide

Executive Summary

During the 1980s and 1990s, USAID Philippines implemented a broad range of environmental programs in forestry, energy conservation, and urban and industrial pollution prevention. These included the Technology Transfer for Energy Management (TTEM) project, 1986–1991; the Industrial Environmental Management Project (IEMP), 1992–1997; the Rainfed Resources Development Project (RRDP), 1983–1991; and the Natural Resources Management Program (NRMP), 1993–present. USAID's Center for Development Information and Evaluation (CDIE)[1] evaluated these four activities in 1995, 1996, and 2000. The evaluations demonstrated that all four had important economic, environmental, and health benefits. They also had important climate benefits: the energy and industrial pollution projects helped reduce carbon dioxide (CO_2) emissions, and the natural resources projects helped sequester carbon. However, climate change benefits were not captured in the original CDIE evaluations because the projects had not been designed with climate change in mind; that is, climate change was not an explicitly stated project objective.

In January 2002, a three-person team traveled to the Philippines to assess the extent to which these programs had reduced net emissions of greenhouse gases. The assessment was designed to quantify and, when possible, assign a value to the win-win effect associated with the mission's environmental programs. The Philippines was selected for this assessment in part because it was one of nine key countries supported bilaterally under USAID's Climate Change Initiative. Although this initiative works in more than 40 countries, 12 countries or subregions were designated as key, based on the magnitude of their contribution to net greenhouse gas emissions or their governments' commitment to addressing climate change problems as demonstrated by concrete action.[2]

World Bank data show that the Philippines has a relatively high rate of deforestation compared to other countries in East Asia and the Pacific and other lower middle-income countries. On the other hand, CO_2 emissions (both total and per capita) are substantially lower in the Philippines than in these countries. Moreover, industrial production in the Philippines was relatively energy efficient during the 1980s and 1990s compared to other countries.

The commitment of the Philippine Government to addressing global environmental issues is demonstrated by its signing the UN Framework Convention on Climate Change in 1994 and by its being a signatory to at least seven other international environmental conventions since 1991.

The assessment found that the four USAID projects combined reduced CO_2 equivalent emissions (or sequestered CO_2 equivalents) annually in the Philippines by 1.5 million mt, a substantial reduction.[3] In relative terms, this amount represents somewhat less than 2 percent of total annual emissions (as recorded in the 1999 Philippine National Greenhouse Gas Inventory).

Sequestered carbon and carbon emission reductions have a potential value to society. In some cases, they can be sold in the market place. For example, carbon emission reductions are being bought by the Prototype Carbon Fund for $5.45 per mt of CO_2 (the mid-level price in 2002). If these could have been sold under TTEM and IEMP, the financial payback period (the time required for the value of the carbon benefits to equal the cost of the project)

[1] CDIE is now the Office of Development Evaluation and Information (DEI).

[2] The bilateral programs are in Brazil, India, Indonesia, Mexico, Philippines, Russia, South Africa, and Ukraine. Poland was the ninth "key country" until it graduated and the mission was closed. The three subregions are Central Africa (including Cameroon, Central African Republic, Republic of Congo, Democratic Republic of Congo, Equatorial Guinea, and Gabon), Central America (including Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama), and Central Asia (including Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan).

[3] Carbon equivalents are used to convert carbon emissions reductions of different gases such as CO_2, methane (CH_4), and nitrous oxide (N_2O) into an equivalent amount of carbon. Similarly, sequestered carbon must be normalized based on parameters such as lifetime before decay and destruction, biomass growth rate, and carbon uptake of the biomass.

would have been 3 years and 7.1 years for the two projects, respectively. In financial terms, these CO_2 reductions translate into $3.4 million annually, assuming they are valued at $5.45 per metric ton.

Valuing the sequestered carbon resulting from RRDP and NRMP is more difficult because of differences in valuing sequestered carbon. Some markets value only carbon that is sequestered through afforestation and reforestation. And the only areas likely to satisfy the Clean Development Mechanism[4] definitions of afforestation or reforestation are areas that were not forested on December 31, 1989. Therefore, not all forestry projects or activities in the Philippines would qualify under the Clean Development Mechanism.

The assessment has three principal conclusions. The first reinforces the conventional wisdom that traditional environmental programs have a positive climate change effect by mitigating greenhouse gas emissions. The other two conclusions reinforce lessons identified in earlier evaluations of USAID Philippines environmental programs.

1 Win-win results. Conventional USAID environmental programs (forestry and land use, energy technology and management, and urban and industrial pollution) can yield significant ancillary climate change benefits.

This assessment provides empirical evidence demonstrating that climate change benefits—even though unintended—result from traditional USAID environmental programs. This creates a "win-win" situation; for example, USAID's support for a forestry program in the Philippines also addressed global climate change by sequestering carbon to prevent its release into the atmosphere. However, climate change is often not regarded as an urgent problem when compared to competing priorities, such as those related to local or national development. Therefore, it is helpful—and generally essential—for greenhouse gas mitigation activities to have direct, tangible, near-term benefits in addition to carbon reduction benefits. Explicit recognition of these dual benefits can help generate broad public support for both climate change programs and traditional environmental assistance programs.

2 Synergy. Institution building, public participation, and sustainability are synergistic and self-reinforcing.

Institution building helps create a supply of environmental services related to climate change. Public participation helps create a demand for these services. The two—institution building and public participation—go hand in hand; they are synergistic. NGOs often carry out both roles, typically through public outreach and education and awareness programs. In the absence of widespread public participation and strong institutions (with motivated and competent staff), the success of climate change programs is jeopardized.

Public participation can also be a powerful tool in ensuring that climate change programs are sustainable. Partnerships with academic institutions can be particularly important in ensuring sustainability: academic institutions are often considered impartial and are characterized by long-term stability. USAID's use of "technology of participation" was especially effective in the Philippines, an open society where participation is highly valued.

3 Incentives. Environmental programs that contribute to net greenhouse gas reductions are most successful when they offer financial benefits or other incentives that encourage participation.

In the case of energy and industrial pollution programs, private firms must be motivated to adopt energy conservation or pollution prevention measures. Such motivation typically stems

[4] The Clean Development Mechanism was created under Article 12 of the Kyoto Protocol. It provides that greenhouse gas reductions from voluntary, qualified projects in developing countries may be counted against the greenhouse gas emission reduction commitments made by an industrialized country. See http://unfccc.int/cdm/

from the prospect of reaping financial benefits in the form of reduced production costs, increased revenues, or both. Even more important than financial benefits in motivating industries to comply with environmental regulations and legal requirements is the desire to avoid fines and penalties. In the case of forestry programs, tenure security—either individual or community-based—is critical in providing an incentive for long-term forest management. Though land ownership is not essential, medium-term access to land is important.

Introduction

USAID's Climate Change Initiative

USAID's Climate Change Initiative helps developing countries reduce the rate of growth of greenhouse gas emissions, maintain or increase sinks for carbon, participate in the UN Framework Convention on Climate Change (UNFCCC), and reduce their vulnerability to the adverse effects of global climate change. Because this USAID initiative did not begin until 1998, many of the activities it supported are ongoing, making an assessment of their effect on climate change premature.

However, USAID has indirectly supported climate change activities for many years—indeed, decades—under its conventional environmental programs. Programs in sustainable forest management, energy conservation, and urban and industrial pollution prevention may not have been designed explicitly to address climate change. Nevertheless, they have had a positive effect on climate change because they reduced carbon dioxide (CO_2) emissions or sequestered carbon. In fact, these environmental programs are now considered part and parcel of USAID's climate change initiative under its win-win strategy, even though they generally were not designed with climate change in mind.

In January 2002, USAID's Center for Development Information and Evaluation (CDIE) undertook an assessment of the climate change effects of USAID-supported environmental programs in the Philippines, where a broad range of such programs had been implemented for over two decades. The purpose of the assessment was to highlight how conventional environmental interventions can be effective in addressing climate change and to measure the climate change effects of these interventions.

Why the Philippines?

Several factors taken together suggested that the Philippines would be a good place to assess the climate change benefits of USAID environmental interventions. First, USAID Philippines has been particularly active in the natural resources, energy, and industrial sectors that are important in responding to climate change. Second, the Government of the Philippines appears to be committed to addressing the issue of climate change, one of the two criteria USAID uses for including countries and regions in its Climate Change Initiative. Third, the Philippines is an archipelagic country with a prevailing tropical climate; it is, therefore, likely to be highly vulnerable to long-term climate change and climate variability.[5] Finally, the Philippines, like many countries, contributes to net global greenhouse gas emissions, though its contribution is relatively small.

Tables 1–5 below use several measures to report on the Philippine contribution to net greenhouse gas emissions over time. These measures include rate of deforestation; CO_2 emissions (total and per capita) and carbon intensity; and energy efficiency. To put the Philippines in perspective, it is compared with other countries in the same region (East Asia and the Pacific); with other countries at a comparable level of economic development (lower middle-income countries)[6]; and, finally, with the United States and the world.

Deforestation

Deforestation in the Philippines has been taking place at the relatively rapid rate of 1.4 percent per year, on average, between 1990 and 2000 (see Table 1). This was much faster than the average annual

[5] The dimensions are described in the *Philippines National Communication* (Velasco 2000) required under the UNFCCC.

[6] In 1999, per capita income in lower middle-income countries worldwide averaged $1,200; in the Philippines, it averaged $1,050.

Table 1. Deforestation in the Philippines and Other Regions, 1990–2000
(annual percent change)

Country or Region	Change
Philippines	1.4
East Asia and the Pacific	0.2
Lower middle-income countries	–0.1
United States	–0.2
World	0.2

Source: 2001 World Bank Development Indicators

rate in other countries in East Asia and the Pacific (0.2 percent), and faster than the rate in other lower middle-income countries, where deforestation was negative (–0.1 percent), implying that reforestation or afforestation was occurring. Few countries had higher rates of deforestation during the 1990s than the Philippines. Those that did were typically in Africa, though Haiti, Nepal, and central America had high rates as well. The high rate of deforestation in the Philippines is often attributed to illegal logging.

CO_2 Emissions and Carbon Intensity

Total CO_2 emissions (measured in millions of mt) in the Philippines more than doubled during the 17-year period 1980–1997, increasing by 110 percent (see Table 2). However, emissions increased even more in the East Asia and Pacific region as a whole (151 percent) and in lower middle-income countries as a whole (183 percent).

Total per capita CO_2 emissions have also risen (see Table 3). But again, the rate of increase has been much less in the Philippines (38 percent) than in other countries in East Asia and the Pacific and in other lower middle-income countries, where emissions doubled.

High CO_2 emissions are often attributed to economic growth. To be sure, *total* CO_2 emissions do tend to rise with economic growth. But the *rate of growth* of CO_2 emissions often declines relative to the rate of economic growth. This has occurred in East Asia and the Pacific and in lower middle-income countries as a whole, where industrial production was cleaner in 1997 than in 1980 (see Table 4); that is, CO_2 emissions (measured in kg) in these countries were less per dollar of GDP in 1997 than in 1980. In the Philippines, however, CO_2 emissions per dollar of GDP remained static at 0.3 kg during this period, implying there was neither an improvement nor a decline in overall carbon intensity.

Energy Efficiency

Energy efficiency is an important yardstick for assessing clean production. In the Philippines, GDP (measured in purchasing power parity dollars

Table 2. CO_2 Emissions in the Philippines and Other Regions
(million mt)

Country or Region	1980	1997	Percent Change
Philippines	39	82	110
East Asia and the Pacific	2,020	5,076	151
Lower middle-income countries	2,458	6,958	183
United States	4,609	5,467	19
World	14,015	23,868	70

Source: 2001 World Bank Development Indicators

per kg of oil equivalent) increased between 1980 and 1998, indicating that more was being produced with the same amount of energy. Table 5 shows that $5.60 of GDP was produced per kg of oil in 1980; 18 years later, $7.00 of GDP was produced with the same kg of oil. However, this 25 percent increase in energy efficiency in the Philippines was not nearly as great as that achieved in other lower middle-income countries, where energy efficiency increased by 125 percent. A key question is how did the Philippines become more energy efficient (as shown in Table 5) without reducing carbon intensity (as shown in Table 4)? One likely explanation is that the country has been switching to more carbon-intensive fuels. Indeed, coal use in the Philippines increased from 0.02 quadrillion Btu in 1980 to 0.11 quadrillion Btu in 1997.

Government Commitment

One measure of a government's commitment to addressing the issue of climate change is whether it supports international environmental treaties and conventions, especially those related to climate change. On this measure, the record of the Government of the Philippines is positive. Most importantly, the government supports the UNFCCC, to which it became a signatory in 1994. Even before then, in 1991, President Corazón Aquino established the Inter-Agency Committee on Climate

Table 3. CO_2 Emissions Per Capita in the Philippines and Other Regions
(million mt)

Country or Region	1980	1997	Percent Change
Philippines	0.8	1.1	38
East Asia and the Pacific	1.4	2.8	100
Lower middle-income countries	1.7	3.4	100
United States	20.3	20.1	-1
World	3.5	4.1	17

Source: 2001 World Bank Development Indicators

Table 4. Carbon Intensity: CO_2 Emissions in the Philippines and Other Regions
(kg per PPP dollar of GDP)*

Country or Region	1980	1997	Percent Change
Philippines	0.3	0.3	0
East Asia and the Pacific	2.0	0.8	–60
Lower middle-income countries	1.7	0.9	–47
United States	1.6	0.7	–56
World	1.2	0.6	–50

* Purchasing power parity (PPP) dollars allow a standard comparison of real price levels between countries. They are used because nominal exchange rates do not always reflect international differences in relative prices.
Source: 2001 World Bank Development Indicators

Change (IACCC) through a presidential administrative order. The committee coordinates climate change projects implemented within the country.

Since 1991, the Philippine Government has signed at least seven other international environmental conventions or treaties. While many of these agreements do not specifically address climate change, they do indicate the country's willingness to enter into international agreements concerning global environmental issues. The more recent agreements, together with the date of Philippine ratification, are as follows:

- The Montreal Protocol on Substances that Deplete the Ozone Layer (1991)
- The Convention on Biological Diversity (1993)
- International Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa (1994)
- Convention on Wetlands of International Importance especially as Waterfowl Habitat (1994)
- The UN Convention on the Law of the Sea (1997)
- Stockholm Convention on Persistent Organic Pollutants (2001)

The government's commitment to addressing climate change issues is demonstrated by other indicators as well. In 1989, for example, the Philippines developed an environmental strategy, and in the same year it carried out a biodiversity assessment. A country environmental profile followed in 1992. The Philippine Government has also participated in Asia's Least-Cost Greenhouse Gas Abatement Strategy (ALGAS). Finally, it has carried out several greenhouse gas inventories, and it has promoted the Climate Change Information Center (CCIC) throughout Southeast Asia.

USAID Philippines Environmental Programs

For over two decades, USAID Philippines has supported a broad-based, comprehensive environmental program in the areas of energy, industrial pollution prevention, and natural resources management. The focus and approach of these programs changed over time. In the late 1970s, for example, the USAID mission moved toward improved energy management and transfer of new and renewable energy technologies, and away from supporting basic power generation and extension of the central grid to rural areas. Similarly, in the early 1980s, the mission began to support improved farming systems and natural resources management, especially in upland areas, not just conventional rice cultivation. In the 1990s, biodiversity programs and urban and industrial pollution prevention programs were added to the mission's

Table 5. GDP per Unit of Energy Use in the Philippines and Other Regions
(PPP dollar of GDP/kg of oil equivalent)

Country or Region	1980	1997	Percent Change
Philippines	5.6	7.0	25
East Asia and the Pacific	—	—	—
Lower middle-income countries	1.6	3.6	125
United States	1.6	3.8	138
World	2.1	4.2	100

Source: 2001 World Bank Development Indicators.

environmental portfolio. None of these programs was designed explicitly to address global climate change. However, all had unintended, positive climate change effects.

USAID Philippines Energy, Industrial Pollution, and Natural Resources Programs

This assessment measures the unintended climate change effects of four USAID Philippines environmental activities. It does not cover activities focused specifically on climate change. The four environmental projects are the Technology Transfer for Energy Management (TTEM) project, the Industrial Environmental Management Project (IEMP), the Rainfed Resources Development Project (RRDP), and the Natural Resources Management Program (NRMP). TTEM and IEMP helped reduce CO_2 emissions; RRDP and NRMP helped sequester carbon.

Technology Transfer for Energy Management (TTEM)

The TTEM project was implemented during 1986–1991 and funded at $4.27 million. The project was designed to encourage industrial and commercial establishments that were heavily dependent on fossil fuels and electricity to adopt energy efficient technologies. It also sought to establish a strong institutional capacity to undertake conservation-related investments in the private sector, particularly industrial and commercial energy consumers, suppliers of equipment and services, engineering firms specializing in energy conservation, and lenders who would finance energy conservation equipment. Widespread adoption of energy efficient technologies was expected to reduce the country's dependence on imported oil, conserve foreign exchange, and improve the financial position of industrial and commercial firms.

The project was successful on both economic and environmental grounds. Thirty technology demonstrations took place at 17 participating companies, which saved 109,331 barrels of oil equivalent (BOE) per year valued at nearly $1.9 million. Financial payback periods ranged from 0.3 to 20.9 years, averaging 1.8 years. The estimated financial rate of return was 12 percent or more for 11 of the firms and 28 percent or more for eight of the firms. The project established a $2.4 million development loan fund that was completely loaned out and repaid. About 1,000 people (plant managers, engineers, equipment suppliers, and finance executives) were trained under the project or benefited from technical assistance. Moreover, after their personnel received training, nine private financial institutions were certified to administer loans to companies that implemented new energy saving technologies.

Environmental objectives were less of a consideration than financial objectives when the project was designed in the mid-1980s. Nevertheless, increased energy conservation and improved energy efficiency resulted in reduced use of fossil fuels (176,500 BOE per year as of 2002), more complete fuel combustion, and fewer pollutants discharged into the environment. Thus, by promoting cost-effective technologies that reduced CO_2 emissions, the project had an indirect positive environmental impact.

Industrial Environmental Management Project (IEMP)

The $13.2 million IEMP, implemented from 1992 to 1997, worked with both the government and the private sector to introduce concepts of waste minimization and pollution prevention to small and medium-sized industrial firms. Pollution audits—simple assessments of opportunities for reducing industrial pollution through low- or no-cost techniques as well as capital investments in equipment—were conducted for 143 factories located outside Metro Manila. In addition, more than 2,600 people from both the public and private sectors were trained in environmental management skills. The audits identified opportunities for each factory to reduce waste and emissions while increasing production, reducing costs, and increasing revenues. The firms invested a combined $27 million to implement audit recommendations. These investments resulted in annual net benefits of $33 million to participating firms. The payback period averaged less than 10 months.

The project helped reduce both water and air pollution. Biochemical oxygen demand Biological

decreased by an estimated 43.5 million kg annually, and total suspended solids decreased by an estimated 31.7 million kg per year. These two pollutants damage aquatic life. To the extent these reductions can be sustained, water quality will improve, aquatic life will resume, and access to marine protein will increase. Since many Philippine communities depend heavily on fish protein, nutrition will improve in these communities.

Interventions at cement plants reduced emissions of suspended particulate matter that endanger human health. The positive health effect of reduced emissions can be substantial, depending on the direction of the prevailing winds and the proximity of the population to the plant.

Rainfed Resources Development Project (RRDP)

RRDP was implemented from 1983 to 1991 and funded at $32 million, of which $11 million supported community and private farm forestry, and $10 million introduced hillside conservation farming practices and soil rehabilitation techniques. The remainder supported agricultural research, rural infrastructure, and expansion of ongoing USAID farming systems programs.

The mission's forestry programs encouraged sustainable forest management and environmentally sound hillside farming systems. Because the programs targeted heavily deforested and erosion-prone upland areas, they reached low-income rural households of many ethnic groups as well as rural women. When the project ended, an estimated 2,200 upland families were applying improved forest management techniques to 1,497 ha of land (86 percent of the target) at 16 sites around the country. Although the project indirectly affected a much greater area—as much as 300,000 ha—this still represented only a tiny fraction of the 6–9 million ha of forested land in the country.

Training was widespread under RRDP. More than 15,000 extension agents and farmers at roughly 30 sites attended courses on forest management. In addition, about 1,000 25-year "certificates of stewardship" were distributed to villages and farmer groups. These certificates provided tenure continuity, essential for sound management of standing forests and for reforestation. Given the lag between tree planting and harvest, land access is more likely to be disputed without such certificates. At the national level, more than 120,000 certificates were distributed between 1988 and 1992.

The agriculture program funded by RRDP fostered sustainable, environmentally sound agricultural practices on deforested slopes. Sloping agricultural lands technology (SALT) was introduced as a viable alternative to the traditional slash-and-burn practices that were causing serious erosion. Farmers who adopted SALT or another environmentally sound farming system qualified for land access under the certificates of stewardship program. Over time, yields increased to levels farmers had obtained before the severe erosion began. Moreover, when all costs (time and labor) and benefits (increased yields) were considered, SALT-based methods provided a 25 percent greater return than traditional slash-and-burn systems. In addition, annual soil loss was reduced from 194 mt per ha with nonterraced plots to only 3.4 mt per ha with terraced plots.

Natural Resources Management Program (NRMP)

The ongoing NRMP, which began in 1995, was funded at $125 million through FY2000. Subsequently, additional resources were added, and the estimated completion date was extended to FY2004. Of the original funding, $25 million supported technical assistance in community-based forest management, $25 million was for a debt-for-nature swap, and $75 million was linked to policy reform measures. The resources were allocated among three complementary projects: Forestry Resources Management (FRM), Industrial Initiatives for Sustainable Environment (IISE), and Coastal Resources Management (CRM).

The Forestry Resources Management project has had the greatest effect on climate change, and has improved the ability of the Department of Environment and Natural Resources (DENR) to manage forests. In addition, new land tenure instruments supported by the project helped bring more

than 600,000 ha under community management. The Foundation for Philippine Environment, established under the debt-for-nature swap, has improved the potential for long-term contributions to national conservation efforts. Finally, the policy-based sector assistance program undertaken by DENR and USAID has supported reforms that promote ecologically sustainable natural resource management, with special attention to tropical forests, biodiversity, and increased economic efficiency of forest products industries.

Government support has been essential to the success of community-based forestry management supported by NRMP (and RRDP). But government support hinges on an executive order, which, unlike a law, leaves the program vulnerable to political changes. Thus, past successes may not be sustained unless a law is passed to cover community forestry.

USAID Philippines Climate Change Mitigation Program (PCCMP)

Although all had climate change effects, none of the four environmental projects described above was designed explicitly to address climate change. In 1996, however, USAID Philippines and the Philippine Government signed a strategic objective agreement (SOAG) with the explicit purpose of working cooperatively to mitigate climate change in the Philippines. This agreement led to initiation of the USAID-funded PCCMP. The program, funded at $8.9 million, was planned to last from 1998 through 2001, but it was later extended through 2002. PCCMP, which incorporates the mission's ongoing energy activities, provides technical assistance, training, and improved access to information and technology in order to contribute to the reduction of greenhouse gases.

An interagency program steering committee, chaired by the secretary of the Philippine Department of Energy, provides overall policy guidance and program direction. The committee is composed of key government departments, the state power and oil companies, and public sector representatives. The program is implemented through one of the USAID mission's principal contractors, PA Consulting. In addition, assistance is available under USAID funding mechanisms involving the U.S. Department of Energy, the U.S. National Renewable Energy Laboratory, and the U.S. Energy Association.

PCCMP has achieved major accomplishments, including the following:

- *Policy and Planning.* This component of the program is designed to improve power sector policies, planning, and environmental compliance. As a result of significant technical assistance and strategic support, the Electric Power Industry Reform Act was passed in 2001, and implementing rules were approved and signed on February 27, 2002. The engagement of civil society in formulating and lobbying for the act has set a potentially far-reaching precedent for public consultation and participation in the national legislative process.

- *Capacity Building.* Staff of key agencies and legislative committees have been trained under this component, and several university-based institutes now provide authoritative information to the public.

- *Clean Fuels.* This component encourages expanded use of clean-fueled power generation systems and promotes renewable energy projects. PCCMP assistance was instrumental in developing a national Renewable Energy Action Plan, which promotes renewable energy projects through community ownership and local institutional strengthening. The Philippine Department of Energy was also assisted to identify and remove administrative barriers to investments in renewable energy.

- *Energy Efficiency.* This component is designed to increase power plant energy efficiency at all stages: generation, transmission, distribution, and use. PCCMP has provided technical support to educate building owners, trade organizations, and the national power company on energy management and conservation. It has also helped to develop the national, demand-side management regulatory framework. With

support from PCCMP, the National Power Corporation adopted a heat rate improvement program. The program has already been implemented successfully in the company's own power plants as well as in those of several independent power producers.

Other ongoing USAID-supported programs specifically related to climate change are described in Annex 2.

Results

USAID Philippines has supported traditional environmental programs in forestry, energy conservation, and urban and industrial pollution for over two decades. These programs are likely to have reduced carbon emissions or sequestered carbon. These benefits should be counted as real contributions made by the Philippines—and USAID—to addressing climate change. The objective of this assessment was to quantify the greenhouse gas reductions of these environmental projects. The assessment had to confront two challenges: the lack of a directly applicable model or method for making such calculations and the lack of data for parameters that were never expected to be measured when the projects were designed. These problems are not unique to the Philippines and would arise in assessing the performance of any program.

Assessment Methodology

Impact evaluations generally assess program results in terms of intended impacts and program performance (effectiveness, efficiency, sustainability, and replication). This study is rather different. It assesses program results in terms of a single unintended impact, i.e., whether four USAID-funded traditional environmental projects implemented in the Philippines in the 1980s and 1990s had an effect on climate change, either by reducing carbon emissions or by promoting carbon sequestration.

The evaluation team applied existing models and methods in a simplified fashion to develop a rapid approach for quantifying the greenhouse gas emissions reductions of the four projects summarized above. The approach could be improved with broader application and adaptation, and the results could be improved by using additional and more refined data. Nevertheless, the approach generates a valid, yet conservative, assessment of the actual net climate change benefits of traditional environmental programs as implemented by USAID in the Philippines.

The methodology for measuring greenhouse gas contributions of environmental and energy projects is described in greater depth in Annex 1. Basically, the approach has four steps:

1. Identify potential greenhouse gas effects (sources and sinks) associated with the four USAID Philippines environmental projects.

2. Determine data availability for the sources and sinks identified in step 1.

3. Define the model (equations) for quantifying each carbon source and sink.

4. Perform calculations using the selected model (and equations) and available data; calculate baselines, program impacts, and net change; and record any omissions and observations.

Summary of Findings

The impact evaluations carried out on each of the energy and environmental projects covered in this report are summarized in Annex 2: natural resources management (Church, Litsinger et al. 1995; Church, Sowers et al. 1995), energy conservation (McClelland et al. 1996), and industrial pollution prevention (McClelland et al. 2000). The evaluations concluded that each project was generally successful in achieving its stated objectives. However, because climate change had not yet become a priority concern of USAID or the Philippine Government, greenhouse gas reduction was not a stated objective of the projects. Nevertheless, each project yielded substantial, unintended greenhouse gas benefits (see Table 6).

Table 6 shows that total greenhouse gas emissions reductions attributable to the four USAID

Philippines environmental projects total over 1.5 million mt of CO_2 equivalent. This amount is less than a 2 percent reduction from the total level of national emissions recorded in the latest Philippine National Greenhouse Gas Inventory (Asian Development Bank 1998). However these reductions are likely to be overstated, because the current National Inventory appears to undercount greenhouse gas emissions in two major sectors—industrial wastes and land-use carbon sequestration. With a more comprehensive National Inventory, the percentage of emissions reductions attributable to the USAID projects would be somewhat lower. On the other hand, estimated reductions would likely be somewhat higher, because various greenhouse gas effects were not included in this analysis. For example, the evaluation team did not consider indirect effects, only direct effects that could be measured with readily available data. Not included were effects due to energy savings under the IEMP project, carbon uptake in soils that occurred under the RRDP and NRMP projects, and secondary effects, such as emissions avoided from flood control or extension of the productive lifetime of hydroelectric dams.

Reducing CO_2 equivalent emissions has positive effects on global climate change. Emission reductions can also be valuable to project sponsors if they can be sold. The international community has asked the Prototype Carbon Fund (PCF) to create and foster such a market. According to its website, PCF's mandate is "to pioneer the market for greenhouse gas emissions reductions" (Prototype Carbon Fund 2000). There is a range of prices offered for a metric ton of carbon-equivalent reduced emissions (or carbon emission reductions). In 2002, the midlevel price on the emerging carbon trade market was $5.45 per mt of CO_2 equivalent.

Assuming conservatively that the annual economic benefits from greenhouse gas reduction remain constant, and valuing emissions at $5.45 per mt, simple payback periods can be calculated for two of the four USAID projects based on the value of carbon emission reduction credits alone. For TTEM, the carbon benefits payback period is

Table 6. Summary of Climate Change (CO_2) Benefits of USAID Philippines Environmental Projects by Source, 2001
(mt)

Source	USAID Program Contributions	National Inventory*	USAID as a Percentage of National Inventory
Energy conservation	–283,500	50,037,150	< 1
Cement production	–69,142	4,771,042	< 2
Industrial organic wastes	–274,470	920,500	NR**
Land use carbon sequestration	–918,847	–68,323,000	< 2
Total	–1,545,959	102,957,000	< 2***

* The total for the national inventory column includes all sources and sinks in the Philippines, not just the four categories in which USAID worked. Therefore, the total is not the sum of the four entries.
** Data in the Philippine national inventory for industrial organic wastes are for factories located in Metro Manila only. This means that national-level emissions are significantly undercounted, and it explains why the percentage of emissions reductions attributable to USAID-funded programs is "not relevant."
*** The percentage of emissions reductions attributable to USAID-funded programs would be somewhat lower if the National Inventory was more complete.

Sources: Energy conservation: Table 7; Industrial organic wastes andement production: McClelland et al. 2000, Table 8; Land use carbon sequestration: Table 9

three years.[7] For IEMP, it is 7.1 years. At $5.45 per mt, this level of CO_2 reduction is worth $3.4 million annually.

For RRDP and NRMP, the calculation of economic benefits is done differently, and as a result CO_2 from carbon sinks is priced differently. A conservative price for carbon sequestration, based on recent purchases, is $2 per mt. Although the team estimated the amount of carbon sequestered, it could not put a value on it, because the data were not disaggregated into the classes of sequestered carbon likely to be bought and sold in the marketplace. Without market prices, the team could not determine the payback period for RRDP and NRMP. However, assuming society was willing to pay at least $2 per mt of CO_2 sequestered, the minimum value of carbon sequestration achieved from these two projects would be $1.8 million.

Project Findings

Technology Transfer for Energy Management Project

TTEM supported a revolving loan fund that was financed by USAID, guided by the Philippine Department of Energy, and managed by commercial banks. The project demonstrated—to industries and lenders alike—that investments in energy conservation make good economic sense. By the end of the project, all borrowers had repaid their loans, and a second tranche of funds for lending was fully subscribed. In addition, commercial banks that had participated in the project began lending their own funds for investments in energy conservation. Total annual energy savings attributable to investments made possible by the loan fund are about 177,000 BOE or about 276,000 MWh of power. The energy saved, quantified according to the World Bank's *Environmental Manual* model, is equivalent to reductions in emissions (including CO_2, CH_4, and N_2O) of 283,500 mt annually (see Table 7). This estimate is conservative, because it is based only on the first two rounds of lending supported by USAID and it does not include additional lending by commercial banks.

Industrial Environmental Management Project

Liquid Wastes. IEMP focused primarily on reducing liquid waste loads. As indicated in Table 8, total annual BOD combined loads at the 143 participating industrial plants were reduced by 43.5 million kg of BOD (column A), which is equivalent to 73.9 million kg of COD (column C). This translates into nearly 275,000 mt of CO_2 equivalents annually (column I). As shown in Table 6, the National Inventory determined that industrial liquid waste totaled 920,500 mt of CO_2 equivalent emissions annually in the Philippines. That 30 percent of national emissions reductions can be attributed to the USAID-funded IEMP is unrealistic, in the evaluation team's view.

As noted, the National Inventory significantly undercounts industrial wastewater sources because it covers only industries located in Metro Manila. If the National Inventory was truly national in scope and included industries located outside Metro Manila, CO_2 equivalent emissions levels would be

[7] The carbon benefits payback period is the time required for the value of the carbon benefits to equal the cost of the project.

Table 7. Calculation of Avoided Emissions as a Result of Revolving Funds Established Under the TTEM Project, Philippines
(mt/year)

SO_2	NO_x	HC_1	SO_2	Particulates	CO	CO_2	CH_4	N_2O	CO_2 Equivalents
938.3	7.3	0.8	3,969.8	270.89	291.4	277,700	128.8	9.85	283,500

Source: McClelland et al. 1996

Table 8. Calculation of CO_2 Equivalent Reductions Resulting from the Industrial Environmental Management Project

(mt/year)

	A	B	C	D	E	F	G	H	I
Industry	Total Reduction of Organic Wastewater from Industrial Source	COD Conversion Factor	Total Organic Wastewater from Industrial Source	Percentage in Treatment	Methane Conversion Factor (MCF)	Maximum Methane Producing Capacity (MMPC)	Net Methane Emissions	CO_2 Equivalent Conversion Factor	CO_2 Equivalents
Units	kg BOD/yr	COD/BOD	kg COD/yr	%		CH_4/kg BOD	kg CH_4		mt
Calculation			A x B				C x D x E x F		G x H x .001
Seafood processing and canning	1,009,803	1.7	1,716,665	100	0.9	0.25	386,250	21	8,111
Desiccated coconut	1,377,579	1.7	2,341,884	100	0.9	0.25	526,924	21	11,065
Coconut oil milling and refining	146,337	1.7	248,773	100	0.9	0.25	55,974	21	1,175
Sugar	29,878,521	1.7	50,793,485	75	0.9	0.25	8,571,400	21	179,999
Distilled spirits	1,397,909	1.7	2,376,445	100	0.9	0.25	534,700	21	11,229
Starch manufacturing	3,201,633	1.7	5,442,776	100	0.9	0.25	1,224,625	21	25,717
Seaweed processing	51,900	1.7	88,230	100	0.9	0.25	19,852	21	417
Fruit canning	1,710,322	1.7	2,907,547	100	0.9	0.25	654,198	21	13,738
Hogs and poultry farming	334,361	1.7	568,414	0	0.9	0.25	0	21	0
Slaughtering	156,286	1.7	265,686	45	0.9	0.25	26,901	21	565
Soft drinks	140	1.7	238	100	0.9	0.25	54	21	1
Paper and pulp	17,259	1.7	539,340	100	0.9	0.25	121,352	21	2,548
Industrial chemicals	363,000	1.7	617,100	100	0.9	0.25	138,848	21	2,916
Wood products	1,754,730	1.7	2,983,041	60	0.9	0.25	402,711	21	8,457
Tanneries	4,703	1.7	7,995	60	0.9	0.25	1,079	21	23
Others	1,765,475	1.7	3,001,308	60	0.9	0.25	405,177	21	8,509
Total	43,469,958		73,898,927				13,070,045		274,470

higher than 920,500 mt, and the impact of IEMP would be less. This point is driven home by the fact that the 143 factories (all located outside of Metro Manila) covered by IEMP had BOD loads totaling 149 million kg, compared to the national total of 192 million kg cited in the National Inventory.

Cement Production. In addition to reducing liquid waste loads, IEMP also increased cement industry product recovery, including recovery of waste that was previously going up the chimney as dust. Thus, more cement could be produced using less limestone, all without increasing carbon emissions.[8] Annual reductions in CO_2 emissions attributable to IEMP's working with cement plants are estimated at 69,000 mt (see Table 6). The actual amount varies with plant output, which typically changes from year to year. To put this figure in perspective, the 69,000 mt of emissions reductions that were due to IEMP equaled about 1.4 percent of total emissions of CO_2 produced annually by the cement industry. Thus, industrial pollution prevention activities can yield major reductions in greenhouse gas emissions, even when the purpose of these activities is generally unrelated to climate change.

Rainfed Resources Development and Natural Resources Management Program

USAID's interventions under the RRD project opened the way for the Philippine DENR to work with indigenous peoples to establish community-based forestry management programs. Old growth forests were protected, reforestation was promoted, agroforestry and forest plantations were developed, and acreage in the program was protected or put under a more sustainable harvest regime. The follow-on NRMP supported government legislation and policies that provided indigenous peoples with tenure rights in certain forest areas. It also provided assistance to local government units and supported NGOs that played a constructive role in policy formation. Because these two USAID-funded programs succeeded in their stated objective of bringing over 5 million ha of land under community-based forestry management, they succeeded in preserving substantial carbon sequestration capacity—an important project "bonus."

The evaluation team estimated the amount of carbon sequestration for both a high-case scenario and a low-case scenario through 1998, the most recent year for which total acreage covered by the USAID program was available. These 1998 data were then extrapolated to 2001. (It is likely that USAID assistance provided to DENR and NGOs led to better protection and management of additional acreage, but the amount is unknown and therefore cannot included here; also unknown is the total acreage not covered by the USAID program.)

Under the high-case scenario, net biomass accumulation on all acreage is attributed to RRDP and NRMP. This represents an upper bound and clearly overestimates the impact. Therefore, results are presented only for the low-case scenario (Table 9). The table shows that over 145,000 ha of land were brought directly under controlled management and reforestation with RRDP and NRMP assistance (column A).[9] The calculation shows that USAID's assistance in the forestry sector resulted in an estimated 919,000 mt of CO_2 being removed annually through sequestration (column G).

Under the low-case scenario—which underestimates the impact—total acreage attributed to the USAID projects is reduced by 3 percent per year to reflect the deforestation that would likely have occurred in the absence of the projects. Although the nationwide rate of deforestation was about 2 percent, according to the Climate Change Information Center,[10] Philippine forestry experts indicated that the 3 percent figure was a more reasonable estimate because it reflected the amount of land that would likely have been logged, cleared, and cultivated in the absence of the USAID

[8] To make cement, limestone (calcium carbonate ($CaCO_3$) is converted to lime (CaO), with CO_2 as the byproduct: $CaCO_3$ + heat ⟶ $CaO + CO_2$.

[9] Land area in the program is calculated by taking the number of ha in the base year and inflating or deflating this number over the 25-year life of a community forest tenure certificate. The annual amounts are then summed and divided by 25 to yield the annual average number of ha in the program. This amount is then used to estimate the carbon sequestration effects of the USAID projects.

[10] The World Bank estimate is 1.4 percent for the same time period.

projects. It also reflected the fact that commercial timber licensing agreements had been cancelled in these areas, leaving no effective land management in place and allowing illegal logging to increase significantly.

Conclusions and Lessons Learned

This assessment demonstrates that USAID environmental programs in the Philippines helped address the issue of global climate change by reducing greenhouse gas emissions and by sequestering carbon. This occurred despite the fact that climate change was not an explicit concern in the design of these programs. This "no regrets" approach to mitigating greenhouse gas emissions is central to USAID's current Climate Change Initiative (1998–2002), and it provides a successful model for future activities designed to achieve global and local environmental and development objectives.[11]

Three principal conclusions emerge from the assessment. The first reinforces the conventional wisdom that traditional environmental programs have a positive climate change effect by mitigating greenhouse gas emissions. The other two conclusions reinforce lessons identified in earlier evaluations of USAID Philippines environmental programs.

1 ***Win-win results.*** **Conventional USAID environmental programs (forestry and land use, energy technology and management, and urban and industrial pollution) can yield significant ancillary climate change benefits.**

Climate change programs have long been touted

[11] The "no regrets" policy reflects a win-win situation in which activities would be supported regardless of any carbon benefits that may result.

Table 9. Calculation of Carbon Sequestration Associated with USAID Philippines Forestry and Land Use Projects, 2001

	A	B	C	D	E	F	G
Forest type	Areas of Forest and Biomass	Annual Growth Rate	Annual Biomass Increment	Percent Biomass Increment Consumed	Carbon Fraction of Dry Matter	Net Carbon Uptake Increment	Convert to CO_2 Emission (–) Removal (+)
units	kha	mt dm/ha	kt dm			kt C	Annual
calculation			A x B			C x (1–D) x E	mt CO_2
Old growth	38.80	3.0	116.39	0.05	0.50	55.29	202,712
Residual protected	38.37	5.2	199.50	0.10	0.43	77.21	283,097
Residual production	61.47	5.2	319.65	0.25	0.43	103.09	377,990
Agroforestry	1.90	6.0	11.40	0.35	0.45	3.33	12,227
Plantation	4.90	8.9	43.25	0.04	0.45	11.68	42,821
Total	**145.39**		**690.20**			**250.59**	**918,847**

Source: Column A: Church 1995; discussions with NRMP staff and DENR
Column B: Discussions with industry experts
Column C: Villarin 1999, *Tracking Greenhouse Gases*

for their win-win benefits. This assessment provides empirical evidence that this is so, demonstrating that climate change benefits—even though unintended—result from investments in traditional USAID environmental programs. Thus, for example, USAID's support for a forestry program in the Philippines also addressed global climate change by sequestering carbon to prevent its release into the atmosphere. The same may be said for energy conservation, urban and industrial pollution, and energy sector reform programs, all of which reduce greenhouse gas emissions.

Although climate change is regarded as an increasingly important global problem, it is not often regarded as an urgent problem when compared to competing priorities, such as those related to local or national development. Therefore, it is helpful—and generally essential—for greenhouse gas mitigation activities to have direct, tangible, near-term benefits in addition to carbon reduction benefits. Explicit recognition of these dual benefits can help achieve broad public support for both climate change programs and traditional environmental assistance programs.

2 ***Synergy.*** **Institution building, public partipation, and sustainability are synergistic and self-reinforcing.**

Institution building helps create a *supply* of environmental services related to climate change. Public participation helps create a *demand* for these services. The two—institution building and public participation—go hand in hand; they are synergistic. NGOs are often instrumental in carrying out both roles, typically through public outreach and education and awareness programs. In the absence of widespread public participation and strong institutions (with motivated and competent staff), the success of climate change programs is jeopardized.

Public participation can also be a powerful tool in ensuring that climate change programs are sustainable. Partnering with academic institutions can be particularly important in ensuring sustainability: academic institutions are often considered impartial, and they are characterized by long-term stability. USAID's use of "technology of participation" was especially effective in the Philippines, an open society where participation is highly valued. For example, by working through NGOs, academia, and civil society, USAID was successful in building a broad-based coalition that led to passage of the politically sensitive Electric Power Industry Reform Act—the "power bill." A similar level of public participation is needed to support legislation concerning the country's forests.

3 ***Incentives.*** **Environmental programs that contribute to net greenhouse gas reductions are most successful when they offer financial benefits or other incentives that encourage participation.**

In the case of energy conservation and industrial antipollution programs, private firms must be motivated to adopt energy conservation or pollution prevention measures. Such motivation typically stems from the prospect of reaping financial benefits in the form of reduced production costs, increased revenues, or both. Even more important than financial benefits in motivating industries to comply with environmental regulations and legal requirements is the desire to avoid fines and penalties. In the case of forestry programs, tenure security—either individual or community-based—is critical in providing an incentive for long-term forest management. Though land ownership is not essential, medium-term access to land is important.

Annex 1. Methodology

Though not explicitly designed with climate change objectives in mind, the four USAID Philippines projects described in this assessment nevertheless made positive contributions in addressing the issue of climate change. These contributions came from projects that focused on 1) *sources* to reduce carbon emissions and 2) *sinks* to increase carbon sequestration. This annex describes a generic approach to quantifying climate change benefits resulting from traditional environmental programs.

The Basic Approach

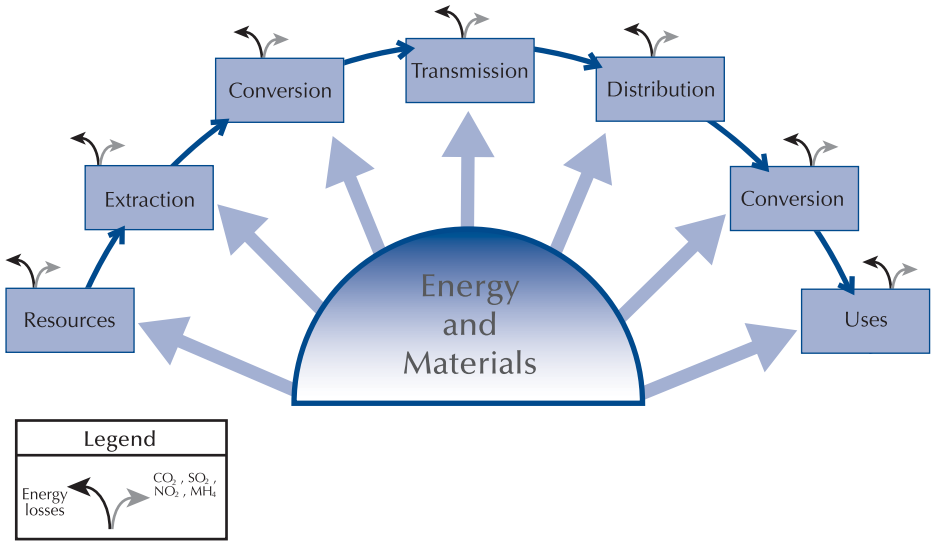
The approach has four steps:

1. *Identify potential sources and sinks associated with the USAID projects.* For example, a USAID forestry program may focus on planting trees, which increases carbon storage in plant biomass. But that is just the initial effect. Reforestation also reduces soil erosion and improves soil quality. This increases carbon sequestration, because carbon is fixed in soils as well as in woody biomass. Reforestation and reduced soil erosion, in turn, reduce silting of watersheds, which increases the life and capacity of hydropower and irrigation investments. Increased hydroelectric capacity, in turn, reduces the need to burn high-carbon fossil fuels. Reforestation also reduces the risk of floods. This, in turn, reduces the potential need for evacuation and rebuilding due to floods, which are energy-intensive—and therefore carbon-intensive—activities. While all of these potential sources and sinks will not be quantifiable, they provide a basis for understanding the full greenhouse gas effects of forestry projects. Figure 1 helps show the relationships and interactions involved.

2. *Determine data availability for the sources and sinks identified in step 1.* Some can be easily quantified, some will require additional data collection, and others must be evaluated qualitatively. In the Philippines, the CDIE team relied mainly on project documentation, supplemented by interviews and discussions with those involved with the projects, including USAID staff, government agencies, companies, and consultants.

3. *Define the model for quantifying each carbon source and sink.* The number of sources and sinks, and the extent to which data are avail-

Figure 1. Sources of Greenhouse Gas Emissions and Energy Losses from Electrical Energy Flows



able, will in large part determine which model to use. Although carbon quantification methods are still being refined, sound models are available through the World Bank and the Intergovernmental Panel on Climate Change (IPCC). These models specify the emission and loss factors to apply to various energy sources from extraction of the raw resource, initial transportation, and primary conversion, and transmission, distribution, and final conversion into end use.

4. *Calculate greenhouse gas effects.* Using the selected models and available data 1) calculate a baseline (i.e., the greenhouse gas effects in the absence of the project); 2) calculate the quantifiable greenhouse gas effects of the project; 3) calculate the project impact, which is the difference between the two (i.e., the greenhouse gas effects with and without the project); and 4) identify omissions and record observations concerning data and methods. Because it is unlikely that all effects will be captured, the fourth step helps put the results in context and contributes to future improvements in information and methods.

Using the cradle-to-grave approach in the World Bank's *Environmental Manual for Power Development* reduces leakages to tolerable limits, so they need not be considered further. However, estimating data leakages for forestry-related projects requires more care. For example, *without* the project, effects would include the emissions generated through the use of energy to harvest, transport, and process timber. *With* the project, effects would include the energy used to transport consultants, train local social foresters, and produce project outputs. This assessment assumes that the effects *with* the project are less than those *without* the project and, to be conservative, these effects are not included.[12]

[12] This rapid appraisal approach is less rigorous than that used by entities (such as the PCF) that actually purchase carbon emission reductions or certified tradeable offsets. However, the method is sufficient to estimate the approximate contribution to emission reductions and value to society.

The subsequent discussion focuses in more detail on reducing the threat of climate change posed by greenhouse gas emissions by 1) reducing carbon sources and 2) increasing carbon sinks. Carbon sources can be reduced by supporting energy management programs, industrial pollution programs, and industrial wastewater programs. Carbon sinks can be increased by supporting forest protection and management programs.

Carbon Sources

Carbon emissions are generated from a variety of sources, including combustion of fossil fuels, industrial processes and wastes, agriculture, and domestic wastes. The principal references used to estimate carbon emission reductions resulting from the USAID Philippines projects were the World Bank's *Environmental Manual for Power Development* and the sector worksheets prepared by the Philippine IACCC (for industrial environmental management programs). These worksheets are based on the 1996 IPCC *Guidelines for National Greenhouse Gas Inventories*—the generally accepted protocol for accounting for such emissions.

Energy Management Programs

Sources of greenhouse gases. Energy derived from fossil fuels or biomass—either as electric power, transportation fuel, or industrial process heat—is a direct source of CO_2 and other greenhouse gases such as methane (CH_4) and nitrous oxide (N_2O). Often overlooked, however, is the fact that energy saved at the point of final consumption yields more than a one-to-one savings—in both fuel and emissions—due to reduction in losses from production, transport, conversion, and transmission. Also reduced are the energy inputs at each stage—it takes energy to make energy.

For example, assume that transmission and distribution losses from a power plant to the point of consumption are 10 percent. Then, for every 100 kWh of end-use demand, 110 kWh must be generated. If the power plant is operating at, say, 60 percent conversion efficiency, then the amount of energy generated at the power plant must be nearly double the amount required at the point of end

use. In addition, recall that it took energy to construct and operate the power plant in the first place and to construct and maintain power transmission lines. If traced back to the coal mine or oil well that produced the fuel for the power plant, the effect of energy savings on gross energy consumption is even greater. A generalized flow diagram for electric power energy production and use is presented in Figure 1. In principle, the cumulative effect of these energy linkages needs to be incorporated into the model in order to assess the impact of an energy conservation project.

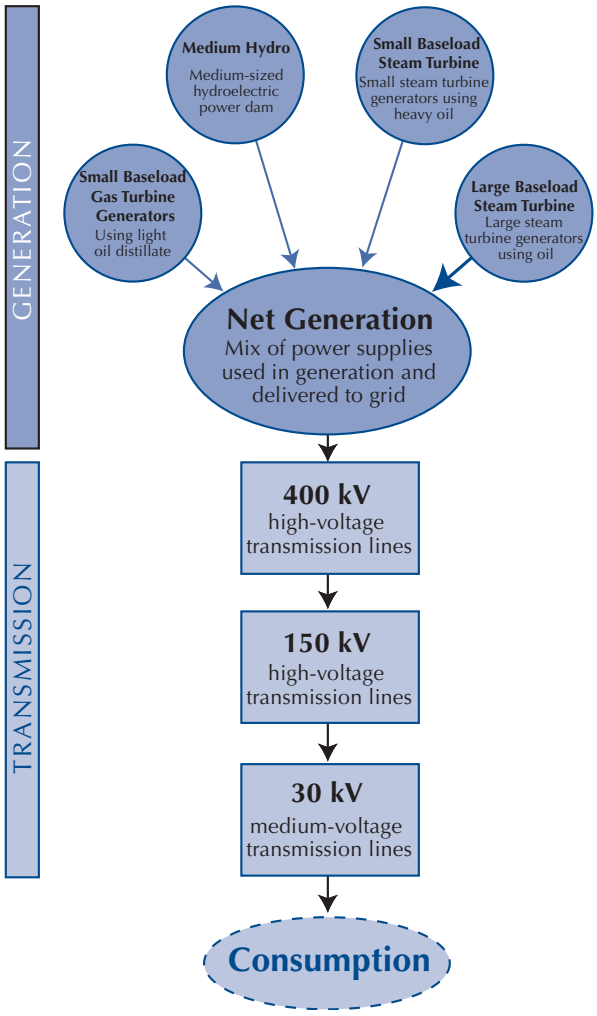
Methodology. The assessment team used the World Bank's *Environmental Manual* and an existing database for the Philippines to measure the energy-related greenhouse gas effects of the IEMP and TTEM projects.[13] The *Environmental Manual* provides a software model that simulates cradle-to-grave or life-cycle environmental impacts of energy production and use. The software can be used to analyze and compare airborne and greenhouse gas emissions, solid wastes, and land use, as well as internal and external costs associated with the investment and operation of a wide range of energy technologies. The software includes a generic database for energy technologies in developing countries.

The manual can be used to assess actual end-use demand under alternative scenarios, e.g., for different types of energy transformer (boilers, generators, or motors), various fuels and power sources, and transport. Using the World Bank model, Figure 2 illustrates a chain of energy flows in the Philippines from power generation technologies to the point of final consumption. Each generation technology has fuel links, illustrated in Figure 3 for coal for base-load electricity generation. In much of Luzon, for example, coal for big, base-load steam turbine power stations is transported by diesel locomotive. The coal is from both surface and underground mines, each of which has its own energy demands and environmental impacts.

The calculation of greenhouse gas benefits resulting from energy management programs should be based on a *with/without* analysis. The *without* (baseline) scenario estimates energy use over time assuming the USAID program was not implemented. The process permits allowances for unrelated events that can also affect emissions. Simply measuring the change in emissions at a facility over time may not accurately reflect the contribution of a project if the reduction in emissions reflect a decrease in energy output, for instance, due to a decline in economic activity.

Measurements for most USAID projects are made at two points in time, before and after the project.

Figure 2. Energy Flows for Power Generation and Transmission in the Philippines
(based on the World Bank model)



[13] The Environmental Manual model documentation can be found at www.oeko.de/service/em/.

Though not ideal, these two data points are sufficient for a rapid assessment, assuming that all conditions except one—energy savings—are the same with and without the project. (This method of estimation would not be sufficient, however, if the project were expected to sell its carbon emission reductions on the market.) This approach dispenses with estimating the baseline and treats project impacts as deviations from the baseline. The *with* scenario estimates energy savings accrued over the period during which the USAID program was implemented. Greenhouse gas effects due to the energy savings are calculated using emission factors in the *Environmental Manual* based on energy flows and transformations incorporated in the model.

When using the *Environmental Manual* and its generic database to measure greenhouse gas impacts at the project level, data are needed only for the final demand for energy—expressed as tons (or barrels) of oil equivalent, Btu, or MWh. A scenario then links final demand to all processes and fuels along the way. For example, if an energy efficiency project reduced final demand by 100 MWh, this impact of this reduction would then be traced through the transmission and distribution system, a power plant, and a fuel for that plant. The generic database contains all other parameters such as power plant efficiency, transmission losses, and other processes involved. This method can be further refined by using country-level or even project-specific parameters, as was done for this assessment. Country databases can be found at the *Environmental Manual* website.

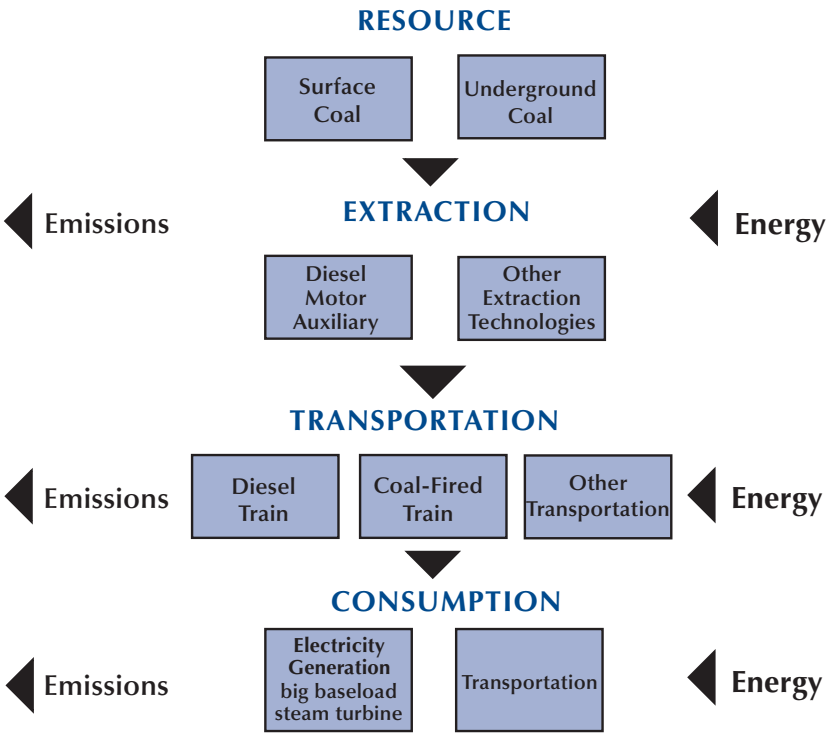
Industrial Pollution Programs

Industrial antipollution programs can help to reduce greenhouse gas emissions by

- increasing energy efficiency, e.g., through better energy management, energy-efficient equipment such as lights and motors, and improved production processes
- reducing waste, e.g., by segregating waste flows or using one waste stream as an input to another process
- reducing inputs of raw materials per unit of output, e.g., by reducing chemicals used per unit of production or reducing the energy needed for producing, transporting, storing, and managing the chemicals

The method used to calculate energy savings from energy management plans (described above) applies to the energy components of industrial antipollution programs, such as IEMP. This section describes the method for calculating industrial emissions unrelated to energy or combustion of fossil fuels. These techniques, described below, apply to many

Figure 3. Scenario Chain for Energy and Emissions in Extraction and Delivery of Coal in the Philippines
(based on the World Bank model)



industries, including those supported under IEMP. The cement industry is selected solely for illustrative purposes. The IPCC website (www.ipcc.ch) describes the method for calculating greenhouse gas emissions for all industries.

Sources. To make cement, limestone (calcium carbonate—$CaCO_3$) is heated to convert it to lime (CaO), with CO_2 as the by-product: $CaCO_3$ + heat ⟶ CaO + CO_2. During this process, plants can lose considerable amounts of cement. This was the case in the Philippines: the cement was literally going up the smokestack, increasing carbon emissions and causing serious atmospheric pollution. IEMP helped cement plants find cost-effective ways of recovering cement, enabling them to produce more cement product with the same level of energy and material inputs—but with the same or lower levels of carbon emissions.

Methodology. Pollution audits were carried out to establish an emissions baseline for each plant supported under the project. During project implementation, emissions reductions were monitored and reported. These reductions could be directly attributed to the project, since they would not have occurred without it. Using a simple adaptation of the IPCC sector worksheet for the cement industry and applying standard IPCC emission factors, a spreadsheet (Table 10) was developed by the evaluation team to calculate emission reductions. Data are required for only two variables: tons of cement recovered (column A) and the emission factor (column B). Emission factors can be obtained from the country's national emissions inventory or the UNFCCC. Alternatively, project data can be used if available.

Industrial Wastewater

Sources. Many industries, e.g., food processing, sugar mills, pulp and paper, and tanneries, produce large quantities of organic pollution in wastewater. As these wastes decompose—either through wastewater treatment systems, or naturally, as untreated wastewater—they release significant amounts of methane and other greenhouse gases. These greenhouse gas emissions derive from the organic load of the wastewater and sludge and the degree of anaerobic treatment on-site—at the plant, at central wastewater treatment facilities, or in untreated water bodies. The greenhouse gas emissions can be reduced when factories reduce the quantity or quality of organic wastes contained in wastewater. In addition, energy used for pumping, heating, and wastewater treatment can be reduced as water use (or organic loads per unit of output) is reduced.

Methodology. The method for estimating greenhouse gas emissions due to industrial wastewater is summarized in Table 11. It is a modification of the

Table 10. Model Spreadsheet for Estimating Greenhouse Gas Emissions from the Cement Industry in the Philippines
(based on the IPCC model)

A	B	C	D	E	F	G
Cement Recovered	Emission Factor	CO_2 Reduced	CO_2 Reduced	Emission Factor	SO_2 Reduced	SO_2 Reduced
mt	CO_2/mt	mt	kg	kg SO_2 /mt cement	kg	mt
		A x B	C/1000		A x E	F/1000
				0.3		

Source: McClelland et al. 1996

IPCC method. Chemical oxygen demand (COD) is the best measure of the organic content of industrial wastewater. However, measurements are usually reported in terms of biological oxygen demand (BOD). A conversion factor of 1.7 (column B) is used to convert BOD (column A) into an equivalent amount of COD (column C). Most developing countries lack formal wastewater treatment facilities, so the percentage of wastes that are treated must be estimated (column D). This was relatively easy in the Philippines for the industries assisted by IEMP because pollution audits had been conducted. In the absence of such data, country averages (as reported in national greenhouse gas inventories) can be used to estimate the amount of COD material (in mt) treated.

The methane conversion factor (MCF) and maximum methane producing capacity (MMPC) are reported in columns E and F, respectively. Default values of 0.9 and 0.25 for MCF and MMPC, respectively, represent Asian averages. These default values were used in the 1996 IPCC workshop on country inventories. The amount of methane generated from waste (column G) is calculated by multiplying the COD load (column C) by these factors. For comparison purposes, the amount of methane is converted to mt of CO_2 equivalent: one mt of methane has the same radiative forcing effect as 21 mt of CO_2.

The parameters that are shown on the worksheet as fixed can be obtained from the country's national level inventory or the UNFCCC.

Carbon Sinks

Trees, forests, and other forms of vegetation sequester (or store) carbon from the atmosphere. The carbon is stored both in standing plants (biomass) and underground in soil. Soil is the largest, non-fossil, land-based organic carbon reservoir on earth. To put this in perspective, globally, the carbon content of soil is three times that of terrestrial plants and animals (Eswaran et al. 1993, 57). Twice as much carbon is stored in the soil as in the atmosphere. The amount of carbon in soil is equivalent to one-third that stored in fossil fuels. Figure 4 shows how deforestation affects greenhouse gas emissions.

Forest Protection and Management Programs

Sources. Forests, soils, and other natural stores of biomass become sources of carbon emissions when they are logged, burned, or unsustainably managed. Grassland and forest soils tend to lose 20 to 50 percent of their original organic carbon within the first 50 years of cultivation. Erosion, leaching, methane production, volatilization, and mineralization (decomposition of complex organic compounds to inorganic forms) lead to carbon loss from the soil.

Methodology. As with the energy management programs and industrial pollution and wastewater programs, standard IPCC protocols were adapted to determine the carbon impacts of the forest protection and management programs. The full IPCC worksheet has been scaled down in Table 9 to accommodate data limitations in the Philippines. Data for forest and biomass stocks (column A) are generally available from national forestry statistics, sometimes on a regional basis. This is also the case for the annual growth rate of stocks (column B). The percent of biomass consumed (column D) reflects the fact that biomass does not stay constant: people use forest products for fuel and building materials, among other things. The carbon fraction of dry matter (column E) is set at the IPCC-recommended value of 50 percent. This approach, however, undercounts total carbon storage because it does not include carbon stored in soils.

According to Philippine forestry experts, these areas would not have been brought into the community forestry program without USAID or other donor assistance. As such, project impacts are measured in terms of their departure from the baseline. Data for each of the input columns are generally available from project documents or from country studies. For example, project-level data are available for column A, while data for columns B and D are typically based on national statistics or studies. This level of generality is typical for carbon baseline studies.

Table 11. Model Spreadsheet for Estimating Greenhouse Gas Emissions from Industrial Wastewater in the Philippines
(based on the IPCC model)

	A	B	C	D	E	F	G	H	I
Industry	Organic Wastewater	COD Conversion Factor	Organic Wastewater from Industrial Source	Percentage Treated	Methane Conversion Factor (MCF)	Maximum Methane Producing Capacity (MMPC)	Net Methane Emissions	CO_2 Equivalent Conversion Factor	CO_2 Equivalent
units	kg BOD /yr	kg COD/	kg COD/yr	%		CH_4/kg BOD	kg CH_4		mt
calculation		kg BOD	A x B				C x D x E x F		G x H x 0.001
Food and beverage		1.7			0.9	0.25		21	
Paper and pulp		1.7			0.9	0.25		21	
Industrial chemicals		1.7			0.9	0.25		21	
Other wood products		1.7			0.9	0.25		21	
Tanneries		1.7			0.9	0.25		21	
Others		1.7			0.9	0.25		21	

Source: McClelland et al 1996

Notes on calculations for Table 11:

Column C. Organic wastewater from industrial sources

$C = A \times B \times 1.7$

Where:

- C Organic wastewater from industrial source (kg of COD)
- A Organic wastewater COD conversion factor (kg of BOD)
- B COB to COD conversion factor (kg of COD/kg of BOD) = 1.7

Column G. Net methane emissions

$G = C \times D \times 0.9$ (column E) $\times$ 0.25 (column F)

Where:

- G: Net methane emissions (kg of CH_4)
- C: Organic wastewater from industrial source (kg of COD/yr)
- D: Percentage of wastewater treated
- E: Methane conversion factor (MCF) = 0.9
- F: Maximum methane producing capacity (CH_4/kg BOD) = 0.25

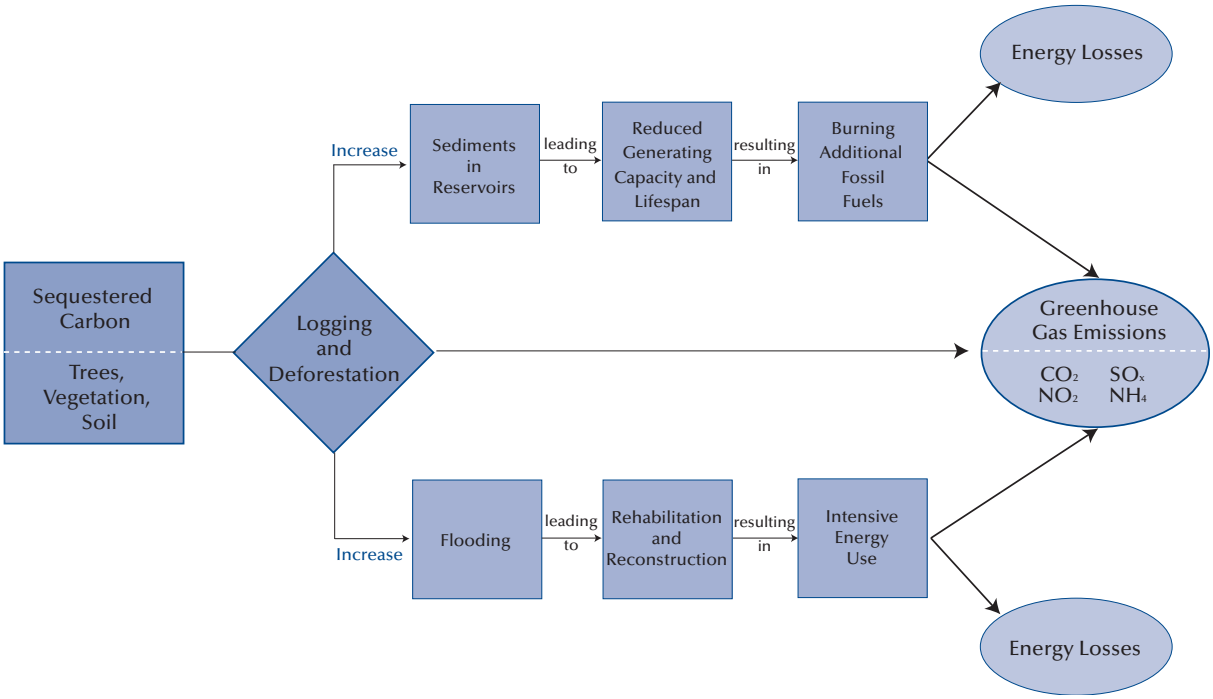
Column I. CO_2 equivalents

$I = G \times H \times 0.001$

Where:

- I: CO_2 equivalents in metric tons
- G: Net methane emissions (kg of CH_4)
- H: CO_2 equivalent conversion factor = 21

Figure 4. Scenario Chain: Impact of Deforestation on Greenhouse Gas Emissions
(based on the World Bank model)



Annex 2. Climate Change-Related Activities Supported by USAID Philippines

This assessment focuses on four activities supported by USAID Philippines in the traditional environmental sectors of energy conservation, industrial pollution prevention, and natural resources management. None of the four activities, which were implemented in the 1980s and 1990s, was designed explicitly to address climate change issues. More recently, however, USAID has supported several activities designed to mitigate climate change in the Philippines. This annex provides an overview of some of these activities.

Philippine Climate Change Mitigation Program (PCCMP)

The PCCMP is one of the more important climate change-relevant programs. This project was funded at $8.9 million for 1998–2001; it has been extended three times because the funds were not fully disbursed. The program is designed to reduce greenhouse gases by disseminating fuel cell technology; increasing power plant efficiency; and strengthening information, education, and communication (including measures to improve the policy, planning, and legal and regulatory environment). Working through this program, USAID supported a campaign to help pass the power bill.

The creation and strengthening of the Climate Change Information Center (CCIC) is due in large part to USAID support provided under the PCCMP. Comanaged by the Global Bureau's Center for the Environment in the Agency's Washington D.C. headquarters and USAID Philippines, the CCIC has become a center of excellence not only in the Philippines but also for the entire Association of Southeast Asian Nations (ASEAN) region. CCIC supports information, education, and communication activities on climate change-related issues. In 1994, CCIC carried out an emissions inventory with USAID assistance. Unfortunately, the data are of questionable reliability because some Philippine Department of Energy (DOE) and DENR enumerators came up with data "just to comply." Because CCIC is not a government institution, operational funding will become an issue when USAID funding ends in 2004. CCIC's publications include:

- *Climate Change: Challenges and Responses.* VCR tape. N.d.
- *Climate Change: The Real Story.* CD-ROM. 2001.
- *Disturbing Climate.* Edited by Jose T. Villarin. Manila Observatory. Quezon City, Philippines: Ateneo de Manila University. 2001.
- *Tracking Greenhouse Gases: A Guide for Country Inventories.* By Jose T. Villarin and collaborators. Manila Observatory. Quezon City, Philippines. 1999.

USAID also used PCCMP resources to provide technical assistance and training to the Philippine National Power Corporation (NPC), and the Department of Energy used USAID resources to help elaborate the country's power development plan using the "integrated resource planning" concept. Six power plants—two coal-based, one thermal-based, and three independent (private) power plants—were involved. The overriding objective of this activity was to achieve fuel savings through heat rate improvement and reduce costs.

Foundation for the Philippine Environment (FPE)

The FPE is an NGO created in 1992 with funds provided under USAID's Natural Resources Management Program (NRMP). Under a "debt for nature" swap, $18 million was used to endow FPE in lieu of paying off $29 million of debt. FPE emphasizes planning as distinct from implementation. Its two objectives are to create awareness about climate change and to build capacity at the community level, initially through seven local government units. The FPE funds its operations with

endowment earnings, and has not yet drawn on the body endowment. However, due to devaluation of the peso after the 1997 Asian financial crisis, the value of the endowment, in dollar terms, has decreased to about $14 million. FPE's publications include:

- *Hotter Facts on Hot Climate.* Quezon City, Philippines. March 2000.
- *Burning Concerns on Climate Change.* Quezon City, Philippines. March 2000.
- *Cool Practices for Hot Climate.* Quezon City, Philippines. March 2000.
- *An Enterprising Spirit Amidst Climate Change.* Quezon City, Philippines. 1999.

Environmental Science for Social Change (ESSC)

ESSC received a $500,000 grant under USAID's NRMP. The ESSC project promotes community-based forest management by assisting the Philippine Working Group for Sustainable Natural Resource Management. In 1900, 70 percent of the country was forested; in 1999, only 18.3 percent was forested. By 2010, only an estimated 6.6 percent will remain forested if no action is taken. However, an estimated 19 percent of the country will remain forested if local governments further community-based forest management. ESSC's goal is to return the country to a better balance between forests and non-forests. This is a daunting task, because there are 4,000 communities in the Philippines. One example of how ESSC has influenced national policy was the issuance of the executive order that made forestry a line item in the government budget. Among ESSC's publications is a map, which has achieved considerable notoriety:

- *Decline of the Philippine Forest.* Quezon City, Philippines: Manila Observatory. Ateneo University. 1999.

Preferred Energy, Inc. (PEI)

Using resources from the Renewable Energy Fund for Technical Assistance (REFTA) project, USAID contributed $902,000 to help create PEI, a local institution to provide financing for renewable energy projects (hydro, solar, windmills, etc.). Contrary to the assumption that lack of financing was the key constraint to investing in renewable energy, PEI found that projects were often not even ready for financing. For those that were ready, PEI provided financing at market rates of interest. A hydro project was funded through PEI-provided equity financing and a bank loan. To fund a solar project, PEI provided a five-year loan at 15 percent interest.

Inter-Agency Committee for Climate Change (IACCC)

The IACCC coordinates climate change projects implemented within the Philippines. These programs have high priority in the government because the geography of the Philippines makes the country particularly vulnerable to rising sea levels. Coordination is essential because climate change-related projects are implemented not only by DENR but also by other departments (such as agriculture and health). IACCC also coordinates the government's position on climate change issues and in that capacity instructs foreign affairs technocrats. Cochaired by the Secretary of the DENR and the Secretary of Science and Technology, it includes a wide range of government and non-government bodies and agencies. IACCC's publications include:

- *The Philippines' Initial National Communication on Climate Change.* December 1999.

Annex 3. People Interviewed

USAID Philippines

Patricia K. Buckles, Mission Director

Francis Donovan, Deputy Mission Director

Jerry P. Bisson, Chief, Office of Environmental Management

Rosario "Chato" R. Calderon, Senior Technical Advisor, Office of Environmental Management

Jose "Boy" B. Dulce, Project Development Specialist, Office of Environmental Management

Noemi C. Bautista, Development Assistance Specialist, Office of Environmental Management

Leila M. Peralta, Program Management Specialist, Office of Environmental Management

U.S. Embassy Manila

Lauren W. Catipon, Environment, Science and Technology Affairs

USAID Washington

Del McCluskey, ANE/SPOTS

Cindy Lowry, ANE

Ko Barrett, Climate Change Team, EGAT/ENV

Virginia Gorsevski, Climate Change Team, EGAT/ENV

Patricia Flanagan, Renewable Energy Programs, EGAT/ENV

Government of the Philippines

Cyril C. del Callar, Undersecretary, Department of Energy (Metro Manila)

Jesus C. Anunciacion, Chief Science Research Specialist, Energy Efficiency Division, Department of Energy (Metro Manila)

Reuben Emmanuel T. Quejas, Chief, Non-conventional Energy Division, Department of Energy (Metro Manila)

Lilian C. Fernandez, Division Chief, Department of Energy (Metro Manila)

Joyceline A. Goco, Head, Inter-Agency Committee on Climate Change Secretariat, Department of Environment and Natural Resources (Quezon City)

Eustaquito T. Tandug, Program Director, Natural Resources Management Program, Department of Environment and Natural Resources (Quezon City)

Rizalino G. Santos, Group Manager, National Power Corporation (Quezon City)

Roland R. Cabasa, Head, Energy Services Company, National Power Corporation (Quezon City)

NGOs

Renato Goco, Chief of Party, PA Services, Inc., Philippine Global Climate Change Mitigation Program (Manila)

Jose T. (Fr. Jett) Villarin, Head, Climate Studies Division, Climate Change Information Center, Manila Observatory (Quezon City)

Maria Lourdes L. Baylon, Coordinator, Climate Change Information Center, Manila Observatory (Quezon City)

Grace S. Yeneza, Managing Director, Preferred Energy, Inc. (Metro Manila)

Sylvia San Mateo Miclat, Environmental Science for Social Change, Inc., Ateneo University (Quezon City)

Julio Galvez Tan, Executive Director, Foundation for the Philippine Environment (Quezon City)

Donors

Ernesto S. Guiang, Natural Resources Management Consultant, World Bank (Pasig City)

Chantale Yok-Min Wong, U.S. Alternate Executive Director, Asian Development Bank (Manila)

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