

Energy for Life

A Case Study Compendium

Prepared for the

United Nations Commission on Sustainable Development - Ninth Session
April 2001



Prepared by the

Office of Energy, Environment, and Technology
Bureau for Economic Growth, Agriculture, and Trade
United States Agency for International Development

FOREWORD

This publication, “Energy for Life,” illustrates that energy plays a critical and catalytic role in human development. The case studies demonstrate a variety of ways that energy technologies provide the means to an improved quality of life and reflect the dramatic impact energy technologies have on development. Examples show a wide variety of energy programs that contribute to gender equity, job creation, and improved health care delivery.

We at USAID hope that these examples are compelling and that decision makers will find ways to providing desperately needed energy services to the millions of people who currently lack these tools for development.

We compliment and thank the entrepreneurs and development practitioners who have provided us with these success stories. We look forward to our continuing work in powering development around the world.



Barbara Turner
Acting Assistant Administrator
Bureau for Global Programs, Field Support and Research



ACKNOWLEDGEMENTS

USAID's Office of Energy, Environment, and Technology prepared this report for the United Nations Commission on Sustainable Development—Ninth Session. Contributors to the report include the Academy for Educational Development; Advanced Engineering Associates International; the Alliance to Save Energy; the Business Council for Sustainable Energy; E&Co.; the Environmental Export Council; the Institute of International Education; the International Council for Local Environmental Initiatives; the International Institute for Energy Conservation; Lawrence Berkeley National Laboratory; National Renewable Energy Laboratory; Nexant, Inc.; Oak Ridge National Laboratory; PA Government Services, Inc.; Sandia National Laboratories; the United States Energy Association; the United States Environmental Protection Agency; and Winrock International.

USAID's Russ Backus, Patricia Flanagan, Dr. John Ingersoll, Dr. Regina Ostergaard-Klem, Robert MacLeod, Mark Murray, Dr. Samuel Schweitzer, and Gordon Weynand provided internal review comments. Dr. Griffin Thompson, Director of the Office of Energy, Environment, and Technology, provided helpful direction throughout the development of this report.

Photos were provided courtesy of the Academy for Educational Development; Advanced Engineering Associates International; the Alliance to Save Energy; the Business Council for Sustainable Energy; E&Co.; the Environment and Natural Resources Information Center; the Environmental Export Council; Fundacion Solar; Ghana Energy Foundation; the Institute of International Education; the International Council for Local Environmental Initiatives; the International Institute for Energy Conservation; Lawrence Berkeley National Laboratory; National Renewable Energy Laboratory; National Rural Electric Cooperative Association; Nexant, Inc.; Preferred Energy Investments Inc.; the Renewable Energy Project Support Offices in Brazil, India, and Nepal; Sandia National Laboratories; the United States Energy Association; Villa Escudero; and Winrock International, as well as April Allederdice, Lisa Buttner and Roger Taylor.

CONTENTS

Foreword

Acknowledgements

Acronyms

Introduction 1

India: Tribal Women Take the Lead 2

Guatemala: Photovoltaic Credit Programs Lighting Up Lives 4

Brazil: Wired through Power: Bringing Computers to a Rural School 6

Mexico: Irrigation for Rural Farms 8

Brazil: Community Health for Rural Poor 10

Mexico: Solar-Powered Radios for Communications 12

Brazil: Working Together to Make a Difference 14

India: Mainstreaming Electric Vehicles 16

Mexico: Clean Solutions for Francisco Madero Refinery 18

Mexico: Emissions Reductions at the Manzanillo Power Station 19

Global: The Renewable Energy Project Support Office Network 20

Global: Phasing Lead Out of Gasoline 22

India: Sustainable Water Services for Cities 24

Global: Setting Standards and Labels for Household Appliances 26

Bangladesh: Rural Electrification 28

Brazil: Sawmill Waste Provides Clean Power 30

Brazil: Sisal Production Gets Solar Assist 32

El Salvador, Guatemala, Honduras, Nicaragua, Panama: Supporting Renewable Energy Entrepreneurs 34

Philippines: Hydro Power for Eco-Tourism 36

Philippines: Remote Area Electrification 38

Global: Rural Energy Can Be BEST 40

Nepal: Advocacy for Hi-Tech Commuting 42

Ghana: Accelerating Energy Efficiency 44

Moldova: Energy Conservation 46

Asia, Africa, and Latin America: Developing Utility and Regulatory Partnerships 48

Global: Partnering to Promote Market Transformation 50

Latin America: Safer, Stronger Cement for Reconstruction 52

Caucasus - Armenia, Azerbaijan, and Georgia: Strengthening Regional Energy Linkages 54

Armenia: Preparing for Commercial Operations 55

West Africa - Benin, Ghana, Nigeria, Togo: Promoting Regional Energy Trade 56

Mexico, Philippines: Local Action for Energy Efficiency 58

Bangladesh: Preparing Utilities for Competition 60

Philippines: Building Capacity for Contract Negotiation 61

Ukraine: Energy MBA Program 62

Global: Energy Training Alumni Take the Initiative 64

Notice 66



ACRONYMS

AED	Academy for Educational Development
ANEEL	Brazil National Agency for Electric Energy
APAEB	Associacao do Pequenos Agricultores do Estado da Bahia
BCSE	Business Council for Sustainable Energy
BEST	Biomass Energy Systems Technology
BNPP	Bataan Nuclear Power Plant
BOO-CA	Build-Own-Operate Concession Agreement
BPDB	Bangladesh Power Development Board
BS & T	Bioenergy Systems and Technology
BUN-CA	Biomass Users Network for Central America
CCP	Cities for Climate Protection
CFE	Comision Federal de Electricidad
CHP	Combined Heat and Power
CLASP	Collaborative Labeling and Appliance Standard Program
CORAMA	Central America Committee for the Environment
DCA	Development Credit Authority
DOE	United States Department of Energy
E & Co.	Energy & Co.
EEAF	Environment Enterprise Assistance Fund
EEGSA	Empresa Electrica de Guatemala
EMC	Energy Management Cell
EPP	Energy Partnership Program
EPT	Electric Power Technologies
ESCO	Energy Service Company
FENERCA	Financiamiento de Empresas Energeticas en Centroamerica
FOCER	Fortalecimiento de Capacidad en Energia Renovable para America Central
GOP	Government of Philippines
ICEN	International Cane Energy Network
ICLEI	International Council for Local Environmental Initiatives
IIE	Instituto de Investigaciones Electricas
NGO	Non-Government Organization
NRECA	National Rural Electric Cooperative Association
PBS	Palli Bidyut Samitio
PEI	Preferred Energy Investments, Inc.
PEMEX	Mexico's National Petroleum Co.
PSA	Projecto Saude e Alegria
PV	Photovoltaic
REACH	Reduced Emissions and Advanced Combustion Hardware
REFTA	Renewable Energy Fund for Technical Assistance
RENOVE	National Network of Civil Organizations for Renewable Energy



REPSO	Renewable Energy Project Support Office
SELCO	Solar Electric Light Company
SENELEC	Societe Nationale d'Electricite du Senegal
TNEB	Tamil Nadu Electricity Board
USAID	United States Agency for International Development
USEA	United States Energy Association
USEPA	United States Environmental Protection Agency
VEPRI	Villa Escudero Plantations & Resort Inc.
WAGP	West African Gas Pipeline
WHAP	Winter Heating Assistance Program

INTRODUCTION

Energy for Life

THERE are 2 billion people in the world today without access to reliable energy services. Countries and their people cannot enjoy the benefits of social and economic development without access to and utilization of affordable and reliable electricity. The challenge for those in development lies in providing sustainable energy while mitigating the impact of energy supply and use on the environment and guaranteeing the long-term quality of our habitat.

The Case Study Compendium

The case studies in this compendium represent a cross-section of sustainable energy projects implemented by USAID's Office of Energy, Environment, and Technology. Each case study speaks to one or more of the objectives driving CSD-9: achieving equitable access to clean energy; incentives, subsidies, regulations, or voluntary measures; choices for producing, distributing, and consuming energy; and public-private partnerships for de-carbonizing transportation.

Each case study is a USAID success story that empowers individuals, households, communities, institutions, and ultimately nations. Each case study achieves one or more of these objectives: providing clean solutions for better living conditions, improving efficiency and conserving energy, building partnerships for improved industry performances, building capacity and strengthening institutions, and empowering people and enriching communities. Each case study tells a unique and compelling story of how individuals and communities have improved and enriched their lives through clean, cost-effective, and reliable energy provision and use.

- In the remote, upland areas of the Philippines, a creek that was once the subject of hostilities between the Tugao and Dananao tribes is now their source of electricity and community solidarity. A project management committee that handles the project operation is composed of representatives from the formerly competing tribes. They were appointed through a people's assembly that was established as a result of the project.
- In Brazil, Luís Moisés da Cunha is a 16-year-old student at the Avani de Cunha Lima Agricultural Family School, located in one of the most drought-stricken areas of Brazil. Luís is learning economically useful agriculture and stock-raising techniques via computers powered by a photovoltaic array installed at his school. Luís is eager to explore the world, and says, "I am now learning how to use computers. I have heard about the Internet on TV news, and want to be able to use it, too!"
- In India, the municipal water efficiency programs in Ahmedabad, Pune, Chennai, and Indore have replaced narrow steel pipes with PVC piping, providing the cities with energy cost savings and guaranteeing a steady sustainable water supply for citizens.
- Manoel Matos lives in the village of Sao Francisco, which now has a community health clinic powered by photovoltaics. The village holds fundraisers and local dances to raise money for the operations and maintenance expenses of the health center. Referring to his community's efforts, Manoel says, "I'm proud of what we have done together. Our lives have changed for the better."

India

Tribal Women Take the Lead

Project: Solar Basket Revolving Fund
Location: Pavur
Duration: 1997-Present
Key Issue: Accessibility of Energy
Sector: Power, Microenterprise, Micro-Credit
Application: Photovoltaic
End Use: Electrification
Impacts: Income Generation, Gender Equity, Improved Health

IN India, tribals are primarily composed of impoverished ethnic groups who live in rural villages and subsist on farming, with women being the main breadwinners through cottage industries. Increasing economic stability improves the standard of living for the households and, ultimately, the communities.

Many of the houses of the tribal village of Pavur, in Karnataka, India, were already considered electrified because they were connected to the grid. But the grid connections supplied no power. In Pavur, as in other parts of rural India, severe power outages are experienced in the rural feeders and the voltage dip is very high. Relatively well off families used voltage boosters to capture the power upstream of the tribals, further compounding the problem. The result is that tribals are forced to spend

enormous amounts of money on transistor batteries for radios; car batteries for TVs; and kerosene for lighting, heating, and cooking.

The women of Pavur had a market for the large baskets that they could weave. After gathering wild creepers from the nearby forest all day, however, the women were left with a few daylight hours in which to make the baskets. Their source of night lighting at that time—kerosene-powered lamps—did not provide adequate lighting for basket making. Instead, the women in Pavur engaged in the less profitable industry of rolling raw tobacco cigarettes (*bidis*), an activity that could be accomplished under the low kerosene-powered lights.

Lack of adequate lighting also resulted in older women of the village having very poor eyesight and suffering from severe eye problems. The income from selling *bidis* was not sufficient to allow the women to send their children to school. In general, all of the villagers had respiratory problems due to inhalation of the smoke from the kerosene lamps.

The USAID Role

USAID provided funds to Winrock International to team up with Don Bosco, an in-country NGO. The team set up a micro-credit revolving fund to pay for solar photovoltaic (PV) powered home lighting systems in Pavur. USAID funds provided the seed money grant that began the micro-credit fund.

Activities

Although Don Bosco could not act as a purely commercial entity, with Renewable Energy Project Support Office (REPSO)-India's help, it was able to create a revolving fund, which could be used to finance PV

Tribal women have gained economic independence.



The Tribals of Pavur benefit from PV lighting



Tribal homes in Pavor now have electric power

systems on a commercial edit basis. With the fund in place, Don Bosco, in partnership with Solar Electric Light Company (SELCO), was able to offer to the villagers PV systems that could be installed on a commercially sustainable basis. After understanding the potential benefits of the proposed lighting systems, the tribals authorized the society to supply them with the lighting and to deduct the monthly installments from the basket sale proceedings.

Don Bosco is working with local residents to develop a self-managed cooperative to market its PV-powered product in more distant markets in Mangalore or Bangalore, where the baskets can fetch higher prices. The extra money earned will be distributed to the basket weavers after deducting the expenses incurred for transportation.

Results

- Women's perceptions of project benefit differ from men's, and women's leadership became a key factor in the project's success.
- Women who do not own systems are influencing cost recovery through social pressure, because they believe that unless the existing owners repay their loans, there will be no money in the fund to finance additional systems.
- Average household income increased from US\$19.30 per month to US\$32.15 per month, and fund beneficiaries are able to pay monthly installments of US\$3.22 out of their increased income.
- More women are putting their children in schools with fees they pay directly to the schools. This was never done before, indicating that the women have significant new financial independence.
- The lights (equivalent to a 45 W incandescent bulb) produce enough light for the children of Pavor to study at night without straining their eyes.
- Inhalation of kerosene smoke caused respiratory illnesses. Health conditions in the villages have improved through lower use of fuel burning.
- Local residents have reduced their energy expenses for lamps and kerosene, which allows them to increase savings and free up income to devote to such needs as improved housing. These increases in quality of life are helping build confidence and improve the outlook of villagers.
- One unexpected result of the project is that a large social problem—excessive drinking by the men in the village—has decreased due to productive activity during the evening hours.
- Following the success in Pavor, Don Bosco has succeeded in installing a 2 KW solar PV system in its Bangalore office.

Children can now study under electric lights.

Solar power brightens the lives of tribal women and children.

Photovoltaic Credit Programs Brighten Lives

Project: Guatemala Credit Program
Location: San Buenaventura
Duration: 1993-Present
Key Issue: Renewable Energy, Rural Energy
Sector: Power
Application: Photovoltaic
End Use: Household Lighting
Impacts: Rural Electrification

Markets for renewable energy can be aggregated through the use of new institutional and financial credit mechanisms. To ensure sustainability of a project, many project developers working in impoverished rural areas are convinced that it is imperative that the families benefiting from technical assistance make a financial contribution to that assistance that is more than symbolic.

The USAID Role

USAID provides funding assistance for revolving fund projects by providing seed money to credit institutions that offer family credit plans.

Activities

In 1993, a partnership among the U.S. National Rural Energy Cooperative Association (NRECA), the Fundación Solar, and the credit institution of Empresa Electrica de Guatemala (EEGSA) led to the selection of the village of San Buenaventura for a pilot photovoltaics (PV) credit project. While economic and geographic reasons were relevant, the fact that the villagers were the first to open a communal bank account for a project demonstrated both their credit-worthiness and capacity to work together.

EEGSA required that each family pay for one-third of the cost of its system. Most of the

families could not afford this sum of US\$123, but villagers astounded utility officials by collecting US\$43 for each potential user in one week's time to demonstrate their willingness to pay. EEGSA's credit arm offered a flexible credit plan with an annual interest rate of 24%. Villagers' credit payments and a monthly dues payment of US\$0.86 per system were placed in an account for battery replacement (expected battery life is 3-5 years) and other smaller replacement parts, such as fuses and bulbs.

From the outset, EEGSA realized that it would be easier to manage the payments as a whole than through each individual user. Thus, even though both the village's representative committee and EEGSA maintained separate financial accounts for each user, all of the families deposited their payment into the same account, opened in the name of EEGSA. NRECA helped organize and train a committee of villagers to be responsible for collecting loan payments and monthly fees. The committee gradually assumed responsibility for managing the project.

In 1997, the Fundación introduced the concept of full credit to the communities surrounding San Buenaventura. Most of the communities that joined the EEGSA project had an annual minimum income of US\$700. In most cases, their money comes from agriculture. Many families receive stipends from family members and relatives working in the Guatemalan capital or in the United States.

Results

- All of the families except one had repaid their loan by the end of this project.
- Owning the PV systems not only electrified homes, but gave families a sense of pride and the confidence to demand quality service and request loans for other community needs.
- Outside institutions, such as utilities and



A simple credit plan helped villagers in San Buenaventura finance a solar system to power their homes.

Without training and follow-up, there is a good likelihood that equipment will be used below optimum capacity

lenders, view the PV-adopting communities' ambitions as responsible.

- The project taught developers valuable lessons learned that could be applied to other similar projects in Guatemala to ensure success:
 - Find dynamic leaders to champion the project in local communities
 - Be sure to prepare for the future with an operations and maintenance fund
 - Ensure open bidding in the presence of the community
 - Create flexible payment plans using a simple credit form
 - Provide technical and organizational training that includes women
 - Hire a local representative to answer questions and promote the project

- Consider radios and television options as part of the initial system

RENEWABLE energy systems help improve the quality of life of participating rural communities and foster the development of small business.

Brazil

Bringing Computers to a Rural School

Project: Brazil Energy Program

Location: Brazil

Duration: 1999-Present

Key Issue: Rural Energy

Sector: Agriculture

Application: Photovoltaic

End Use: Communications, Distance Learning

Impacts: Education

Five million Brazilians have access to the global computer network, according to the National Association of Internet Users. But 20 million Brazilians still do not have access to basic services, such as electric power, according to research conducted by the Brazilian Ministry of Mines and Energy. Brazil also has a shortage of teachers in the rural areas. Where there is a teacher shortage, distance education can contribute to human capital advancement in developing countries. The key to distance education is reliable power. Modular, renewable energy technologies are allowing rural children and adults to receive an education in new and effective ways.



In the foreground, the array; in the background, Avani de Cunha Lima Agricultural Family School

The USAID Role

USAID supported Winrock International in the needs assessment study that examined expansion of energy services to the Avani de Cunha Lima Agricultural Family School. Located in the city of Valente, 250 kilometers from Salvador, the state capital of Bahia, the school is situated in one of the most drought-stricken areas of the country.

USAID also supported the submission of a technical study by Associação do Pequenos Agricultores do Estado da Bahia (APAEB), a nonprofit association of small farmers in the State of Bahia, to the Bahia State Ministry of Infrastructure. This assistance triggered further cooperation among NGOs, local governments, and the federal government. USAID is one of the principal partners of Winrock International's Renewable Energy Project Support Office (REPSO) in Brazil.

Activities

The Bahia State Ministry of Infrastructure approved the APAEB request and asked the federal Ministry of Mines and Energy to donate a 2 KW photovoltaic (PV) array through the National Program for the Energy Development of States and Municipalities. Winrock installed the solar array at the Agricultural Family School.

Results

- Installation of the 2 KW PV array tripled the energy available to the school, which allowed for illumination of the classrooms and the installation of a personal computer (PC) for student use.



Solar-powered personal computers facilitate distance learning in Brazil.

A Brazilian school lit by solar power

- The sons of 100 small farmers who are members of APAEB are now able to study in the agricultural school.
- Improvement of the school's electrical distribution system is making it possible for the school to power a radio, television, VCR, and a refrigerator for storing food and vaccines.
- APAEB is working with USAID and Winrock to install five more PCs in the classrooms of the school and to buy a rural cell phone, which will enable the school's computers to connect to the Internet.
- Students of the Agricultural Family School are learning basic computer applications and studying useful agriculture and stock raising techniques.

THE key to distance education is reliable power. Renewable energy technologies are allowing rural children and adults to receive an education in new and effective ways.

Mexico

Irrigation for Rural Farms

Project: Renewable Energy Program

Location: Mexico

Duration: 1994-Present

Key Issue: Renewable Energy, Rural Energy

Sector: Agriculture

Application: Photovoltaic, Wind

End Use: Water Pumping

Impacts: Drinking Water, Irrigation, Cattle Ranching

MORE than 5 million Mexicans in 88,000 villages do not have access to electricity. More than 100,000 rural communities are in need of potable drinking water, and 600,000 ranchers need water for livestock or irrigation. Given Mexico's abundant solar and wind resources, the rural energy needs of the country represents a huge opportunity for the utilization of renewable energy technologies for electricity and power for productive uses.

The USAID Role

Since 1994, Sandia National Laboratories has received assistance from USAID to operate the Mexico Renewable Energy Program.

Activities

The goals of the Sandia Mexico Renewable Energy Program are to increase the use of renewable energy technologies in Mexico, thereby expanding the markets for U.S.



The Renewable Energy Program has sponsored nearly 200 PV and wind energy projects in 8 states in Mexico.

THE Mexico Renewable Energy Program, in partnership with Sandia, Mexican state and federal organizations, and international environmental groups, has sponsored nearly 200 PV and wind energy projects in 8 states in Mexico.

industry and combating global climate change, especially greenhouse gas emissions.

Most of the project's activities focus on implementing water-pumping systems with electricity for pumping provided by solar PV systems. The story of Marcos Alvarez's farm is

an example of one such installation. Every year, in the hot, dry spring, Marcos Alvarez and his ranch hands would spend extra hours each day ensuring that the cattle had sufficient water.



Wind power

One recent spring, however, new grass came up. Water flowed automatically

through his troughs. Marcos Alvarez had also been able in the year before to stockpile a supply of silage produced from grass grown on his own ranch to feed his cattle.

The change was due to the PV water pumping system that Alvarez had installed with help from Sandia and Fideicomiso de Riesgo Compartido (FIRCO), a federal agency under the Mexican Secretary of Agriculture that encourages the use of advanced technologies to increase agricultural production. The Marcos Alvarez story is illustrative of the benefits that solar power can provide to its rural users with the proper intervention of outside forces catalyzed by the power of the market place.



A PV powered water pump installation

Results

- Over the past four years, Sandia's Mexico Renewable Energy Program, in partnership with Mexican state and federal organizations and international environmental groups, has sponsored nearly 200 PV and wind energy projects in eight states in Mexico.
- More than 40 renewable energy companies from the United States and Mexico have participated in the program.
- The PV and wind systems are providing energy to more than 9,000 people and are indirectly benefiting almost 50,000 more through the creation of business and jobs in all sectors of the economy.
- A potential market of US\$1 billion has been identified for renewable energy applications in Mexico.
- More than 1,500 engineers, suppliers, and decision makers have been trained in renewable energy technologies.

Brazil

Community Health for Rural Poor

Project: Projecto Saude e Alegria

Location: Para

Duration: 1999

Key Issue: Accessibility of Energy

Sector: Power Generation

Application: Photovoltaic

End Use: Lighting, Refrigeration, Communications

Impacts: Electrification, Education, Health

ENERGY has an important role to play in promoting health and reversing negative health patterns. Projecto de Saude e Alegria (PSA) is a Brazilian NGO working to improve health conditions of the poor communities located at the margins of the Tapajós and Arapiuns rivers, in the state of Pará, near the Amazon forest border. While a few of those small villages have generated electricity in the past using old and no longer operable diesel systems, the



PV systems provide lighting, refrigeration, and communications at community health centers

majority of villagers have never experienced the benefits of electricity.

The USAID Role

Using USAID funds, Winrock International prepared the technical details of the photovoltaic (PV) systems for submission to the Brazilian Ministry of Mines and Energy and provided the project technical assistance.

Activities

Residents from 13 communities participated in workshops that presented the new technology and trained participants on operating the equipment. With logistical support from PSA and technical assistance from Winrock, residents installed 17 systems in seven villages. Villagers formed community associations and progressively began to purchase televisions and sound equipment for communal use.

Long-term sustainability of these energy systems is not the project's only success. "USAID and its partners have provided more than energy to those people," says Jair Resende, PSA's director. "They've given people an amazing opportunity to interact and build a strong sense of community. This is the real meaning of sustainable aid."

Results

- The PV systems have electrified seven community centers, three health centers (lighting, refrigeration, and communications), and seven schools (lighting and educational television) that reach more than 550 students to date.



Rural communities in Pará received power for the first time.

In the foreground, the array; in the background, the Urucureá Community Health Center

- Twenty-five local people were trained in operation and maintenance of PV solar equipment.
- Radios were installed in the health centers in July and represent another milestone in the development of these localities. The radios are connecting the villages for the first time to the national telecommunications network, facilitate the work of paramedics and other health professionals, and allow villagers to make calls to any place in the world.
- Financial initiatives designed to maintain the systems have been so successful that community associations have raised enough money to maintain systems that have yet to be installed at six other communities.
- Villagers have proven to be very adept at raising funds to sustain the systems. One community raises money by arranging public showings of television sporting events and charging 10 cents for each person.
- Another community has established a community vegetable garden where resi-

SOLAR radios linked to the national network connect remote villages with paramedics and health-care professionals.

dents work one hour a day and all the proceeds from vegetable sales are contributed to the revolving PV fund.

- Still another is raising fund by sponsoring bingo games and dances for an admission fee.

Mexico

Solar-Powered Radios for Communications

Project: Sandia Protected Areas Management

Location: Chiapas

Duration: 1994-Present

Key Issue: Renewable Energy

Sector: Agriculture

Application: Solar Radios

End Use: Communications Network

Impacts: Productivity, Income Generation, Disaster Response

Rapid and reliable communications is helping farmers successfully develop microenterprises.

IN the highlands of Chiapas, remote coffee growers are beginning to adopt organic cultivation methods. But for small, individual, remote subsistence farmers, turning attractive profits from the organic coffee market is not a simple business. Therefore, individual growers are seeking technical assistance in growing crops that will produce coffee of a quality worthy of certification.

Given the high volatility of the international coffee market, cooperatives would fail if they had to spend valuable resources—time and cooperative staff labor—traveling between producers to relay basic information about meetings and cultivation techniques. Thus, rapid and reliable communications plays a critical role in determining the success or failure of a developing micro-enterprise. Coffee growers' associations must be able to access fluctuating market prices and mobilize the coffee accordingly from the dozens of highland producers.



A PV panel

The USAID Role

Under the sponsorship of USAID and the U.S. Department of Energy (DOE), Sandia National Laboratories partnered with the World Wildlife Fund (WWF) to support the design, training, and technical assistance for a solar-powered radio communications system that would meet the needs of CESMACH, a coffee grower cooperative in Chiapas.

Activities

The project partners— WWF, Sandia, and CESMACH— determined that PV supplies were the most feasible energy source for the necessary radio network. This network includes a mountain-top repeater, three community base stations, three mobile units, and a fourth base station at the CESMACH urban headquarters.

The technical team involved CESMACH leaders, board members, and field promoters from the beginning of the design process, through negotiations with the system vender, to the installations themselves. Sandia provided training to radio operators in performing routine system inspections and worked with the board of directors to develop a long-term operations and maintenance plan to ensure that the system inspections were completed and that the cooperative would save enough money to pay for future parts replacements.

Results

- The ability to mobilize producers to bring their harvest from the mountaintops when the prices in New York were right has resulted in an 18% increase in the purchase price of the producer's coffee.



The solar radio system benefits 6,099 people; nine CESMACH personnel, and 1,250 family members of the coffee producers.

The network includes a mountaintop repeater, 3 community base stations, 4 mobile units, and the base station at the CESMACH urban headquarters

- The radios reduce to minutes the many hours formerly lost to travel by key personnel to coordinate workshops or deliver information to cooperative members.
- Rapid and open communications promoted by the PV solar radios have had a positive effect on the members' sense of equity in accessing information, have brought together geographically distant producer groups, and have improved community relations.
- CESMACH charges community members a minimum fee to use the phone. The fee is deposited into the cooperative system maintenance fund, improving community relations and increasing their contribution to the long-term maintenance of the radio network.

RENEWABLE energy powered radio systems help improve wildfire response, open communication lines, and forge community ties.

- In spring 1998, Chiapas experienced some of its worst wildfires. An unanticipated benefit of the radio network has been its utility in wildfire control and emergency response. The radio network was used frequently throughout the season, warning nearby populations to evacuate and allowing observers to call for firefighting assistance.

Brazil

Working Together to Make a Difference

Project: Renewable Energy Initiative
Location: Brazil
Duration: 2000-Present
Key Issue: Renewable Energy
Sector: Power
Application: Photovoltaic, Wind, Hydro, Solar, Biomass
End Use: Rural Electrification
Impacts: Economic Growth

FOR the first time, at least in the political and institutional sphere, renewable energy is being considered as an alternative to diversify the national energy mix in Brazil. It is also recognized as a cheaper way to supply energy to rural remote localities away from the grid.

RENOVE
brought together 18 NGOs dedicated to rural energy development in Brazil.



Biomass can be used as a source of renewable energy

A series of regulatory mechanisms has been proposed to improve the competitiveness of non-conventional renewable energy technologies. These mechanisms include the extension of the same subsidies to renewable energy (solar, wind, biomass, and small hydropower) that are already given to conventional sources of energy. Some of these subsidies are already in place.

The USAID Role

The National Network of Civil Organizations for Renewable Energy (RENOVE) in Brazil is a joint initiative of Winrock International and USAID.

Activities

The objective behind the formation of RENOVE was to promote the role of renewable energy in the improvement of the quality of life for rural populations. RENOVE, a network of 18 NGOs, aggregates the individual strengths and previous experience of NGO members working in renewable energy and disseminates them to the other NGO network members new to renewable energy. RENOVE brings together Brazilian NGOs already engaged in rural development and more specifically in essential activities, such as energy, health, education, natural resources preservation, capacity building, leadership, and human potential development.

RENOVE contributes to the objective above in a variety of ways:

- It provides training and capacity building and uses its influence as a consortium to encourage the formulation of public policies for renewable energy usage.
- It provides technical assistance and disseminates the findings, lessons learned, and results within its membership.

- It identifies credit lines for renewable energy and supports fundraising for sustainable social and economical projects for the productive uses of renewable energy.

Results

- In July 2000, 18 NGOs came together at Praia do Forte Eco Resort in the state of Bahia to establish RENOVE.
- The 18 NGOs comprising RENOVE have been carrying out sound programs in rural zones, in protected areas of the Amazon region in northern Brazil, in the Atlantic Tropical Forest in the East Coast, and in the center of the country.
- The partnerships and collaborative environment created by RENOVE have already facilitated the conception of a project to implement five renewable energy community systems in the Mamirauá Sustainable Development Protection Zone, located in the middle of the rain forest in the Amazon State. The project was approved and will be funded through the National Scientific and Technologic Development Council as part of the Humid Tropic Program. This project is in the initial stages and its major objective is to provide water pumping and purification driven by solar energy. The project's merit is not the technology itself but rather the participation of the communities in all project phases.
- Another relevant achievement of RENOVE is its participation in an important national forum that discusses renewable energy development and climate change in Brazil. The Climate Change Brazilian Forum, linked to the Presidency and supported by the Ministry of Science and Technology, aims at mobilizing the society and increasing awareness regarding climate change issues, as well as advocating and developing the Clean Development Mechanism.



RENOVE aims to improve the lives of rural populations by bringing electricity into their homes

RENOVE brings together 18 Brazilian NGOs already active in developing rural energy, health, education, natural resources preservation, capacity building, leadership, and human potential development.

- The Executive Committee of RENOVE is preparing a proposal for funding and implementing two thematic projects within the NGO network: a revolving fund to implement solar home systems and a village-scale biomass power pilot project.
- RENOVE has prepared a portfolio of projects for submission to such institutions as the Shell Foundation and the W. Alton Jones Foundation.

India

Mainstreaming Electric Vehicles

Project: India Zero Emissions Transport

Location: India

Duration: 1998-2001

Key Issue: Clean Air

Sector: Transportation

Application: Electric Two- and Three-Wheelers, Pollution Reduction

End Use: Public and Private Transport

Impacts: Health, Environment

Air pollution adversely affects human health and the environment. Electric vehicles can reduce transport-related emissions in heavily congested urban areas.

THE transport sector is a major contributor to urban air pollution in India. Emissions from the transport sector produce up to 70% of air pollution in Indian cities. Approximately 25 million two- and three-wheeled inefficient, two-stroke engine-powered vehicles clog the roads, emitting reactive organic compounds and consuming approximately 60% of the petrol in India.

Two-wheeled scooters and three-wheeled auto-rickshaws are the chief contributors to air problems in three Indian cities—Mumbai, New Delhi, and Calcutta – which rank among the 10 most polluted cities in the world. In New Delhi alone, health costs associated with ambient air pollution are estimated to be approximately US\$250 million per year.

The USAID Role

USAID brokered a public-private partnership and is co-sponsoring a zero emissions transport demonstration project to accelerate an environmentally benign, commercially proven transport alternative.

Activities

USAID, in collaboration with private partners in India and the United States, initiated several activities to explore interest in

the reduction of urban air pollution brought on by the transport sector.

USAID's work on the India Zero Emissions Technology (IZET) project began by identifying the main sources of urban air pollution. Information on the technologies best suited for mitigating air pollution was then obtained, assessed, and updated. Although electric vehicle technology was a high-risk venture, it emerged as a serious contender to mitigate urban air pollution.

Given the constraints on USAID funding and the long lead time needed for the development of a commercially viable electric vehicle technology specifically suited to Indian conditions, private sector collaborators were carefully selected to ensure long-term technical and financial commitment.

Discussions took place between USAID and prospective partners over a span of four years. During this time, a collaborative program evolved among USAID; Bajaj Auto Limited, India (BAL); New Generation Motors (NGM); Welcomgroup; and Tricon Restaurants International.

Bajaj, India's leading manufacturer of conventional two- and three-wheelers, with a large network of dealerships, was actively involved in screening electric drive systems for



ECOrick electric three-wheeler prototype



Pizza Hut in New Delhi will use electric two-wheelers to deliver pizza.

Two-and three-wheelers are a major source of traffic congestion and hydrocarbon emissions in Indian cities

the Indian marketplace. Bajaj committed to providing substantial resources for design, testing, certification, operation, maintenance, oversight of data acquisition, and product evaluation. New General Motors, an innovative electric drive system manufacturer and integrator in the United States, was the technology provider selected by Bajaj. The other two private sector partners are the Welcomgroup's Mughal Sheraton Hotel in Agra and Tricon Restaurants International (Pizza Hut) in New Delhi.

Currently, the Mughal Sheraton Hotel in Agra is using four electric three-wheelers to shuttle tourists back and forth from the Taj Mahal and other points of interest as part of the 6-12 month demonstration. In addition to the vehicles at the Mughal Sheraton Hotel in Agra, an electric three-wheeler was donated to the Archeological Survey of India (ASI), the organization responsible for preservation of the Taj Mahal. Three-wheelers are used to transport elderly and handicapped people within the monument compound.

Similarly, Pizza Hut in New Delhi will use electric two-wheelers as part of its normal operations. Some two-wheelers will also be field-tested on the streets of Pune. Data acquired during these demonstration programs will be analyzed and the lessons learned will be applied toward the next generation of vehicles.

Results

- The project has raised private and public sector awareness of environmentally benign urban transport options and spurred several commercial initiatives.
- Policies and regulations are being shaped in recognition of the need to reduce the growing severity of urban air pollution.
- Indo-U.S. private sector is moving toward the commercial production of electric two- and three-wheelers.

Three-wheelers are being used to transport guests to and from the Sheraton and the Taj Mahal.

Mexico

Clean Solutions for Francisco Madero Refinery

Program: Introduction of Cleaner Combustion

Location: Tampico, Mexico

Duration: 1999-2001

Key Issue: Air Emissions

Sector: Petroleum

Technology: Improved Combustion

End Use: Refinery Boilers

Impacts: Health, Environment



Pollution plumes over the Francisco Madero Refinery

THE Francisco Madero Refinery, located near Tampico, Mexico, on the Gulf Coast, has seven boilers totaling 1,400 tons per hour of steam flow, or about 385 MW, that are primarily fired on heavy oil. The Madero Refinery emits about 1.8 million tons of carbon dioxide, and 4,000 tons of particulate matter per year.

PEMEX, Mexico's National Petroleum Co., is undergoing a significant modernization program to improve operations and reduce emissions at its plants. Improving plant combustion will greatly reduce emissions and the amount of heavy oil consumed at the refinery.

The USAID Role

USAID is collaborating with PEMEX and the Instituto de Investigaciones Electricas (IIE), and Electric Power Technologies (EPT) in the U.S., to demonstrate the use of cleaner combustion technologies to mitigate greenhouse gas emissions and to reduce urban pollution.

Activities

Following a screening study to determine the least-cost solution to improve combustion, PEMEX chose the Reduced Emission and Advanced Combustion Hardware (REACH) – a more efficient, cleaner, -burning fuel combustion system.

REACH was developed by Electric Power Technology (EPT), a firm in a California. Installation of REACH technology will upgrade the heavy oil burners at the Madero Refinery.

Following a site inspection of the Madero Refinery, REACH equipment was designed and manufactured. Installation took place in early December 2000, coinciding with a planned outage.

Results

- The clean solution identified for the Madero Refinery reduces emissions of nitrogen oxide by 350, unburned carbon by 558, and carbon dioxide by 100 tons per year, by retrofitting a single boiler.
- Retrofitting the remaining 39 boilers at the Madero Refinery could potentially reduce emissions by 140,600 tons per year.

RENOVE brings together 18 Brazilian NGOs already active in developing rural energy, health, education, natural resources preservation, capacity building, leadership, and human potential development.

Mexico

Emissions Reductions at the Manzanillo Plant

THE Manzanillo Power provides base load capacity for the industries of Guadalajara. It is a 1,900 MW heavy oil-fired plant located on Mexico's West Coast in the State of Colimas. A lack of environmental controls and use of low-grade fuel oil causes the power station to emit highly visible plumes over one of Mexico's prime tourist locations.

USAID began a dialogue with Mexico's electric utility, Comisión Federal de Electricidad (CFE), and two U.S. organizations—the Salt River Project (an Arizona electric utility) and the EPT—to explore combustion improvements at CFE's Manzanillo Plant.

The USAID Role

USAID co-funded a demonstration of an innovative, commercially proven burner technology to improve combustion and operational characteristics at a CFE power station.

Activities

USAID and CFE began discussions about each organization's expectations. From these discussions a consensus emerged: technology that could improve the efficiency of CFE's operations. It was jointly agreed that an innovative burner technology demonstration should be performed.

The next step involved screening technologies to determine which would be best suited and which would have wide application to CFE's power stations. Given the constraints on USAID funding, private sector collaborators were selected to help ensure long-term technical and financial commitment.

The eventual partners included CFE and the Instituto de Investigaciones Electricas

Program: Mexico Power Station Combustion Improvement

Location: Manzanillo, Mexico

Duration: 1996-1998

Key Issue: Air Emissions

Sector: Power

Technology: Improved Combustion

End Use: Power Boilers

Impacts: Health, Environment

(IIE), CFE's research and development arm, the Salt River Project, a public utility in Arizona; and EPT. A representative power station, Manzanillo, located on the west coast of Mexico near Guadalajara, was selected for the demonstration site. Equipment was designed, manufactured, installed, and tested. The results were significant.

Mexico's power stations could realize cost savings in oil of US\$10 million.

Results

- The demonstration at the Manzanillo power station reduced carbon dioxide emissions by 9,400 tons annually.
- The solutions identified for Manzanillo could be replicated on all of CFE's power stations, resulting in annual cost savings in oil of US\$1.9 million and reductions in annual carbon dioxide emissions by 59,500 tons.
- Replicating Manzanillo's clean solution in most of Mexico's power stations could result in cost savings in oil of US\$10 million and could reduce carbon dioxide emissions by 315,000 tons annually.

EPT and CFE are engaged in commercial discussions.

Renewable Energy Project Supports Office Network

Project: Renewable Energy Initiative
Location: Brazil, Central America, India, Indonesia
Duration: 1997-2002
Key Issue: Accessibility of Energy
Sector: Agriculture, Industry, Power
Application: Renewable Energy
End Use: Heating, Lighting, Irrigation, Distance Learning, Communications
Impacts: Rural Electrification, Income Generation, Economic Growth

WITHOUT access to affordable and reliable electricity, countries and their people cannot advance socially or economically. The poorest people challenged to survive, often have little choice but to over-exploit the natural resource base. To improve the quality of life and reduce environmental stress, additional energy services must be made available in rural areas. Renewable energy technologies offer clean, cost-effective, reliable options and flexible delivery mechanisms appropriate for almost any use. But eliminating the barriers to smarter energy use



Distance learning in an electrified rural school

requires not just input from individual countries and their institutions and organizations, but the collective commitments of NGOs, governments, financial institutions, and the private sector worldwide.

The USAID Role

USAID has been the primary funder of Winrock International's Renewable Energy Project Support Office (REPSO) Network.

Activities

The REPSO Network was established to work with governments, the private sector, NGOs, utilities, manufacturers, distributors, developers, the international finance community, and other relevant players to accelerate the use of renewable energy technologies and to develop and strengthen in-country capacity in all aspects of renewable energy technology commercialization.

The REPSO Network provides energy development services, including feasibility studies, financing strategies, policy guidance, project development, implementation assistance, and training. The goal is to ensure that energy projects are well designed, use appropriate technology, and are sustainable.

REPSO offices can be found in Brazil, Guatemala (Central America region), India, Indonesia, Nepal, the Philippines, and South Africa. These offices are housed in and managed by in-country NGOs; are set up as independent, in-country entities; or operate as extensions of Winrock International in-country offices. They are brought together through the REPSO Network, which serves as a link between in-country public and private sector organizations in renewable energy and as a



A wind-powered irrigation system in Indonesia



A training session for local farmers in Brazil

vehicle for an international sharing of information and experiences in technology commercialization.

Results

In the past year the Network has:

- Installed a new 100 MW of capacity on-grid.
- Installed 5,000 systems have been installed off-grid.
- Precipitated the adoption and implementation of 15 policies or regulations favorable to renewable energy.
- Enabled the formulation of 50 businesses and joint ventures.
- Leveraged US\$200 million in new financing by the private and public sector.
- Established and strengthened 150 institutions for promoting renewable energy.

THE REPSO Network leveraged US\$200 million in funding for renewable energy projects from multilateral development banks and the private sector in the past few years.

Global Phasing Lead Out of Gasoline

Project: Implementers Guide to Phasing Out Lead in Gasoline

Location: Global

Duration: 1997-Present

Key Issue: Air Quality

Sector: Transportation

Application: Lead

End Use: Refining Gasoline

Impacts: Institutional Strengthening, Health, Environment

A guidebook has been developed for policy makers and government officials charged with lead phaseouts.

LEAD exposure that were previously considered safe. While lead exposure to humans comes from a variety of man-made sources (e.g., paint, pipes, etc.), the most important source is lead in aerosol form created by the combustion of anti-knock additives in gasoline.

Progress in refining technology in the course of the last several decades has made it possible to eliminate lead as a gasoline additive and still maintain a sufficiently high octane rating for gasoline used to fuel motor vehicles. The U.S. has successfully eliminated lead from its own gasoline and



Lead in gasoline poses health risks, particularly to the mental development of children

the U.S. government supports phasing out the use of lead in gasoline worldwide.

Among the most important obstacles to phasing out lead in gasoline in many countries is the uncertainty felt by many policy makers regarding the technical alternatives to lead, the cost and benefits of reducing and eliminating lead use, and the potential impacts on the refining sector and vehicle fleets. In many cases, the political decision to eliminate lead has already been taken, but progress is impeded because officials are uncertain about how to conduct the phase-out.

The USAID Role

The development, publication, and dissemination of the *Implementer's Guide to Phasing Out Lead in Gasoline* is a collaborative effort between USAID, the U.S. Environmental Protection Agency (USEPA), the United States-Asia Environmental Partnership, and the U.S. Department of State. The guide is intended as a tool to assist national and local decision makers in addressing a broad range of implementation issues—managing the transition to unleaded gasoline, determining the effect of oxygenates, assessing the impact of phase-out on vehicle fleets, and developing a list of priority actions.

Activities

The USAID-sponsored USEPA handbook contents has been designed to address these questions and issues related to lead phase-out and to provide answers to policy makers and government official in various countries tasked with the development of a lead phase-out strategy in their country. *The Implementer's Guide to Phasing Out Lead in Gasoline* provides guidance and information on a number of important

areas to assist these policy makers. The handbook's most important chapters include:

- early involvement of key stakeholders in the process of developing a lead phase-out strategy
- identification of technical options for reducing or eliminating lead additives in a specific country
- assessment of lead phase-out impact on the vehicle fleet of a country
- assessment of the public health benefits of lead phase-out in a country
- execution of a cost-benefit analysis
- development of public education and awareness programs
- identifying the appropriate policy instruments for a country
- development of a monitoring compliance process
- establishment of a follow-up evaluation and reporting during the lead phase-out period.

Modules can be adapted to a particular country context. The application of the handbook guidelines in formulating lead phase-out strategies for developing countries is being executed via workshops tailored to the needs and realities of specific countries and regions.

Results

- The *Implementer's Guide to Phasing Out Lead in Gasoline* has been published and is being disseminated to countries and regions around the world.



Developing countries are working on eliminating lead in gasoline used to fuel motor vehicles

- A series of workshops and related activities have been carried out in Indonesia, which is the first major developing country proceeding with the implementation of a lead phase-out program in accordance with the handbook guidelines.
- Workshops were held in the Philippines, Vietnam, and Senegal, and follow-on activities are being planned for countries in Southern and West Africa, which are in the process of formulating strategies for lead phase-out programs in accordance with the handbook guidelines.

India

Sustainable Water Services for Cities

Project: Sustainable Cities Initiative
Location: Ahmedabad, Chennai, Indore, Pune
Duration: 1996-Present
Key Issue: Energy and Water Efficiency
Sector: Utilities
Application: Water Supply and Distribution
End Use: Energy Management
Impacts: Energy and Cost Savings, Reduced System Demand

Energy efficiency is an excellent basis for developing a comprehensive strategy to deal with the intricacies of both electricity and water supply and distribution systems.

MUNICIPALITIES across the world are struggling to provide two critical services: energy and water delivery. In fact, the two areas are tightly linked: Municipal water utilities are usually one of the top energy consumers.

Problems such as inadequate or antiquated infrastructure and limited or irregular supply impede efficient delivery of both electricity and water. In addition, many municipalities lack the capacity and know-how to begin to address many of their problems.

Energy efficiency is an excellent basis for developing a comprehensive strategy to deal with the intricacies of both electricity and water supply and distribution systems. Improving energy efficiency across the board can provide enormous savings in capital expenditures, reduced losses, and improved revenue collection.

Water efficiency can provide cost savings, wastewater reductions, and reduced system demands for water resources, all vital to managing the costs and resources of a water system.

The USAID Role

USAID and the Alliance to Save Energy have launched a program to provide assistance to municipalities in making the water supply and delivery system more energy efficient.

Activities

Many Indian cities, including Ahmedabad, Pune, Indore, and Chennai, face a scarcity of water and have significant power supply problems. In Indore, Pune, and Ahmedabad, there is an extremely high level of energy input per unit of water delivered, with an average of more than 75% of the municipal electricity bill used for water supply and wastewater treatment.

Combining energy and water efficiency strategies, the program has achieved considerable results in Ahmedabad, Pune, Chennai, and Indore.

Results

Ahmedabad

- Ahmedabad has reduced peak electricity demand by 11%.
- Replacing pipes increased flow rates by 40%.
- The project has saved the city more than US\$300,000 in energy costs and has reduced carbon dioxide emissions by 4,650 tons annually.
- The Municipal Corporation began an energy management cell (EMC) to help address energy efficiency issues on a more consistent basis.

Pune

- 4.23 MW hours in low- or no-cost saving were identified.
- As a result of the program's initial success in Ahmedabad, the Pune Municipal Corporation agreed to team up with USAID and the Alliance to Save Energy to create an EMC to find and implement more energy savings opportunities. The EMC created an advanced energy use data tracking system that has brought to light an additional US\$139,275 in savings.

Indore

- Indore Municipal Corporation also created an EMC to coordinate its efficiency activities.
- The EMC set up an extensive data collection and management system that, within a month of operation, identified savings of US\$66,424 by monitoring and tracking energy usage more efficiently.

Chennai

- The Tamil Nadu Electricity Board (TNEB), a utility, implemented a demand side management pilot project.
- TNEB instituted a major end-user metering purchase and installation campaign to better track energy use and savings.

The program is applying lessons learned from India to cities in Brazil. The Municipality of Fortaleza has developed an EMC and is looking to train its staff in all areas of energy efficiency to create a true systematic approach to improving water efficiency. The City of Campina Grande is conducting a consumer awareness campaign to help minimize water usage.

Energy and water delivery are key to sustainable urban development and they are intricately linked.

Box 1 Ahmedabad Results

Background

- 75% municipal electric bill for pumping water
Declining watertable

Project Actions

- Created an energy management cell
- Reduced demand
- Loss reduction from pumps w/capacitor
- Replaced piping in wells to prevent friction loss
- Installed transformers
- Installed energy efficient lighting

Results

- Energy savings = Rs. 8.79 million (2 years)
- Reduction in carbon dioxide emissions = 4,100 tons annually
Reduced electricity use = 3.7 million kilowatt hours annually
- Energy management cell continues to advocate and implement energy efficiency projects

Municipalities can set up energy management cells to seek and implement water efficiency activities.

Global Household Appliances Standards and Labels

Project: Collaborative Labeling and Appliance Standards Program

Location: Global

Duration: 1998 Present

Key Issue: Energy Efficiency

Sector: Residential, Commercial

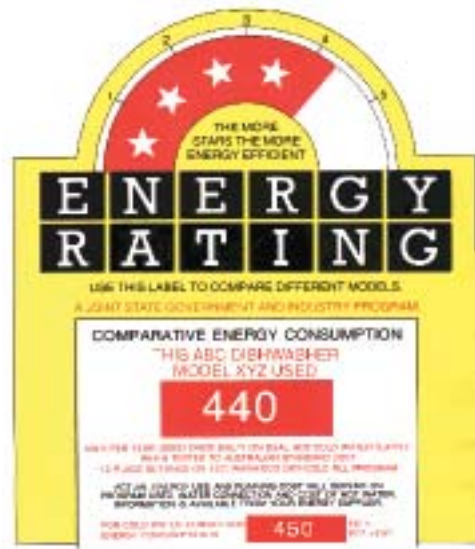
Application: Standards and Labels

End Use: Household Appliances, Heating and Lighting Equipment

Impacts: Energy Savings

THROUGHOUT the developing world, growth in demand for power is straining an already inadequate energy infrastructure and hindering economic growth. Energy efficiency standards and labels for appliances, equipment, and lighting products are an especially cost-effective policy for energy conservation. They fit well

CLASP is working to make standards and labels the backbone of countries' energy policy portfolios.



Energy rating label for dishwashers in Brazil

with most other energy policies and can play a role as the backbone of all countries' energy policy portfolios.

Standards raise the efficiency of a country's energy use by gradually eliminating inefficient appliance models, and stimulating the development of new, more efficient technologies.

The USAID Role

In 1999, the International Institute for Energy Conservation, Lawrence Berkeley National Laboratory, and the Alliance to Save Energy formed the Collaborative Labeling and Appliance Standards Program (CLASP). With support from the USAID, CLASP has begun to implement activities with aimed at establishing regional standards.

Activities

CLASP's mission is to promote efficiency standards and labels in developing and transitional countries. To achieve its mission, CLASP develops regionally applicable tools, conducts capacity-building activities, and provides technical support to partner countries.

Tools developed by CLASP include a Web site, www.clasponline.org, launched in July 2000. The CLASP Web site is designed to be an information clearinghouse for standards projects, test procedures, and standards and labeling requirements for countries throughout the world. It is intended to provide all the information necessary to help anyone planning or developing labels and standards program.

To strengthen stakeholder capacity, CLASP conducts workshops to build consensus in labeling and standards projects and to build support for regional harmonization and

individual country progress.

In Ghana, CLASP is providing guidance to the Ghana Standards Board, to support the development of effective energy efficiency standards and labels. The Ghana Energy Board was appointed by the Ghana Energy Foundation to develop energy efficiency codes and labeling procedures for household appliances.

CLASP conducted a baseline study that established that implementing a European-type minimum energy performance standard in Ghana for household appliances could result in significant consumer savings.

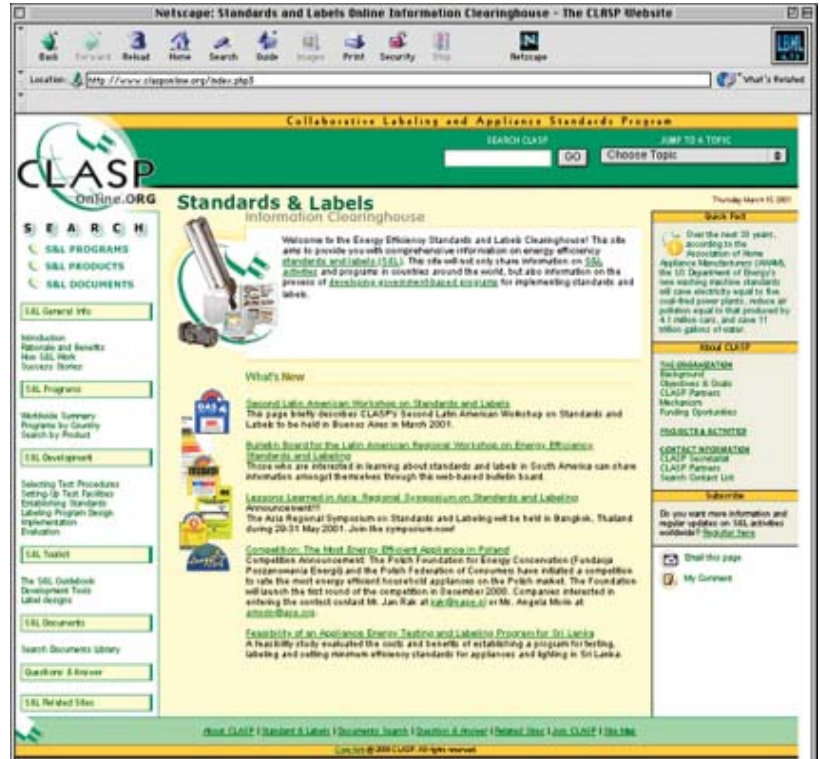
An energy performance standard for refrigerators could result in savings of up to US\$50 million by 2010 for consumers, and could reduce carbon emissions over the same period by 230,000 metric tons.

According to the study, 10% savings in energy consumption for room air conditioners could save residential consumers nearly US\$8 million and reduce carbon emissions by 38,000 metric tons.

Saving 10% of the residential lighting load through policy and regulation would translate into US\$6 million in consumer savings (counting only urban customers), and carbon reductions would amount to 24,000 metric tons.

Results

- Working with CLASP in India, officials have written an initial draft for a new standard for storage water heaters and an accompanying label.
- Ghana is expected to have standards for household appliances in 2001.



The CLASP Web site has had 88,000 hits from unique users

WORKING with CLASP in India, officials have written an initial draft for a new standard for storage water heaters and an accompanying label – a highly cost-effective approach to conserving energy.

Bangladesh

Rural Electrification

Project: Rural Electrification Program

Location: Bangladesh

Duration: 1977-Present

Key Issue: Rural Energy

Sector: Power

Application: Natural Gas, Renewables

End Use: Household Electrification

Impacts: Increased Access to Energy

IN 1977, less than 10% of Bangladesh's land was electrified. The majority of the rural population could not afford electricity. More significantly, Bangladesh lacked a centralized entity that could shoulder responsibility for generating, transmitting, and distributing electricity to Bangladesh's rural populace.

The Bangladesh Rural Electrification program was begun to put Bangladesh on a rapid accelerated path of rural electrification.

The goal of the program was to implement and sustain rural electrification cooperatives and electrification in Bangladesh. The Bangladesh program was closely modeled after the U.S. rural electrification experience. A Rural Electrification Board was created to be the governmental agency responsible for developing all phases of planned rural electrification cooperatives.

The USAID Role

USAID funded a feasibility study conducted by the U.S. National Rural Electrification Cooperatives Association (NRECA) in 1976. The study showed that a renewable energy program based on the U.S. model was feasible for Bangladesh. Based on the results of the USAID-funded study, the Rural Electrification Ordinance of 1977 was executed by the President of Bangladesh in October 1977.

The Rural Electrification Board was formed in 1978 to oversee the development of the Rural Electrification Program. USAID has supported the program since its inception, funding the first 17 electric cooperatives or Palli Bidyut Samities (PBS).

Activities

Out of 70 cooperatives envisioned to cover the entire country, 67 were established and, of these, 57 are still operational.

The electric cooperatives are successfully addressing the issues of poor load density, low revenues, system losses, and poor power supply. Theft of power and a culture of nonpayment in the public urban system in Bangladesh can result in losses of 50% or more. Bill collection losses are equally poor. But the cooperatives outside the city limits worked with

ELECTRIFICATION in Bangladesh is proceeding at the rate of 390,000 new connections annually, averaging more than 1,000 per day.

their new member consumers to upgrade power lines and move electricity meters outdoors. Losses have quickly decreased to below 16%. Collections rates have increased to 96%, which equals the overall average for the rural electrification program.

Over the next five years, NRECA, in partnership with the Rural Electrification Board, the PBS, and USAID, will work to improve specific aspects of the Bangladesh Rural Electrification Program. The team will examine ways to increase loads and improve revenues for increasing the long-term viability of the cooperatives. Both the Rural Electrification Board and cooperative operations will be computerized to increase the efficiency of operation.

A small power generation program will be developed, including installation of private 10 MW power stations (on a Build-Own-Operate basis) that will feed directly into the grid systems of the participating cooperatives. To ensure a reliable and adequate fuel supply, the cooperatives are encouraging construction of a growing number of dispersed 10 MW natural gas-fired generators.

Results

- About 20 million people in rural areas now have access to electricity that powers 62,000 irrigation pumps and 245,500 rural and village commercial, light industrial, and public service facilities.
- Electrification is now proceeding at the rate of 390,000 new connections annually.
- The financing base for the program has expanded to include 15 international donor agencies as well as the government of Bangladesh, with total investments currently exceeding US\$850 million.
- Cooperatives operate with system losses of only 16% and collect nearly 95% of payments.

A BOUT 20 million people in rural areas now have access to electricity that powers 62,000 irrigation pumps and 245,500 rural and village commercial, light industrial, and public service facilities.



U.S. rural electric cooperatives are partnering with Bangladesh (above)

Bangladeshi electrical repair shop uses a solar-powered light and soldering iron to increase productivity (left)

Brazil

Sawmill Waste Provides Cleaner Power

Project: Gethal Amazonas SA Cogeneration Project

Location: Itacoatiara

Duration: 1998-Present

Key Issue: Renewable Energy, Energy Efficiency

Sector: Agro-Industry

Application: Biomass Cogeneration

End Use: Electrification

GETHAL Amazonas SA is a Brazilian firm that owns and operates a plywood and veneer mill near the City of Itacoatiara in the State of Amazonas. The plywood facility employed a 60-year-old 4 MW diesel generator to supply electricity and steam for its operations. Gethal Amazonas SA began looking for ways to improve generating capacity and increase operating efficiency at the mill. The

firm decided to replace the diesel generator with a 5.5MW, highly efficient, state-of-the-art wood waste burning boiler and a high-pressure steam turbine generator.

The USAID Role

USAID contributed the necessary investment to secure a Development Credit Authority (DCA) portable loan guarantee to finance the Gethal Amazonas SA project. The DCA mechanism is a relatively new instrument in USAID to support the financing and realization of energy-related projects.

Activities

This DCA activity was approved in August 2000. The Gethal Amazonas project represents the first application of the DCA mechanism in Brazil. A USAID investment of about US\$193,200 was able to leverage a US\$6 million investment for the project. Because of the renewable nature of power generation in this project, Gethal Amazonas SA also became eligible to receive a Combustible Consumption Credit benefit from the Brazilian federal government. The credit amount was equal to the cost of diesel-fueled electric generation offset by the wood waste burning fuel. The credit amount of US\$2.7 - US\$3 million will provide added liquidity to the mill finances. In addition, Gethal Amazonas SA applied for and obtained Forest Stewardship Council (FSC) certification not only for its Itacoatiara mill operation, but also for its 150,000-hectare forest operation in Manicore. The Gethal Amazonas SA operation is the only one in the Forest

THE implementation of the project will sustain the current 930 jobs at the sawmill.



Wood waste powers a sawmill facility in Brazil



Gethal Amazonas converts the wood waste to power using a 5.5 mW boiler and a high-pressure steam turbine generator



Wood waste provides clean power

USING renewable biomass waste instead of diesel, the plywood mill receives reliable and sustainable clean power and reduces carbon emissions by 100,000 tons during the life of the mill.

Stewardship Council. Certified plywood is exported primarily to the U.S. and Europe, where the demand for such a product is very high.

Results

- This project represents the first application of DCA funding for a project in Brazil, leveraging USAID funds at a 1:31 ratio.
- Using renewable biomass waste instead of diesel, the plywood mill receives reliable and sustainable clean power.
- Use of biomass as an energy source will reduce carbon emissions by 100,000 tons during the life of the mill.
- The implementation of the project will sustain the current 930 jobs at the sawmill.

Brazil

Sisal Production Gets Solar Assist

Project: Renewable Energy Program

Location: Valente

Duration: 1994-Present

Key Issue: Rural Energy

Sector: Agriculture

Application: Photovoltaic

End Use: Electric Fencing, Crop Security

Impacts: Productivity, Income Generation

THE Associação do Pequenos Agricultores do Estado da Bahia (APAEB) is a nonprofit association of small farmers and is based in the city of Valente. It covers 15 municipalities in the driest area of the state of Bahia. APAEB began activities using solar energy in 1993 as a means to diversify local agriculture, based on sisal (used for making rugs and mats). The idea was to aggregate value to local sisal, with two goals: to generate jobs and benefit individuals in the rural zone by creating an attractive market for commercialization of their produc-

Electric fencing provides food and crop security.



Solar panel powering an electric fence

tion of sisal, and to develop a revenue stream to finance the educational and social issues carried out by APAEB.

The USAID Role

USAID funded Winrock International's assistance to APAEB.

Activities

The activity utilized the solar energy technology to electrify fences to keep goats away from the new sisal crops.

Results

- The cost of electrifying 1 km of electric fence can be 10% less expensive than conventional fence materials. Electrifying 40 km of electric fence costs 66% less than conventional fencing, based on economies of scale.
- The U.S. Department of Energy and a Belgian NGO sponsored the electrification of 180 km of fencing. The project was implemented through a partnership among the U.S. National Renewable Energy Laboratory, the Brazil Energy Research Center, and the Electric Company of the State of Bahia.
- Approximately 70% of the sisal crop is used for carpet and rug manufacturing.
- Sisal carpets and rugs comprise 20% of Brazil's national exports.
- Sisal based carpet and rug production has directly generated 420 jobs.
- The success of the solar fencing project has generated further international interest.



Workers install solar panels atop rural homes



APPROXIMATELY 70% of the sisal crop is used for carpet and rug manufacturing. Sisal carpets and rugs form 20% of Brazil's national exports.

El Salvador, Guatemala, Honduras, Nicaragua, and Panama Supporting Renewable Energy Entrepreneurs

Project: Financiamiento de Empresas Energeticas en Centroamerica

Location: El Salvador, Guatemala, Honduras, Nicaragua, Panama

Duration: 2000-2001

Key Issue: Renewable Energy

Sector: Power

Application: Hydro, Photovoltaic, Biomass

End Use: Capacity Building, Small Business Development

Impacts: Microenterprise Business Planning, Financing

enterprises, institutional strengthening activities for NGOs and financial institutions, and regulatory and policy alternatives to local governments.

The USAID Role

USAID is providing funding and support to E&Co for activities focusing on enterprise development, next-state financing, capacity building, and policy/regulatory reform and training for energy entrepreneurs supplying off-grid power.

Activities

E&Co, in association with Biomass Users Network for Central America (BUN-CA) and PA Consulting, is implementing a US\$1.375 million, 18-month, USAID initiative to increase the use of renewable energy in five countries throughout Central America: El Salvador, Guatemala, Honduras, Nicaragua, and Panama.

FENERCA focuses on the identification, development, and implementation of renewable energy projects and enterprises. This work is achieved by providing assistance to local entrepreneurs in business planning design, financial support through seed capital, and identification of additional sources of investment to bring them to the next stage.

As part of this process, training sessions in renewable energy financing and enterprise development for financial institutions and NGOs are being held in each of the five target countries, and efforts are being made to introduce regulatory and policy options to overcome targeted renewable energy implementation barriers.

To date, targeted outreach meetings with approximately 80 different stakeholders throughout Central America have taken place. In an effort to identify renewable energy projects and assess the needs of local entrepreneurs and financiers, 537

THE main objective of Financiamiento de Empresas Energéticas en Centroamérica (FENERCA) is to promote the development of renewable energy enterprises and projects, while increasing the capacity of financial institutions and NGOs to support the region's renewable energy sector. The program provides business training and direct investment to renewable energy projects and

FENERCA promotes renewable energy by assisting local entrepreneurs and

microenterprises in business planning and by

providing support through seed capital.

surveys were prepared and distributed among project entrepreneurs, energy enterprises (both public and private), NGOs, and financial institutions.

As a result, 92 projects at various stages of development were identified, of which 20 were selected for support. Project examples include:

- 600 KW hydroelectric project in Honduras
- PV system leasing program with a target of 100 units per month in El Salvador
- 50 MW hydroelectric project for sale to the spot Market in Guatemala
- 600 KW biomass-to-energy project using peanut shells to supply the electricity demand of a peanut processing plant in Nicaragua
- small hydro project for decentralized energy supply to an unelectrified community in Nicaragua
- 6 MW bagasse co-generation project in Honduras
- biomass-fueled biogas system to provide process steam for a limestone processing plant in El Salvador
- municipal energy enterprise in Guatemala.



Project developers and sponsors work together to evaluate microenterprise business proposals

and business development for renewable energy projects.

- A user-friendly *Business Plan Development Manual for Renewable Energy Entrepreneurs* and a guide on renewable energy project assessment are currently being distributed in Spanish to entrepreneurs and financiers.

Results

- As of March 2001, seven projects and enterprises have been supported with business plan development and enterprise development services. E&Co and other financial institutions are currently analyzing these projects for potential investment.
- In partnership with FOCER (Fortalecimiento de Capacidad en Energía Renovable para América Central), an initiative sponsored by the United Nations Development Programme and the Global Environmental Facility, FENERCA has trained more than 100 financial institutions, NGOs, and entrepreneurs on risk assessment



Project developers receive training in renewable energy financing

The Philippines

Hydro Power for Eco-Tourism

Project: Renewable Energy Initiative

Location: The Philippines

Duration: 1994-1997

Key Issue: Renewable Energy

Sector: Power

Application: Small Hydroelectric Power

End Use: Electrification

Impacts: Tourism

VILLA Escudero Plantations & Resort, Inc. (VEPRI) is a very popular tourist spot in the Philippines as it is close to Metro Manila and showcases Philippine culture. Here, the late Arsenio Escudero built the first hydroelectric



It is a unique lunch experience in the low-water side of the dam; guests can wade ankle-deep in water while having a traditional meal in the ambience of cascading water from the dam's overflow

power station in the Philippines using a river that runs through the property. The dam was built in 1921.

The ecology-friendly features of the power station contribute to the resort's appeal. It is a unique lunch experience in the low-water side of the dam; guests can wade ankle-deep in water while having a traditional meal in the ambience of cascading water from the dam's overflow.

The ecology-friendly features of this power station contribute to the resort's appeal. It is a unique lunch experience in the low-water side of the dam; guests can wade ankle-deep in water while having a traditional meal in the ambience of cascading water from the dam's overflow.

Summer is typically dry and also the height of the tourist season; thus, the hydro is temporarily shut down and not used to maximize energy output. Included in the tour of the former plantation is a tour of the hydropower station, which reinforces the importance of ecology-friendly electrification to huge numbers of people on a yearly basis.



Resort cabanas overlooking the Labasin River upstream from the micro-hydro plant

The USAID Role

With USAID funding, Winrock International and Preferred Energy, Inc. (PEI) provided technical assistance to VEPRI in the preparation of necessary documents for the processing of an Environmental Clearance Certificate and Water Rights Permit for the project. USAID also provided assistance with securing the project loan.

Activities

In addition to the technical assistance noted above, PEI and Winrock International provided assistance in the form of project packaging and financial structuring. The project loan (70%) was made available through Winrock International's USAID-funded Renewable Energy Fund for Technical Assistance (REFTA) project, and was prepared and disbursed by Renewable Energy Project Support Office (REPSO)-Philippines and PEI.

VEPRI's engineering department, headed by Mr. Manolet Escudero, was responsible for construction of the civil works, installation of the hydro equipment, and commissioning of the plant.

Installations included a new 62 KW turbine at the RESORT station (old powerhouse) and a new power station to house a 36 KW turbine downstream at the KIPOT site. Both plants began operations in 1997.

Results

- VEPRI's hydropower capacity increased from 75 KW to 173 KW, adding 98 KW of new capacity.
- VEPRI now generates an additional 556,336 KW per year.
- The project's investment performance based on displacing electricity costs for VEPRI resulted in an internal rate of return on project cost and equity invested of 19% in 1997.
- Based on past experience with hydro, VEPRI expects to derive savings from this project beyond its economic life of 20 years.
- Performance to date has been satisfactory, with actual savings estimated at US\$4,000 per month. VEPRI is extremely happy with the results.
- VEPRI makes a positive environmental contribution by showcasing a successful renewable energy project to tourists who visit the resort.



A view of the micro-hydro plant

A tourist resort showcases eco-friendly hydro-power to hundreds of tourists every year.

Philippines

Remote Area Electrification

Project: Renewable Energy Financing and Technical Assistance Project

Location: Philippines

Duration: 1997-2000

Key Issue: Renewable Energy

Sector: Power, Agriculture

Application: Micro-Hydro Power

End Use: Post-Harvesting, Lighting

Impacts: Rural Electrification, Community Empower

FOR very remote communities, attracting private sector interest is nearly impossible without some unique form of intervention and innovative approach. The Village Power Model employs a flexible and appropriate delivery mechanism for organizing and financing community-based renewable energy projects for remote communities. The Village Power Model was



Villagers passing sand and gravel to the construction site

designed and employed by Preferred Energy Investments, Inc. (PEI), which manages the Renewable Energy Fund for Technical Assistance (REFTA) and manages the Renewable Energy Project Support Office (REPSO) in the Philippines.

Regulatory changes in the Philippines have made it possible to employ such a model. The draft power sector restructuring bill, with its open access provision, is directed toward the opening up of the energy sector to competition both on the generation side and at the distribution level. The new competitive environment will put pressure on renewable energy companies to first concentrate on improving service in their core systems prior to expanding lines to marginal areas.

The USAID Role

With the support of USAID, Winrock International provided PEI a grant to conduct feasibility studies of renewable energy projects in eight selected rural communities. USAID provided the initial funding for the feasibility study under REFTA, and has funded ongoing project activities of REPSO-Philippines. USAID has been a key supporter of this effort.

Activities

The Tulgao-Dananao Micro-Hydro Project is the first of eight projects initiated in various upland areas through the partnership of PEI and Winrock International using the concept of community-based renewable energy development for off-grid areas—the Village Power Model.

Because of the remoteness of the population, it is not possible to connect *barangays* (villages) to the main grid, making

mini-grids the most cost-effective way to provide electric power to the area.

The Tulgao-Dananao Micro-Hydro Project—a 33 KW power plant system—provides power to three villages, Tulgao East, Tulgao West, and Dananao, which are populated by approximately 300 households. This micro-hydro project enables the three villages to use modern electric power for household energy, to operate production and post-harvest facilities, and to light schools and other public facilities. Community ownership of the project and community effort contributed to the project from the beginning and were crucial components that made the project a success.

Risks faced by such projects in the Philippines are in the selection of right partners, flexibility of government policy, and agreement of franchisees to allow off-grid community-based projects to operate in their franchise. Because of the rapid changes in the rural power sector policy, another major condition is the commitment of other local institutions, particularly the Philippine Department of Energy. There is a need to formalize these organizations before they can be acceptable as vehicles of credit. The ability of an NGO to provide technical and management oversight will also be crucial to sustainability of projects.

Results

- A Project Management Committee has been formed to handle project operation. This committee consists of representatives from the three villages appointed through a People's Assembly established as a result of the project.
- The project has established a pilot revolving fund for community-based energy projects.
- Based on the successful results of the Tulgao-Dananao project, PEI was recently awarded a US\$350,000 project by the World Bank's Energy Sector Management



Transformers at the Tulgao-Dananao Micro-Hydro project, which provides power to 300 households

- Assistance Program (ESMAP) to support a Village Power Fund.
- Seven more projects are in various stages of construction. Some of these projects are seeking investment support. ESMAP funding is being sought to help further develop the program as a sustainable model for delivering financing to communities for village power.
- One project has received a formal waiver from a rural electric cooperative and a commitment from the Philippine Department of Energy to allow open pricing to prevail in this off-grid community activity by a renewable energy service company. This is a precedent that can be institutionalized.
- The Tulgao-Dananao Micro-Hydro plant is also an example of how natural resources, such as water, can be used to produce power in an environmentally friendly way and to increase incentives for careful watershed management.

A creek that was once the subject of hostilities between the Tulgao and the Dananao tribes in the upland areas of the Philippines is now their source of electricity and community solidarity.

Global Rural Energy Can Be BEST

Project: Biomass Energy Systems Technology

Location: Global

Duration: 1988-1998

Key Issue: Accessibility of Energy

Sector: Power, Agriculture

Application: Biomass Cogeneration

End Use: Crop Processing, Drying

Impacts: Rural Electrification

IN most tropical developing countries, agriculture is a critical component of the domestic economy and a major source of exports (rice, sugar, coconut products, rubber, palm oil, paper, and other forest products). Many of these industries already use their biomass, or waste plant material, to provide energy for pro-

cessing. Because most agricultural processing facilities are located in rural areas and have already developed infrastructure to support the production of their primary product, they represent an excellent institutional base from which to strengthen rural energy supply. In most countries, the amount of electricity that could be produced from efficient management of waste streams is significant. Innovations in co-generation are enabling large agricultural processing facilities to use their inputs more efficiently and to sell excess power to nearby towns, villages, and utility grids.

These industries by definition are located in rural areas so that the power or thermal energy that is created in excess can be sold either to the local grid or to local users. Increasing energy availability in these areas creates more employment and stimulates economic activity in areas where it is needed most.

Increasing energy availability in rural areas creates more employment and stimulates economic activity where it is needed most.



In most developing countries, agriculture is a vital component of the domestic economy

The USAID Role

The Biomass Energy Systems Technology (BEST) project was designed by USAID to build on an existing Bioenergy Systems and Technology (BS&T) project, implemented by Winrock International.

Activities

The BEST project assisted developing countries in using biomass resources for the production of energy and related byproducts. The way to do this was to reduce the risks—technical, financial, economic, and institutional—associated with biomass energy systems to encourage public and private sector interests to invest in commercially proven energy conversion systems. Activities under the program were extensive: work on policies and regulations; capacity building; the mobilization of funding from financial institutions and the private sector;

and, with governments and the private sector, private sector stimulation, policy dialogue, research, technical assistance, and pre-investment project planning. Most of this work was conducted with the world sugar industry.

In addition to further expanding investment in biomass energy, Winrock also worked throughout the life of the BEST project to increase understanding of the positive environmental benefits that can be attained through improved management of the biomass resource base. Specifically, Winrock disseminated awareness of the potential for reducing greenhouse gas emissions through improved management of natural resources, including expanded production of commercial energy from biomass. The methodology applied was to monitor above- and below-ground carbon in wood plantations, implement natural forest management and agroforestry projects employing commonly accepted forestry inventory methodology, and use soil science and ecological survey principles and practices to monitor carbon impacts.

Results

- In 1998, approximately 230 MW of electrical export capacity based on biomass co-generation were being generated and sold to the utility in countries that have received USAID assistance. The amount of installed electrical capacity generated from biomass sources is even greater, since a significant amount of this capacity is used by the companies for their internal power requirements.
- The private sector investment in equipment required to generate this amount of electricity is estimated to be approximately US\$300 million (using a conservative estimate of US\$500 per installed kilowatt for sugarcane co-generation systems).
- The annual amount of carbon dioxide prevented from entering the atmosphere when 300 MW of electrical power is generated from biomass fuel sources is estimated to be more than 2 million tons.



A field trial where New Holland balers, pulled by a tractor, haul cane residue and drop bales

- The International Cane Energy Network (ICEN) was formed in 1993, demonstrate and promote commercially available technology for generating power via the sugar industry. ICEN brought together representatives from leading sugar cane research institutions to promote the concept of can energy development.
- Policies were changed, or policy actions favorable to renewable energy were implemented, in Costa Rica, Guatemala, India, El Salvador, Brazil, and Honduras.
- Winrock used existing and planned U.S. government projects to document that carbon can be sequestered at low costs and to standardize methods and procedures for measurement.
- The project was responsible for founding the Environmental Enterprises Assistance Fund (EEAF) in 1990, establishing or strengthening 10 institutions in Brazil, Indonesia, the Philippines, Indonesia, Guatemala, and Costa Rica, and beginning the Renewable Energy Project Office (REPSO) Network.
- A system of cost-effective methods and procedures to monitor carbon sequestration impacts of land use projects were developed and made available.

Policies were changed, or policy actions favorable to renewable energy were implemented, in Costa Rica, Guatemala, India, El Salvador, Brazil, and Honduras.

Nepal

Advocacy for Hi-Tech Commuting

Project: Kathmandu Clean Electric Vehicles

Location: Kathmandu

Duration: 1997-Present

Key Issue: Air Quality

Sector: Transportation

Application: Electric Three-Wheelers

End Use: Public Transport

Impacts: Health, Environment

POOOR emission controls and the continued use of old and poorly maintained gas and diesel-powered vehicles have turned Kathmandu into a highly polluted city, affecting the health of residents and tourists.

The USAID Role

USAID in partnership with Winrock International provides funding support to



Electric Tempos for public transportation in Kathmandu

Kathmandu's three-wheeler electric vehicle program.

Activities

Environmental NGOs Martin Chautari and Leaders Nepal, and the business group Explore Nepal, mounted an advocacy campaign to draw public attention to Kathmandu's growing air pollution and demand clean transportation in the capital.

The advocacy group's efforts were successful in influencing the national and city governments to gradually withdraw polluting vehicles from the Kathmandu city center and explore alternative public transport options, such as electric three-wheelers.

Concurrently, the city's two competing commuter fleet operators, Nepal Electric Vehicle Industry and Electric Vehicle Company, began manufacturing battery-operated, three-wheeled Safa Tempos.

Winrock International helped the three-wheeler manufacturers gain access to international manufacturers and equipment suppliers. Using components from the U.S. and chassis from India, the commuter fleet operators built Safa Tempos for their own use as well as for sale, at US\$6,000 per vehicle.

With USAID funding, Winrock and local NGO Martin Chautari helped establish the Samuhik Sewa Driving Institute and the Mechi Mahakali Driving Institute. These institutes train locals in driving electric three-wheelers. Most of the trainees are women, since men have usually learned to drive other vehicles.

The standard lead-acid battery technology of electric vehicles requires their drivers return every 30 miles to their charging stations to exchange their battery packs for freshly charged units.

An impediment to expanding the use of Safa Tempos in Kathmandu has been the lack of public charging facilities for the Safa Tempo's battery packs. The city's two commuter fleets both own charging stations and are exploring possibilities of building more in central locations around the city.

Results

- The government of Nepal reversed a decision to allow the importation of 500 diesel three-wheelers and decided to ban the operation of existing polluting vehicles within the Kathmandu Valley.
- The government of Nepal now provides customs privileges on the importation of electric vehicles and their component parts, making the vehicles cost-competitive.
- Passengers who use Safa Tempos are willing to pay a 15% higher transit rate to avoid the throbbing noise and irritating smoke of the diesel-powered vehicles.
- The driver training is self-sustaining. Samuhik Sewa was subsidized by Martin Chautari for its first two months of operations. It now charges and receives US\$50 for driver training and no longer needs donor support.

Fourteen women have been trained and are seeking vehicles to drive.



Fourteen women have been trained and are seeking vehicles to drive

THE Government of Nepal now provides customs privileges on the importation of electric vehicles and their component parts, making the vehicles cost-competitive.

Ghana

Accelerating Energy Efficiency

Program: Ghana Energy Foundation

Location: Nationwide

Duration: 1998-Present

Key Issue: Energy Efficiency

Sector: Buildings, Homes, Industry

Application: Heating, Lighting, Industrial Controls, Load Management

End Use: Energy Management

Impacts: Energy and Cost Savings

The “Save a Watt” campaign used radio, newspaper, and television commercials to educate consumers on efficient energy use.

CREATED in 1997, the Ghana Energy Foundation is the first NGO devoted to sustainable energy issues in West Africa. Its mission is to promote sustainable development of energy resources and efficient consumption of energy in all of its forms. The Foundation works to educate consumers through publicity campaigns about the benefits of reducing energy waste, and assists residential, commercial, and industrial consumers in improving energy efficiency.

The USAID Role

USAID provides funding to the Alliance to Save Energy to support the



An energy efficient home in Ghana

coordination and planning of efficiency and renewable energy programs and activities in Ghana.

Activities

Since August 1998 when the Energy Foundation became fully operational, the Energy Foundation and the Alliance have focused their efforts on building public awareness and on activities targeted at improving energy management among households, industries, and businesses.

Educating Energy Services Companies. The Foundation trained Energy Services Companies (ESCOs) to improve their skills in marketing, business controls, and energy efficiency financing.

Save a Watt. The campaign used radio, TV, and newspaper commercials to educate consumers on improving energy efficiency use in their homes. Consumers were encouraged to read their electricity meters daily, take steps to reduce consumption, and establish targets for their monthly consumption levels.

Energy Wise. A brochure on the “dos and don’ts” of energy use was distributed free of charge. It includes easy tips and teaches consumers the energy efficient way of using common household appliances, such as refrigerators and air conditioners.

Power Factor Improvement. This involves the installation of capacitors to improve the power factor of industrial enterprises from a low of 0.5-0.7 to an average of 0.9-0.95. So far the 100 industrial and commercial firms have been installed with power capacitors. This resulted in the release of about 15MVA of reactive power into the grid—the target is the release of 30MVA into the grid.

Energy Management in Industry. Ten local industrial and commercial firms are being assisted in adopting computer-based effective energy management techniques. The Foundation

is developing a special energy management program for the Ghana Water Company, which alone accounts for 10% of domestic electricity consumption.

Electrical Load Management. Detailed electrical load management studies have been completed for 30 large industrial firms, and results indicate that industries can reduce their peak electricity demand by more than 75 MW by shifting loads to off-peak periods. The Foundation will assist industries in improving electrical load factor through the installation of load controllers and monitoring devices.

Industrial Energy Assessment Center. Students at the Kwame Nkrumah University of Science and Technology are trained at the Center in Energy Management. In return, the students offer advisory services to industry and have started conducting energy audits in industries in the Kumasi industrial zone.

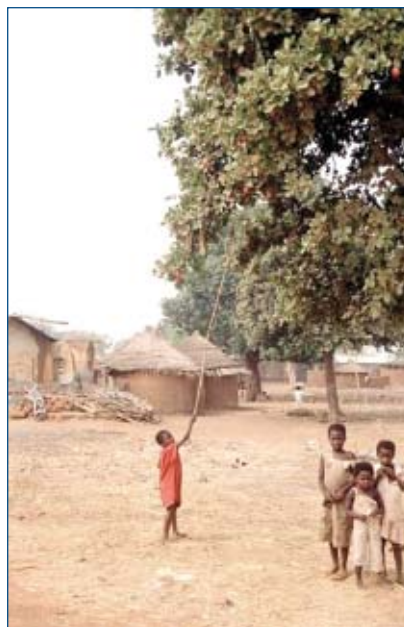
Energy Efficient Buildings. Energy management is being extended to large commercial and office buildings with high lighting and air conditioning and ventilation loads. Three buildings—the Kotoka International Airport and the Accra’s Ministry of Mines and Energy building and Golden Tulip Hotel—are being monitored via occupancy sensors for cuts in electricity consumption. Other buildings with a total load of more than 27 MW have been identified and earmarked for the next phase.

Energy Efficiency Codes and Standards for Household Appliances. A baseline study estimated that implementing a European-type minimum energy performance standard for refrigerators in Ghana could result in savings of up to €107 billion by 2010 (US\$50 million) for consumers, and could reduce carbon emissions over the same period by 230,000 tons. A 10% savings in energy consumption for room air conditioners could save residential consumers nearly €18 billion (US\$8 million) and reduce carbon emissions by 38,000 tons. For lighting, saving 10% of the residential load through policy and regulation would translate into €13.8 billion (US\$6 million) in consumer savings and carbon reductions would amount to 24,000 tons.

Results

- Electricity consumption can be reduced by 25%-75% and electricity bills lowered by 5%-20%, in some cases.
- Implementing minimum energy performance standards for household appliances could result in savings of up to US\$62 million, and could reduce carbon emissions by more than 300,000 tons by the year 2010.

ELECTRICITY consumption will be reduced by 25%-75%, and electricity bills lowered by 5%-20%.



The “Save a Watt” campaign (above)

Children play in a village in rural Ghana (left)

Energy Conservation

Program: Weatherization Program
Location: Baltsi, Chisinau
Duration: 2000–2001
Key Issue: Energy Efficiency
Sector: Homes, Hospitals, Schools.
Application: Winter Weatherization
End Use: Energy Management
Impacts: Energy and Consumer Savings

WINTER presents a very bleak prospect for Moldavian citizens and institutions that cannot afford their heating bills. Three of the five electricity distribution companies (*distcos*) in Moldova are now privatized and threaten to cut off nonpayers, which did not happen in previous years when the state owned the *distcos*. District heating companies in Chisinau and Baltsi are currently being tendered for privatization, as are the Combined Heat and Power (CHP) plants that supply them. Further, GazProm-owned MoldovaGaz has recently begun to enforce a stricter commercial regime. These developments, while required for instilling a commercial discipline that is necessary for reform, dramatically amplify the threat that Moldavians face—freezing in the harsh Moldavian winter after their energy sources are disconnected for nonpayment.

The USAID Role

In 1998-2000, using funds designated for humanitarian assistance, USAID implemented a Winter Heat Assistance Program (WHAP), which distributed free coal to needy institutions and individuals in all regions of the country, providing them with free winter heating fuel. USAID decided not to implement another WHAP for the winter

of 2000/01, opting instead to fund a Weatherization Program for Moldova that helps needy institutions preserve what precious heat energy they can pay for.

Activities

The winter weatherization program aimed in increasing the energy efficiency of nine needy institutions and one residential complex. Activities were geared toward training Energy Service Companies (ESCOs) in weatherization techniques and providing upgrades in selected buildings to reduce the amount of fuel used and to improve comfort. The chosen buildings either housed or served vulnerable populations: schools, hospitals, clinics, and orphanages located in rural areas or municipal centers.

Buildings were improved through low-cost measures that increased their fuel efficiency and the temperatures within the buildings. Measures such as window and door repair and replacement, glass replacement,



Winter weatherization treatment for windows saves energy

caulking, and insulation were applied rapidly to achieve the improvements before the height of the winter season.

Local established construction companies were contracted to do the installation work. All construction materials for weatherization—glass, wood, window and door hardware, and paint—were purchased from local suppliers.

Results were monitored through temperature and energy use measurements and surveys. Caulk and weather-stripping weatherization materials from the U.S. were expedited through Moldavian customs.

In addition, the technical college in Chisinau provided 40 recent graduates of their construction program to integrate with the local construction crews. The technical college has a high-quality program and was anxious to provide work opportunities for its graduates.



Forty public buildings underwent energy efficiency weatherization in Moldova

Results

- Work was completed before the coldest part of the heating season in Moldova, in January 2000.
- Forty sites—including schools, hospitals, medical clinics, and orphanages—underwent energy efficiency weatherization in Moldova.
- Room temperature measurements showed an increase in indoor temperature of 5-10° Celsius resulting from the weatherization.
- Energy and cost savings from the weatherization ranged from 22% to 42% annually.
- Local response to the weatherization work was overwhelmingly positive.
- The weatherization program directly affects the day-to-day lives of almost 10,000 people by providing a more comfortable living and working environment for the most vulnerable populations.

WINTER weatherization at schools, rural health clinics, city hospitals, and orphanages directly affects the day-to-day lives of nearly 10,000 of Moldova's most vulnerable citizens.

Asia, Africa, and Latin America

Developing Utility and Regulatory Partnerships

Program: Energy Partnership Program
Location: Asia, Africa, and Latin America
Development Project
Key Issue: Energy Efficiency, Renewable Energy
Sector: Electric Utilities, Regulatory Bodies
Application: Power
End Use: Energy Pricing, Financial Management, Commercialization, Regulation, Restructuring
Impacts: Transmission and Distribution Improvement

DEVELOPING countries are in need of information regarding structuring, financing, management, and regulation of power generation, transmission, and distribution under free-market economic conditions. Partnering with already-established and successful U.S. utilities and regulatory bodies would facilitate the transfer of best technologies and practices, improve the management and financial performance of the power sector, and increase energy efficiency in USAID-assisted countries in Asia, Africa, and Latin America.

The USAID Role

USAID's Office of Energy, Environment, and Technology is providing funding to the United States Energy Association (USEA) to develop the Energy Partnership Program (EPP). This program establishes practitioner-to-practitioner, multiyear partnerships between U.S. and developing country utilities and regulatory agencies.

Activities

Working with USAID, USEA identifies and matches utilities or regulatory agencies in the U.S. and overseas according to the compatibility of their needs and

capabilities, the similarity of their energy systems, potential common business interest, and other criteria. The benefits to the foreign partners include the opportunity for senior executives of overseas utilities and regulatory agencies to observe how their U.S. counterparts are structured, financed, managed, and regulated under free-market economic conditions. The program also offers U.S. energy executives the opportunity to understand the dynamics of non-U.S. energy markets and to forge strategic international alliances.

Once selected, the participating organizations execute partnership agreements and commit to cooperate for a 2-year period, during which the partners focus their exchange activities on three or four key issues:

- In India, corporate re-structuring increased energy efficiency through reduction of distribution losses, improved plant operations, development of India's National Institute for Power Systems and Distribution Management, and joint venture and pilot projects with U.S. partners.
- In Indonesia, managing a distribution company in a privatized environment, utility decision making from the private company perspective, regulation and trading mechanisms, and privatization of the gas industry.
- In the Philippines, management and corporate rate restructuring, quality of service, and customer service.
- In Senegal, generating capacity through independent power production, improved efficiency, and improved system reliability through enhanced water, fuel, and materials analysis.
- In Brazil, delegation of regulatory powers to Brazil's states, staff development and training, and generation resource portfolio planning.

Results

India

- Andhra Pradesh State Electricity Board, through its partnership with Pennsylvania Power & Light Company, is replacing inefficient irrigation pumps with more reliable ones. The new pumps will reduce technical distribution losses by 14% per unit.
- Calcutta Electric Supply Corporation, Ltd. has adopted a simpler, one-piece connector between the distribution lines and transformers, using Gulf Power's low-voltage bushing and cable connector design. These direct connectors reduce line losses from oxidation, breakage, and inefficiently bolted connection.
- Bombay Suburban Electric Supply, Ltd. has established the National Institute for Power Systems Distribution Management based on a model provided by Plum Street Enterprises (an affiliate of Niagara Mohawk Power Corporation).
- Karnataka Electricity Board, the Karnataka Power Corp. Ltd., and Duquesne are considering possible joint venture power projects.
- Orissa Electricity Regulatory Commission has adopted rate case hearing procedures from the District of Columbia Public Service Commission and the Colorado Public Utilities Commission.

Philippines

- National Power Corporation has implemented a "Responsibility Management Accounting System" based on a model demonstrated by Georgia Power Corporation.
- Manila Electric Company has implemented a "Customer Satisfaction Measurement Program" through the assistance of Central and South West Services.



Staff and collaborators of the USEA-USAID Energy Partnership Program

Indonesia

- PT PLN senior executives completed the Southern Company College's "Electric Utility Game" to learn how to deal with financial, management, and operational issues confronting investor-owned utilities in regulated and unregulated environments.

Senegal

- Societe Nationale d'Electricite du Senegal (SENELEC) is redesigning its plant maintenance outage schedules based on lessons learned from General Public Utilities International. GPU International legal advisors helped SENELEC and the Senegalese government develop new laws to encourage independent power production.

Brazil

- Through a regulatory partnership, the Brazil National Agency for Electric Energy (ANEEL) is developing guidelines for the new state-level regulatory agencies with assistance from the Florida Public Services Commission, the Iowa Utilities Board, and the Oregon Public Utility Commission.

Partnering to Promote Market Transformation

Program: Partnering with Business
Location: Latin America, Eastern Europe, Africa, and Asia
Duration: 1999-Present
Key Issue: Clean Technology
Sector: Business, Industry, Government
Application: Public-Private Partnerships, Technology Transfer, Capacity Building
End Use: Market Transformation
Impacts: Market Policy Development

THERE is a need for developing countries and regions to adopt clean energy practices in order to reduce urban pollution and use energy in a sustainable fashion. Countries include Brazil, India, Indonesia, Mexico, the Philippines, Russia, South Africa, and Ukraine; and such regions as Southern Africa, Latin America, Eastern Europe, and Southeast Asia.

The USAID Role

Partnering with Business is a three-year private sector partnership between the Business Council for Sustainable Energy



Todd Delaey, First Environment, Inc. (left), and David Antonioli, USAID

(BCSE) and USAID aimed at promoting sustainable energy technologies and the reduction of greenhouse gas emissions in developing countries and economies in transition. BCSE works with USAID to encourage industry and government representatives to consider the adoption of clean energy practices in several target markets.

In conjunction with BCSE, USAID sponsors industry roundtables and seminars for developing country audiences on clean energy issues. USAID also supports the publication of industry-oriented position papers on the major issues related to market-based mechanisms to reduce greenhouse gas emissions. In addition, USAID collaborates with the Council's Private Sector Working Group to obtain industry input on U.S. government clean energy initiatives and to increase visibility of U.S. clean energy companies in USAID target markets.

Activities

Private Sector Working Group. In March 2000, the Council launched the Private Sector Working Group to serve as a vehicle for cooperative links between clean energy companies and USAID. Working group members represent U.S. and developing country companies from the energy efficiency, natural gas, renewable energy, independent power, and electric utility industries.

The working group also serves as a virtual body of experts for USAID to consult for policy advice and project ideas within target markets. It strives to increase visibility of U.S. clean energy companies in USAID target markets, provides feedback on U.S. government clean energy initiatives, and gives input on BCSE's industry position papers and the Partnering with Business industry roundtables. The working group held its second meeting in March 2001 to introduce the new energy and environment strategic objectives of

USAID for developing country clean energy markets under the new administration and to discuss linkages with other industry-related government activities.

Industry Roundtable: In October 2000, the BCSE convened an industry roundtable in Mexico. The roundtable served as a broad educational forum on business opportunities related to the reduction of greenhouse gas emissions in Mexico, as well as an expanded industry dialogue on clean energy market development. The event brought together members of BCSE with executives of Mexican- and U.S.-based companies in the industrial, manufacturing, energy, electricity, energy efficiency, and renewable energy sectors along with representatives of the financial sector and key government officials.

The objective of this event was to strengthen the sustainable energy framework in Mexico by broadening understanding of the benefits of greenhouse gas emissions reductions through market-based mechanisms. Participants agreed that market-based mechanisms represent a common-sense business approach to achieve significant emissions reductions and to bring investment opportunities to Mexico, Latin America, and other developing countries and regions. Industry and governments are very interested in looking for ways to establish partnerships in Mexico and other developing countries to implement pilot projects.

Industry Workshop: In April 2000, BCSE members were brought together with executives of Polish, European, and U.S.-based companies in the industrial, manufacturing, energy, electricity, energy efficiency, and renewable energy sectors, along with representatives of the financial sector and key Polish government officials.

This event served as one of the first broad-based private sector dialogues on these issues in Poland and provided clean energy companies with a forum to discuss their projects and success stories in the Polish market. Polish companies were encouraged to contribute their voice and experience with greenhouse gas emissions reduction initiatives by



Jorge Barrigh, Ballard Generation Systems (left), Luise Felipe Ordóñez of the Asociacion Mexicana de Fabricantes de Aislamientos, and Virginia Gorsevski of USAID

sharing their message with the industrial community in Poland. The event also helped strengthen the links between the Polish and regional network of clean energy companies and USAID. BCSE plans to hold a second international roundtable on clean energy market development in 2001.

Results

- Two Private Sector Working Group meetings have been held so far between representatives from U.S. and developing country energy and energy service companies to facilitate the exchange of information and to lead to project development.
- Industry Workshops on emissions trading were held in Mexico and Poland involving local government participation as well as energy industry members from the U.S. and the host country.

Industry and government representatives from the United States and developing countries come together to exchange information and discuss project development.

Latin America

Safer, Stronger Cement for Reconstruction

Program: Latin America Initiative for Environmental Technology

Location: Latin America

Duration: 1999-2000

Key Issue: Industry Efficiency

Sector: Industry

Application: Technology Transfer, Capacity Building

End Use: Cleaner Cement Production

Impacts: Health, Environment

energy efficient and environmentally sustainable processes.

The USAID Role

The USAID Global Environment Center has funded the Environmental Export Council (EEC) to develop opportunities to promote private sector investment in energy efficient and environmentally sustainable development in Central America and the Caribbean.

CEMENT is a necessary industrial ingredient for the development of emerging economies. Manufacturing of cement is also a major source of greenhouse gas emissions. Thus, it is imperative that cement manufacturing, along with other industrial products, follows

Activities

USAID's promotion of private sector investment in Central American countries involved in post-hurricane reconstruction activities showed how blended cement can be

The benefits of safe, strong, and cleaner cement use is being promoted for post-hurricane reconstruction.



Central American cement manufacturers visited this cement plant in California that burns used tires for fuel

just as strong as the more energy intensive traditional Portland cement. The Environmental Export Council implemented a study tour at the request of USAID to create this awareness among cement industry manufacturers and government officials in Central America and the Dominican Republic.

The Environmental Export Council worked with its local partner, the Central America Committee for the Environment (CORAMA), to identify appropriate workshop participants. Professionals representing the cement industries in Costa Rica, the Dominican Republic, Guatemala, Honduras, and Panama visited with technical experts, research institutions, government officials, industry associations, and cement plants in Washington, DC; Texas; and California.

In California, workshop participants toured a cement plant that employed used tires in the cement kiln as an alternative fuel. Technical sessions and interactive discussions related to cement manufacturing technology, environmental policy, and financing provided the opportunity to exchange ideas and experiences related to cleaner production, energy efficiency, and improved performance.

The Environmental Export Council subsequently hosted a follow-up workshop in Guatemala City to highlight opportunities for using blended cement. The workshop afforded opportunities to share experiences among manufacturers and buyers, and to develop action plans to apply these new understandings to business practices from supplier to vendor, with government support.

Results

- Through site visits and information exchanges, the study tour built awareness of alternative technologies in the cement industry within industry associations, and with consumers.
- The participants and their firms are actively seeking solutions to environmental chal-



Central American companies visit U.S. cement production plants

The program illustrated effectively that stakeholder buy-ins are critical for continuing the momentum of energy efficient reconstruction activities.

lenges and are enthusiastic to partner with U.S. companies and experts.

- The blended cement workshop brought manufacturers together with purchasers and government representatives to consider new strategies for harmonizing standards and applying improved environmental practices. The workshop broadened a policy dialogue among cement manufacturers and government officials, particularly regarding blended cement, a less energy intensive product than Portland cement.
- The program illustrated effectively that stakeholder buy-ins are critical for continuing the momentum of energy efficient reconstruction activities.

Caucasus-Armenia, Azerbaijan, and Georgia

Strengthening Regional Energy Linkages

Program: Strengthening Regional Energy Linkages

Location: Armenia, Azerbaijan, and Georgia

Duration: 1999-2000

Key Issue: Energy Efficiency

Sector: Power, Gas

Application: Training, Institutional Capacity Building

End Use: Energy Management

Impacts: Cross-Border Energy Trade

THE energy sector is a critical ingredient in fueling the economic growth in the Caucasus. In each of the region's three countries—Armenia, Georgia, and Azerbaijan—the major energy problem is inefficiency. All three countries experience periodic power outages and shortages, of varying severity.

Full integration of the Caucasus (as a region) into international energy markets is needed. The first step toward that goal will be to facilitate and awareness among the governments and utilities in the Caucasus about the benefits that could be achieved through closer cooperation in the energy field.

The USAID Role

USAID funded the Academy for Educational Development (AED) to initiate dialogue among Armenia, Georgia, and Azerbaijan about regional energy trade, and to provide training to country officials on international trading agreements.

Activities

The project's goal is to facilitate cooperation among the governments and utilities in the Caucasus countries that could

result in the creation of multinational working groups that would continue the dialogue and move toward greater regional power integration.

First, a regional energy needs assessment was conducted to determine the potential for regional energy trade. The assessment documented the inefficiencies that exist in current power facility supply operations in the three countries, the benefits of coordinating power grid operations, and technical barriers to integration.

Next, a model was developed that looked at power flows in the region. A regional cost-benefit analysis was also conducted to quantify the potential economic benefits of greater regional integration. The analysis revealed that Armenia, Azerbaijan, and Georgia could save US\$1.4 billion in operating costs over 20 years by coordinating and integrating electric power grid operations.

These documents were presented to representatives from the three countries at a series of regional workshops and executive seminars aimed at building support for the nascent regional initiative.

Results

- A regional working group was established comprising representatives from Armenia, Azerbaijan, and Georgia.
- The three countries drafted a joint Memorandum of Understanding, adopting principles and objectives for regional cooperation.



Regional energy training

Increasing energy cooperation and cross-border trade will help the Caucasus reduce periodic power shortages.

Armenia

Preparing for Commercial Operations

ARMENIA recently established an energy regulatory commission and is in the process of commercializing and privatizing much of the sector. Key players in the country's energy sector sought training on issues related to power sector commercialization and privatization.

The USAID Role

USAID provided funding for a series of training courses designed to increase the capacity of the key players in Armenia's power sector.

Activities

The Armenia Energy Training Program was designed to further USAID's ongoing power sector efforts by providing complementary training in key areas.

Key energy sector representatives received training in electric power, natural gas, and business improvements. Eleven training courses were designed and delivered to participants. Training courses built capacity of and consensus among participants to prepare them for Armenia's power sector privatization.

Two executive seminars were offered to high-level managers in the energy sector. The objective of the first seminar was to provide information on privatization and investment attraction, and current management concepts (empowerment, change management) with the goal of enhancing management skills. The second focused on financial reporting and management, and human resource management issues. At the participants' request, the second seminar also dealt somewhat with a proposal under consideration for restructuring the power sector.

Program: Energy Training

Location: Armenia

Duration: 1998-1999

Key Issue: Energy Efficiency

Sector: Power

Application: Training, Consensus Building

End Use: Energy Management

Impacts: Commercialization, Privatization

Results

- Participants in the course on Grid Code and Contracting Practices in the Electric Power Industry endorsed a series of principles for power sector reform and agreed to meet regularly in a working group setting to pursue power sector reform.
- Trainees in business improvements to support privatization have applied the skills they learned to facilitate the transition to privatizing Armenia's utilities.
- The capacity building and training activities helped build consensus for tariff reform in both the natural gas and electric sectors.

THE capacity-building and training activities helped build consensus for tariff reform in both the natural gas and electric sectors.

West Africa – Ghana, Togo, Benin, and Nigeria

Promoting Regional Energy Trade

Program: West Africa Gas Pipeline
Location: Benin, Ghana, Nigeria, and Togo
Duration: 1999-2002
Key Issue: Energy Trade
Sector: Gas, Electricity
Application: Improved Energy Supply
End Use: Regional Energy Trade
Impacts: Economic Growth

WEST Africa is in the process of transforming its economy from one based largely on natural resources, such as timber, minerals, and agricultural products, to one increasingly based on service industries, high technology, and manufacturing. As this transformation progresses, energy demand is

increasing.

Four countries in the region—Benin, Ghana, Nigeria, and Togo—are seeking to better use gas resources in Nigeria, which are currently being flared, to power demand growth in Ghana, Benin, and Togo. A new gas pipeline, the West African gas pipeline (WAGP), is now the centerpiece of the region's strategy to boost nontraditional exports, diversify industrial structures, create regional markets, and initiate a collaborative approach to sustainable resource use.

Successful implementation of the WAGP project requires all four nations to complete a series of cross-border agreements while simultaneously harmonizing their respective regulatory environments. At the present time, the four sponsoring governments lack sufficient capacity to negotiate a commercially built and operated pipeline. They also lack the regional enabling frameworks that are essential to developing a transnational gas pipeline project.

THE West African Gas Pipeline is the centerpiece of the region's strategy to boost non-traditional exports, diversify industrial structures, create regional markets, and initiate a collaborative approach to sustainable resource use.

The USAID Role

USAID is providing technical assistance to and is working with public and private sector partners in the region to resolve legal, fiscal, and environmental issues to facilitate construction of the natural gas pipeline.

Activities

USAID assistance focuses on analyzing and resolving the technical and operational issues and economic impacts associated with the project, developing the terms and condi-

tions of pipeline concession agreements, and strengthening the capacity of governments to negotiate and implement a concession agreement with the private sector project development team headed by Chevron. Specifically, activities will focus on:

- increasing stakeholder understanding of the technical issues, economic benefits, environmental impacts, and terms and conditions of the pipeline concession agreement
- helping resolve technical and operational differences among the sponsoring countries while strengthening their capacity to negotiate and implement a Build-Own-Operate concession agreement (BOO-CA) with the project's private sector development consortium
- providing training for key government officials of each country to ensure their readiness to monitor implementation and integrate the project into their respective economies
- ensuring longer-term viability of those government institutions associated with the pipeline to maximize economic benefits to each participating country.

Given its ambitious goals and objectives, this undertaking is without a doubt a major project. To address the challenge, USAID has mobilized an interim technical adviser, stationed in Abuja, Nigeria, to work in conjunction with the project's facilitators and stakeholders.

A USAID core team of specialists with significant experience in natural gas pipeline commercialization will oversee technical assistance, training, and capacity building activities. Furthermore, in the initial stages of the project, a simulation exercise and workshop, specifically designed to illustrate some of the requirements expected of the sponsoring countries, will be held. The



Harnessing power in Nigeria

activities aim to raise awareness of the components and processes of concession agreement negotiation.

USAID will also provide the pipeline partners with access to a pool of technical experts for short-term consultation and advice on various aspects of the negotiation of the term-sheets that will lead up to the final BOO-CA negotiation with the private sector consortium that will develop WAGP.

Results

- Clean, lower-cost long-term energy supplies for the region
- Regional energy trading within a sound environmental framework
- Creation and expansion of transnational electricity markets
- New private capital for private power, renovation and modernization, and new technology
- Restructuring, policy, and tariff reform
Chevron investment estimated at US\$450-US\$600 million

Mexico and the Philippines

Local Action for Energy Efficiency

Program: Cities for Climate Action

Location: Mexico and the Philippines

Duration: 1998-2000

Key Issue: Energy Efficiency, Renewable Energy

Sector: Residential, Industrial, Commercial

Application: Lighting, Heating

End Use: Energy Management

Impacts: Energy and Cost Savings, Emissions Reduction

and national governments, has engaged more than 350 city governments in the campaign. These cities jointly account for approximately 7% of global greenhouse emissions.

The USAID Role

USAID supports the CCP campaigns in the Philippines and Mexico by funding energy efficient and renewable energy interventions aimed at reducing local greenhouse gas emissions.

THE Cities for Climate Protection (CCP) campaign is a global campaign to reduce the emissions that cause global warming and air pollution. The International Council for Local Environmental Initiatives (ICLEI), in partnership with state

Activities

The project is working to reduce local greenhouse gas emissions through dissemination of the CCP campaign and its five-

A two-year pilot project engaged 9 cities in Mexico and the Philippines to reduce local greenhouse gas emissions.



The city of Cebu converted mercury vapor lamps to high-pressure sodium lamps

milestone performance framework, which gives local governments a simple, standardized approach to reducing greenhouse gas emissions. Local governments must conduct energy and emissions inventories and forecasts, establish an emissions target, develop and obtain approval for a Local Action Plan, implement policies and measures, and monitor and verify results.

A two-year pilot project engaged nine cities in Mexico and the Philippines to reduce local greenhouse gas emissions.

Local authorities from a group of cities in Mexico—Cuajimalpa, Mexico City, Querétaro, San Luis Potosí, and Tlalpan—have joined the CCP campaign and have committed to reduce local greenhouse gas emissions.

In Mexico, each participating government has determined the sources and quantity of the majority of its greenhouse gas emissions. A number of greenhouse gas emissions reduction measures are already under way. Projects presently being implemented in Mexico include energy efficient public lighting in Querétaro, solar water heating in Tlalpan, and solar streetlights in Cuajimalpa.

A group of cities in the Philippines—Cagayan de Oro, Cebu, Naga City, Puerto Princesa, and Tagbilaran—have also joined in the efforts to reduce local greenhouse gas emissions.

In the Philippines, projects are focused on retrofitting city buildings and public markets in Cagayan de Oro, energy efficient streetlighting in Cebu, and socialized housing in Puerto Princesa that incorporates energy-saving features.



Green Homes Project is a low-income housing project of 1,000 units that incorporates energy saving features

Box 2 Mexico CCP Campaign Results

Querétaro: Streetlight Conversion

The conversion of 8,000 streetlights from 250 watt to 150 watt lamps, and 2,000 streetlights from 150 watt to 70 watt lamps.

Carbon Dioxide savings = 3,930 tons per year

Cost savings = US\$456,540 per year

Energy savings = 4,500,000 kWh/year

Cuajimalpa: Solar Streetlight Conversion

The conversion of 410 streetlights from electricity to solar energy.

Carbon dioxide savings = 100 tons per year

Cost savings = US\$25,879 per year

Energy savings = 100,000 kWh/year

Tlalpan: Solar Water Heating

Use of solar energy for water heating in the Olympic Village Sports Center.

Carbon dioxide savings = 1,130 tons per year

Cost savings = US\$146,782

Energy savings = 1,215,000 kWh/year

Results

- The activities in Mexico helped reduce greenhouse gas emissions by 290,832 tons per year.
- In the Philippines, greenhouse gas emissions have been reduced by 38,814 tons per year as a result of CCP activities.



The city of Cuajimalpa converted 410 street lights to utilize solar energy

Bangladesh

Preparing Utilities for Competition

Program: Bangladesh Power Development Board

Management Training

Location: Dhaka

Duration: 2000-2001

Key Issue: Energy Efficiency

Sector: Power

Application: Training, Institutional Capacity Building

End Use: Energy Management

Impacts: Improved Operations

The USAID Role

USAID is funding the Academy for Educational Development (AED) to develop a leadership training course for BPDB's senior and middle management.

Activities

A course manual and training program were developed that included comprehensive lectures, free-form group discussions, selected readings, and knowledge application and skills development activities through individual and group assignments and case studies. Key themes in the course included power sector restructuring and modernization programs and lessons learned from other countries.

The training course was designed to strengthen BPDB, with an immediate focus on improved decision-making and management. To that end, participants were provided training on developing communication, management and leadership skills, human resource management, and corporate and financial planning.

More than 100 senior and middle managers from BPDB received training. BPDB managers who showed an interest and an ability to serve as future trainers for their organization received further training. The future trainers will ensure the continuity of the program.

Results

- Training has improved BPDB's leadership and management skills.
- The BPDB is prepared to manage the transition to a more competitive environment.

THE Bangladesh Power Development Board (BPDB), the principal electric utility organization in the country, has launched an initiative for performance improvement and professional development of its employees through training.

Existing BPDB training programs have been outdated and bear little resemblance to training programs and methods employed by today's modern utilities. As a utility operated and managed by well-trained officials, an improved BPDB can make a major difference in the overall reform of the country's power sector.

More than 100 senior and middle managers received training.

Training has improved the Bangladesh Power Development Board's leadership and management skills.

The Philippines

Building Capacity for Contract Negotiation

FOLLOWING the successful discovery of natural gas by international oil companies at the deep waters of Palawan, the Government of the Philippines (GOP) planned to use natural gas for electrical power application by converting the Bataan Nuclear Power Plant (BNPP) to gas. A long-term gas sales and purchase agreement was a fundamental requirement for development of the gas field and successful development of gas industry in the Philippines.

The GOP requested training on how to prepare a central core of GOP officials and experts who would be responsible for negotiating long-term gas sales and purchase agreements. The GOP also needed training on how to plan and develop a natural gas industry in the country.

The USAID Role

USAID created the Asia Sustainable Energy Initiative to support developing countries' efforts in restructuring, privatization, and regulatory reform of their power sector. One of the goals of the Asia Sustainable Energy Initiative is to address the major obstacles to implementing large-scale sustainable commercial energy projects by focusing on policy reform, planning, and project development.

Activities

The Institute of International Education (IIE) developed a two-week training workshop on gas industry development, with emphasis on long-term gas contract negotiations. The workshop was held in Manila in

Program: Asia Sustainable Energy Initiative

Location: The Philippines

Duration: 1996

Key Issue: Gas Industry Development

Sector: Industry, Public Utilities

Application: Capacity Building

End Use: Contract Negotiation

Impacts: Improved Operations, Institutional Strengthening

September 1996 for 32 senior-level officials from a cross-section of several departments and agencies within the GOP. The training covered in detail topics central to natural gas industry development, including regulatory policies in the natural gas industry, long-term exploration, purchase and production agreements, political risk insurance and risk allocation, project finance, and conversion of BNPP to gas-fired combined cycle.

A two-day contract negotiation simulation exercise was held to give participants skills and structured training to conduct negotiation transactions. Participants divided into teams representing a national power generation company and a gas producer that negotiated for natural gas to supply a 1,200 MW power plant. This exercise was conducted in six rounds in which the lead negotiator, supporting analyst, and legal advisor were rotated among participants.

Results

- The training prepared senior-level officials to negotiate sales and purchase agreements with international oil and gas companies.
- In November 1997, the Philippine government approved the BNPP plan for integrated conversion into a combined cycle plant for power generation using natural gas.

A two-day contract negotiation simulation exercise was held to give participants skills and structured training to conduct negotiation transactions.

Ukraine

Energy MBA Program

Program: Energy MBA Program

Location: Ukraine

Duration: 1997-Present

Key Issue: Restructuring, Privatization

Sector: Power, Oil, Gas

Application: Training, Capacity Building

End Use: Energy Management

Impacts: Institutional Strengthening

Ukraine's power sector has been undergoing a major restructuring for the past several years. A small set of large, monolithic, and bureaucratic entities are being unbundled into a large number of smaller corporations to be operated as commercial, market-oriented businesses. Some of these companies have already been privatized, and many others will follow suit in due course.

The major transition of the Ukrainian power sector, which is not dissimilar from a trend seen across the globe, requires a new group of managers and leaders trained and

familiar with modern methods of management and market principles. To meet this urgent need, a unique Energy MBA Program has been established for promising executives from existing energy sector entities.

The Energy MBA program is housed at one of the leading management institutes in the country, the International Management Institute of Kiev. In addition to the Ukrainian faculty members teaching core MBA courses, it brings the students in contact with leading academicians and practicing professionals from the U.S. utility industry through specialized courses.

The USAID Role

USAID provides funding to the Institute of International Education (IIE) to support the coordination and planning of the Energy MBA Program in Ukraine.

Activities

A two-week internship and study tour of U.S. utilities and energy agencies is one of the integral components of the Ukraine Energy MBA Program. The purpose of the internship and study tour is to familiarize participants in the program with the workings of various energy-related organizations in the U.S.

The study tour was conducted in New York and Pennsylvania, where Ukrainian participants visited investment banks, a credit-rating agency, the New York Stock Exchange, and power utilities. An afternoon was spent hearing from both the Pennsylvania Public Utility Commissioner and the privatized Pennsylvania Electric Company regarding their different perspectives on the restructuring of energy markets.

A unique Energy MBA Program has been established for promising executives from Ukraine's energy sector.

Study tour participants also spent a week on-site at a U.S.-based electric utility company. This experience provides the MBA participants with valuable first-hand knowledge of their American counterparts operations and best practices.

The study tour ended with a two-day seminar in Washington, DC, where participants spent time in roundtable discussions and seminars learning about the role of the Federal Energy Regulatory Commission, the National Association of Regulatory Utility Commissioners, and the interests of private power developers.

Participants also met with USAID and World Bank officials to discuss possible cooperation as the power sector in Ukraine undergoes restructuring and privatization.

Through the integration of the study tour seminars and the internships, participants acquired an in-depth understanding of the context of the topics that they had been studying in the classroom. As a result, they are better prepared to contribute to the successful management of their company upon return to Ukraine.



Energy MBAs visit Washington, D.C.

THE Ukraine Energy MBA Program is in its fourth year and has already graduated 122 professionals. Almost all alumni have moved rapidly upward in their organizations. One graduate served as Deputy Minister of Energy. Training alumni have become the leading voices for power sector reform in Ukraine.

Results

- The program is in its fourth year and has already graduated 122 professionals.
- Thirty are enrolled in the ongoing fourth-year program.
- Alumni have been promoted to positions of senior management responsibility, including ministerial levels. One graduate served as Deputy Minister of Energy.
- Alumni now meet as part of the Ukraine Energy MBA Alumni Association, an independent, indigenous energy sector NGO designed to offer a forum for energy specialists to come together, share ideas, and work to apply their knowledge

to assist the transformation of the energy sector in Ukraine.

- Trained alumni have become the leading voices for power sector reform in Ukraine.

Global

Energy Training Alumni Take the Initiative

Program: Technical Leadership Training
Location: Global
Duration: 1981-Present
Key Issue: Training Energy Professionals
Sector: Industry, Government
Application: Leadership Training, Capacity Building
End Use: Energy Management
Impacts: Improved Operations

The training focuses on supporting economic development without harming the environment.

THE Energy Training Program provides working energy and environmental professionals the skills and knowledge they need to do their jobs better – develop projects in an energy-efficient, cost-effective manner—and to enable companies and countries to be competitive in the world market using environmentally friendly technologies. Since 1981, more than 12,000 professionals, from senior policy makers to industry engineers, have benefited from USAID’s capacity building and training and now play leading roles in the development and implementation of national energy and environmental programs. This achievement

was made possible by combining the knowledge and experience of carefully selected expert practitioners as trainers with a class and field environment designed to stimulate enthusiasm, attention, and interaction throughout the course, workshop, study tour, or internship.

The USAID Role

In partnership with the International Institute for Education, USAID has focused on developing the skills and knowledge of key energy and environment professionals worldwide, to assist them in supporting their nations’ economic development while protecting the natural resource base.

Activities

A Technical Leadership Training program was designed to build leadership capacity and to provide analytical tools that decision makers can use to address challenges faced by their countries in developing the energy sector in a manner that is both friendly to the environment and beneficial to economic growth. The program focused on issues related to energy efficiency, renewable energy, urban environmental management, and global climate change.



Energy training alumni

PARTICIPANTS have shown significant progress in applying skills and knowledge gained during their training to projects in their countries.

One of the many training courses delivered under this program includes a 4-week course on “Application of ISO 14000 for Municipalities,” which trained 30 participants from Bosnia-Herzegovina, Ghana, Guatemala, India, Latvia, Mexico, Namibia,

the Philippines, Poland, Romania, and Ukraine.

The course showed participants how municipalities can use an environmental management systems approach to improve efficiency, worker competency, stewardship, and operational control at the municipal level. Participants have showed significant progress in applying skills and knowledge gained during their training to projects in their countries.



India energy training program

Results

- D.K. Roy, India. Mr. Roy, a Leadership Training alumnus, is the first Regulatory Chairman in the history of the Republic of India. As Chairman of the Orissa Electricity Regulatory Commission, Mr. Roy guides the State of Orissa through the challenges of electricity sector ownership, operation, and regulation. Mr. Roy received training in power sector restructuring and regulatory reform under USAID's program in October 1996.
- Ashfaq Mahmood, Pakistan: Mr. Mahmood became the Secretary of the Pakistan Ministry of Water and Power in 1992 and served until 1997. As Secretary, he directed key activities of Pakistan's power sector, which has an installed capacity of about 13,000 MW and serves a population of about 130 million. The Ministry's efforts to bring private sector investment to the power sector placed Pakistan at the forefront of the worldwide trend toward privatization. Mr. Mahmood received training in power and energy sector development and privatization under USAID's program in 1990 and 1992.
- Costa Stanisav, Romania: Mr. Stanisav is Director of International Programs, Public Relations, and NGOs at the Environmental Protection Agency in Cluj, Romania. In this position, he regularly applies the knowledge and concepts gained during his participation in the 1999 in-country workshop on application of ISO 14000

ONE of the Technical Leadership Training alumni, D.K. Roy, is the first Regulatory Chairman in the history of the Republic of India.

for municipalities. Under Mr. Stanislav's initiative, the city of Cluj has started to develop and implement an environmental management system.

- Nolasco Jove, Philippines. Mr. Jove is a team leader for a pilot coal-fired thermal power plant project in Calaca municipality, Batangas province. He has started developing environmental management systems and has completed the Initial Environmental Review, based on training received under USAID's program.
- Rodolfo Azpuru, Guatemala. Mr. Azpuru's municipality is planning to implement an urban industrial waste project based on principles of the environmental management system approach.

**Since 1981,
more than
12,000
professionals
have benefited
from USAID's
capacity
building and
training.**

NOTICE

THIS report was prepared as an account of work sponsored by an agency of the United States government. Neither the United States government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or any agency thereof.

Available to USAID and USAID contractors from:

Office of Energy, Environment, and Technology
Bureau for Economic Growth, Agriculture, and Trade
U.S. Agency for International Development
Ronald Reagan Building
Washington, D.C. 20523-1000
USA
Phone: 1+202-712-1750
Fax: 1+202-216-3230
<http://www.usaid.gov/environment>

Available to the public from:

USAID Development Experience Clearinghouse
1611 North Kent Street, Suite 200
Arlington, VA 22209-2111
USA
Phone: 1+703-351-4006 x106
Fax: 1+703-351-4039
E-Mail: docorder@dec.cdie.org

This report was produced by USAID Global Environment Center's Environment Information Clearinghouse, under Contract No. LAG-I-00-99-00035-00.

**U.S. Agency for International Development
Ronald Reagan Building, Room 3.08
1300 Pennsylvania Ave., N.W.
Washington, D.C. 20523-3800
(202) 712-1750
<http://www.usaid.gov>**