The Newsletter of the International Network of Renewable Energy Project Support Offices

# REPSOurce

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*Winrock International receives support for the REPSO network from the U.S. Agency for International Development*

John Kadyszewski, Leader, Renewable Energy and Environment Program

## The View from Winrock

*by John Kadyszewski*

In the past several years, individuals and policymakers worldwide have increasingly argued that the planet needs to move away from a carbon-based energy economy. As a result, within the global energy community, debates about global climate change have dominated discussion related to the environment.

These debates, however, have not attained the same importance within the developing economies where Winrock works. Other environmental challenges appear far more threatening and energy has a critical role to play.

Four challenges are worth noting:

1) As populations continue to increase, food production must keep pace. We must learn to grow more food on less land or face the consequences of degraded natural ecosystems and reserves. Increasing the food produced on a given amount of land requires knowledge and additional inputs. Strategically utilized, small amounts of energy will boost agricultural productivity.

> "...small amounts of energy will boost agricultural productivity."

2) The fragile environments found in tropical forests and watersheds around the world cannot be protected from

Please see VIEW continued on page 15

PHOTO COURTESY OF VILLA ESCUDERO

Resort Cabanas overlooking the Labasin River upstream from the micro-hydro plant.

## VEPRI Micro-hydro Project: A Win for Everyone

*by Chris Rovero and Andrea Collins*

Villa Escudero Plantations and Resorts, Inc. (VEPRI) was originally a colonial-era coconut plantation. Today the resort, located about a two-hour drive from the metropolitan Manila area, is a warm, cheerful showcase for Philippine hospitality in a rural life setting where guests are given a good respite from their everyday city life.

One of the most-visited tourist spots in the Philippines, it receives an average of 8,000 guests per month. It has now become a showcase for environmentally benign renewable energy, as well.

### Genesis of the Project

The former plantation houses the oldest hydroelectric power plant in the Philippines, a still operational 75 kW microhydro power facility built in 1937 to provide irrigation and power supply to the resort.

VEPRI management became interested in adding additional hydro capacity due to a number of reasons, including the institution of R.A. 7156, the MiniHydro Act, recent oil price increases and the impending oil price liberalization, and the expectation of electricity rate increases in the future. While significant benefits stood to be gained from the hydro project investments, VEPRI management had the challenge of undertaking the project without forsaking or compromising their commitment to nature-based tourism.

### Features of the Project

VEPRI increased the capacity of the existing plant from 75 kW to 172.8 kW by adding two microhydro plants of 62 kW and 35.8 kW, respectively, which enabled them to maximize exploitation of hydro resources within the estate while avoiding negative environmental impacts. This increased capacity will enable the resort to generate most of its own electricity requirements.

The microhydro systems are designed to continuously operate at desired output without manual intervention. This enables VEPRI to keep the waterfalls, a major attraction at the resort, flowing at the Laabasin Picnic area during the day.

Please see VEPRI continued on page 11

Editors Note: REPSOurce newsletter has changed format. Up to this issue, we have focused on the countries represented in the REPSO network. We are now turning to producing issues that deal with topics within the renewable energy and development communities. Future issues planned will cover renewable energy and finance, agriculture, NGOs, and gender.

# Interview

## Drs. Joan Woodard and Paul Klimas

*by Andrea Collins*

Drs. Joan Woodard (left) and Paul Klimas are experts in the field of renewable energies. They spoke with REPSOurce Editor Andrea Collins.

*Dr. Joan Woodard is Vice President of the Energy, Information, and Infrastructue Technology Division at Sandia National Laboratories, Albuquerque, New Mexico, USA. She manages a 335 million dollar annual research and development budget for projects that range from work in fossil fuels, solar, wind, geothermal, fusion energy, and nuclear power safety, to environment-related programs in remediation, waste management, and waste minimization, to command and control systems and various activities in combating terrorism.*

*Dr. Paul Klimas is Manager of the Renewable Energy Office at Sandia National Laboratories. His responsibility is coordinating all cross-technology renewable energy technology development activities at Sandia, as well as all international projects in this area, where the emphasis has been on supporting the aims of U.S. industry in applying appropriate renewable energy solutions to problems.*

*Drs. Woodard and Klimas talked with WI writer Andrea Collins about how this U.S. national laboratory "works" the problems of renewable energy and the environment.*

*AC: What is a national lab?*

JW: A national lab in the U.S. today is a facility that is supported primarily by federally-funded research and development dollars but also through private industry dollars to address issues of national importance. What's important to this country has, in the last decade or two, taken on much more of an international dimension than ever before.

There is no such thing as just working within our borders. I'll give you an example: As we deal with U.S. policy questions and the policy debate, something that is clear is that the climate change issue needs to be worked globally.

It is not sufficient to just look at what the developing nations do, or just at what the developed nations do, but in fact how we all work in concert. That's the thread running through every aspect of our energy program today. It's very much thinking about the national perspectives but in the global context.

*AC: Do you work with any institutions in developing counties?*

JW: We have worked with others for years in the renewable energy area. They range from a very active program in Mexico to work in Central America.

PK: I think Mexico is a real good example. We have a number of associations with Mexican universities that have energy development sectors. They have looked to us to provide them with the renewable energy technology that they have then made appropriate to their country's needs.

In South Africa we also had a program. I worked with a lot of the Technikon network which is sort of a vocational school network. It's a higher education, tertiary level, quite practical, involving a lot of train the trainer kinds of activities. So yes, we have been using those kinds of relationships.

*AC: When you use the phrase "make it appropriate," I assume that you mean on the technology?*

PK: Absolutely. It is participatory development because we need to know what the cultural context is for the technologies that we're advocating. Something that's quite appropriate in South Africa might be very inappropriate in Mexico.

*AC: In Mexico, did you begin your activities working with local NGOs?*

PK: We did have a partner early in the Mexico program and that would be the National Rural Electric Cooperatives Association (NRECA). We've also had partnerships with Enersol, The World Wildlife Fund, Conservation International, The Nature Conservancy, and Southwest Technical Development Institute. And we have found some universities where we could partner directly.

*AC: What is the latest scientific research saying about the realities of global climate change and other environmental concerns?*

JW: I read an article that was published in the November issue of Science magazine by a scientist at Princeton University at the National Oceanic and Atmospheric Administration (NOAA) lab. In the article he organizes what is known, and I put that in quotes, into categories: virtual certainty, 90% certainty, and so forth. His article is based on the international research community and their assessment of the situation so in a sense it represents a consensus of the international community.

And all you have to do is look at the 90% probable column and you are hit with just how significant our understanding is. What it's saying is that we're no longer considering whether or not a phenomena exists, but we are beginning to debate the magnitude of this or that aspect of the phenomena.

For example, we are debating how much the ocean level will rise by 2100. I must say that any rise of that magnitude is of concern to me with children who could possibly be seeing those effects by the end of their lifetimes.

Please see INTERVIEW continued on next page

## INTERVIEW

Continued from page 2

*AC: What do you think are the main energy-related challenges to the well-being of the planet?*

JW: Weaning ourselves from the carbon-based energy economy.

> "...moving forward with a portfolio of options is the right approach..."

*AC: In a way it sounds simple.*

JW: Sounds simple but it's truly phenomenal how difficult it is.

*AC: What are the most significant technologies, maybe that Sandia's developing, for addressing global climate change issues, or environmental issues?*

JW: One of the things that we have been doing for about eight years, has been to provide support to monitoring stations distributed throughout the globe to get data on the effect of clouds, which is one of the key unknowns in the global circulation models that are used to predict the phenomenon.

The effect of clouds and what they might do in contributing to moderating or accelerating global circulation. They could be doing either; the phenomenon is not understood very well at all. Our data goes out over the world wide web and is being used by scientists in 20 plus countries.

In the energy technology area, carbon dioxide sequestration is something we're just starting to look at. Given its long life in the atmosphere, what types of technology might be available to help moderate the effect of carbon dioxide that's already been put into the atmosphere.

We are also looking at how technologies work together from a standpoint of a portfolio of energy options to support the process of weaning from a carbon-based energy economy to whatever our end point might be.

It's really too hard to pick the right end solution now, so moving forward with a portfolio of options is the right approach—for example, rather than having huge centralized power generating stations, it may be better to have a balance of that with distributed systems that would give you more robustness in the overall operation of the grid and the network, to provide for reliability.

PK: And that's something you can address now in developing countries because you have a green field.

My experience, however, showed me how muddied those green fields can get. In South Africa I was with the rural unelectrified populations. Twenty-five percent of those people were spending enough money on kerosene and candles to afford small solar home systems (SHS). The difficulty, though, is that there was no energy store or bank to go to, there were no operations or maintenance technicians around. No infrastructure at all. People had the money and wanted to spend it on this particular type of system but couldn't.

Kipahulu, Haleakala National Park, Hawaii
This National Park Service installation is a 2 kW solar powered pump that provides 3000 gallons of water per day from a well depth of 330 feet to a ranger station/visitor center, campground, and maintenance facility (installed in cooperation with Sandia National Laboratories).

*AC: What are some of the most "outside the box" energy and environment technologies on the horizon?*

JW: One of the things that we are working on is a "back contact" solar cell, a manufacturing technology which basically takes the contacts and puts them all in the back. It allows you to take fabrication techniques and understanding that has developed in the micro-electronics industry and bring it to the photovoltaics (PV) manufacturing area.

Our current estimate is that you can achieve about a 25% reduction in manufacturing cost.

PK: We are also working on balance-of-systems that go with PV panels. Typically, half the cost of a PV system is outside of the PV module itself. There are some tremendous opportunities to make these systems more affordable and less maintenance-intensive, which will make them much more appropriate for developing country applications. We've been working with some of our advanced power electronics people at some companies here in the U.S. in order to achieve these more robust, less expensive, more reliable PV balance-of-systems.

PK: We are also working with hybrid systems. There are many small grids powered by diesel, and by adding batteries and appropriate renewable energy technology, like a wind turbine or PV, one can take advantage of the fact that the distribution infrastructure has already been installed.

The generator is there, and it can act as a backup, and the wiring is there. And the villages are operating on electricity right now. So just for small incremental costs you begin to avoid the use of diesel, i.e., fossil fuels.

JW: Another area is in the solar thermal area and parabolic dish systems area. We have been working recently with some industry partners in furthering parabolic dish receiver design, as well as engine design, so that we can push even further the efficiency in conversion of power from solar to electricity, perhaps even higher than 30%, which is the current high.

PK: I would say that the ability to buy a system that has all the bugs rung out of it is a range of three-to-five years in the future.

JW: Part of the timing is a function of our work with industry. In the particular technology described above, we had a partnership with one very aggressive company. That was four or five years ago, but they have chosen to get out of this area. So for the past couple of years we have been working with a new company. We're actually hoping to do a test soon.

There are new entrants into the renewable energy area now—I can name three large energy industries that have overall goals and strategies in the renewable energy area: British Petroleum, Shell, and Enron.

*AC: Can you work with international companies like BP?*

> "There are some tremendous opportunities..."

JW: Yes, though if an international company has no U.S. operations, factories, or production capabilities, then we have a bit harder time working with them. But, for example, BP has a presence in the U.S., and we work with them in a variety of areas: catalyst design; to change energy forms, to make them safer and less environmentally insulting; climate change; and PV as well as other renewable energy technologies.

PK: Vice President Gore recently opened the new BP photovoltaics plant in Fairfield, California.

PV Facilitates Protection of Forest Ecosystems:

# Guatemala's Sierra de las Minas Biosphere Reserve JI Project

*by Melissa Edwards,*
*Fundación Solar*
*and Anne Dix,*
*Defensores de la Naturaleza.*

In 1998, the REPSO Central America/Fundación Solar and Fundación Defensores de la Naturaleza submitted for consideration the country's first joint implementation (JI) initiative for the Sierra de las Minas Biosphere Reserve (SMBR).

The project goal is to conserve Central America's largest remaining cloud forest (housing over 400 bird species and 70% of known vertebrates in the region, representing the largest bank for pine germplasm in the world, and providing water for 40% of Guatemala) without neglecting the needs of the human population inhabiting the reserve.

## Project Design

The project is divided into two mair components: a land use component co sisting of reforestation, managing natu regeneration, agroforestry systems and stabilizing the advance of the agricultu frontier by enhancing land tenure, act ites directed toward the enhancement the Sierra de las Minas as a carbon sin and an energy component geared tow using renewable energy technologies to offset fossil energy production and developing small hydroelectric systems and improved cook stoves.

It is estimated that 536,917 tons of carbon/year are emitted into the atmosphere as a consequence of deforestation in the Sierra, making it essential that locally relevant and environmentally friendly technologies are promoted in the region. One such technology is photovoltaic (PV) lighting.

In SMBR only six of 150 communities around the reserve's nucleus have electricity. Most households rely on firewood for cooking and lighting.

The proposal is to install 1,000 stand-alone PV systems (50 watts or less) for homes, health clinics and school lighting. Each will power three 20-watt fluorescent lamps for lighting, and an outlet to supply 12 V. power to small appliances (radios, black and white televisions, or kitchen appliances).

These systems have no moving parts, can provide power for over 15 years if used correctly, and are designed to withstand local environmental conditions and use. PV systems can provide 113 amper/hours, may last up to four days with no sunshine, and will avoid almost 700 tC in the project lifetime.

PHOTOS COURTESY OF IVÁN AZURDIA

## Electricity Means Economic Growth

The availability of electricity often precedes economic growth in the form of higher employment, higher local wages, and acquisition of new skills. Electricity has also made productivity increasing devices possible. Modern energy sources have reduced health threats for women and other users who embroider at night, cook with open fires, or live with kerosene lamps. Electricity facilitates night-time studying and meetings; makes people feel safer; and brings about water pumping, communications and less expensive refrigeration. In a nutshell, PV lighting promises a better standard of living, more economic opportunities, and a cleaner and more sustainable environment.

We expect these strategies to promote regional, decentralized, sustainable development while facilitating protection of forest ecosystems. Without this project we predict many of these ecosystems will disappear within the next century.

## Cohabitation and Economic Growth

Pictured left, the Sierra de las Minas Biosphere Reserve and an installation of one of the proposed stand-alone PV systems.


# Hi-tech Commuting in Kathmandu: Clean Electric Vehicles

*by Bikash Pandey*

Battery-powered electric vehicles (EVs) are more visible in the streets of Kathmandu than probably any other city in the world. Safa Tempos, battery-operated three-wheeler vehicles, have successfully entered the public commuter market in the capital of the Himalayan Kingdom of Nepal.

These vehicles, which carry 11 passengers plus a driver, are actually reducing global emissions as opposed to simply changing the type of emission from car smog to power plant smog. This is because over 90% of Nepal's electricity is generated via hydropower.

Three main factors have made the Safa Tempo commercially feasible in Nepal. Kathmandu is relatively small, so vehicles only need to travel short distances, and the maximum speed around town is approximately 20 miles per hour, in lots of stop-and-go traffic

The standard lead-acid battery technology is adequate to allow travel of around 90 miles a day with two battery changes, perfect for the trip back and forth on fixed routes (approximately 2 1/2 miles) Safa Tempos make up to 20 times a day. They return every 30 miles or so to their charging station to exchange their battery pack for a freshly charged unit.

Thus speed and range, the two parameters which are behind the lack of popularity of EVs in the U.S., are not limiting factors for EVs in Kathmandu.

Lastly, it was probably the negative impact that the city's highly visible pollution has had on tourism, the country's major foreign exchange earner, that encouraged the Government of Nepal to reduce customs on electric vehicle components starting in 1995.

> "...speed and range...are not limiting factors for EVs in Kathmandu."

Safa Tempos have in addition generated a loyal following among passengers who pay the 15% higher rates to avoid the throbbing noise and diesel smoke of the diesel-powered Vickram Tempos they formerly rode.

The majority of the nearly 1500 Vickram Tempos, operated as commuter vehicles in Kathmandu, could be prime targets for future replacement by the Safa Tempo. One major impediment, however, is the lack of public charging facilities for the Safa Tempo's battery packs.

Of the 40 electric Tempos which run in Kathmandu today, 25 are part of two competing commuter fleets owned by Nepal Electric Vehicle Industry (NEVI) and Electric Vehicle Company (EVCO) both of which own charging stations. The remaining 15 are operated for private use and are charged at their owners' homes.

NEVI and EVCO are both exploring possibilities of building a number of charging stations at central locations in Kathmandu where EVs can be charged. NEVI and EVCO manufacture vehicles using components from the U.S. and chassis from India for their own use and also for sale (around US$ 6,000).

# Biomass vs. Fossil Fuels in the Indian Sugar Industry: A Study in Process

"...there is no net addition of $CO_2$ to the atmosphere."

*By S. Gopinath and Lee Jakeway*

The Indian sugar industry is one of the largest producers in the world, with 12 million tonnes of sugar projected in the 1997/98 season. Most sugar factories have traditionally operated their cogeneration plants (power plants fueled by fossil fuel and by waste from the sugar cane crushing, called bagasse) only to make sugar during the six-month cane harvesting season.

In places where cogeneration plants operate for a longer period of time they can support increased processing of cane, and can produce a surplus of electricity that can be sold to the grid.

One of the major problems of year-round power generation is meeting the additional fuel requirements during the non-harvest season. Currently the Indian sugar industry uses primarily lignite (brown coal) for power in the off-season, or only cogenerates during the cane crushing season.

As demands for power are increasing, cane trash as a fuel for cogeneration is attracting much attention in India. REPSO has been promoting the use of cane trash as an alternate fuel in biomass-based power projects in India.

## Environmental and Other Advantages of Biomass

Of the biomass fuels available for a typical sugar plant (including bagasse, the waste left over after the cane is crushed, the use of which is already an established practice), cane trash offers much as alternate fuel. This resource is estimated at eight to 15 dry tonnes per hectare at harvest; it dries to 15% moisture and has a better net heat value than bagasse; and it has less economic value in any of its present uses than it would have as fuel for cogeneration plants.

Nationally, the use of cane trash for cogeneration will contribute to power needs with indigenous fuel. Globally, it will result in a net reduction of greenhouse gases. The $CO_2$ released by the burning of biomass fuels is more than compensated by the assimilation of $CO_2$ by growing equivalent biomass. Thus, there is no net addition of $CO_2$ to the atmosphere.

The benefits to the local area are perhaps the most significant: increased income to rural based sugar industries; off-season employment and income gained from supply of cane trash to cogen plants; more power to the rural grids enhancing grid stabilization; potential for attracting other rural industries that need reliable electric power and the subsequent additional employment; and environmental and social benefits from lower pollution and eliminating open-field burning of cane trash and displacing fossil fuel burned in the power plant.

Cane trash bailing trials.

## Problems with Burning Cane Trash for Cogeneration

But using cane trash as a fuel presents problems. Cane trash can be a useful soil amendment when used as a mulch for moisture retention and it adds to soil organic matter when it decomposes. Experience has shown though that mechanical harvesting leaves some cane trash in the field (actually recommended as a sustainable practice).

The most immediate problem is no availability of cane trash at the mill site. Harvesting and transport are a problem due to cane trash's high bulk density, and storage requires large areas and constant supervision. Other problems encountered when burning cane trash include slagging inside the boiler.

## The Effectiveness of Cane Trash Baling

REPSO has facilitated demonstration field trials to prove the efficacy of balers in Indian field conditions, identifying a Ford New Holland baler from M/s New Holland Tractors India Pvt. Ltd. in Delhi for demonstrations.

The baler effectively worked in the field collecting cane trash and dropping bales as it was pulled by a tractor. Subsequent trials were conducted to establish other parameters that could assure the success of the commercial application of cane trash baling.

In addition, India-REPSO has awarded an investigative study to Thiru Arooran Sugars Limited, a privately-operated sugar company in Tamilnadu to establish the following:

- transportation cost of cane trash from field to the plant;
- cost of processing the cane trash to suit the boiler feed;
- impact of trash removal on soil nutrients;
- environmental impact;
- social and economic impact on farmer communities.

Thiru Arooran was the first sugar mill cogeneration plant in India to attempt year-round power generation. During the off-season the plant currently runs on lignite, a fossil fuel.

Work on the study is expected to be completed by August 1998. On the success of this pilot project, the system can be replicated by all the sugar mills implementing cogeneration projects in the country.

# Shining a Light for Clean Water

*by David Taylor*

Ashok Gadgil, a scientist at the Lawrence Berkeley National Laboratory (LBNL) in California, has invented a device that uses ultraviolet (UV) rays to disinfect water. The invention earned for its inventor Discover magazine's 1996 Discover Award.

In countries like India, where water-borne disease poses the number one environmental health risk, UV Waterworks can save lives.

"By our calculation," says Gadgil, a village unit "will avert 15 deaths of children below age five and avoid the stunted growth of 150 children over the 15 years of its useful life."

The purifier's lamp kills waterborne bacteria and viruses by deactivating their DNA. The lamp is like a standard fluorescent lamp, except that its glass allows UV light to pass through.

> "...the purifier can help rural women."

The design is the first in which the lamp is not immersed in the water during disinfection—a significant improvement over lamps where there is light blockage caused by a build-up of mineral deposits and algae. Water is disinfected as it flows in a shallow pan a few centimeters below the lam

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energy needed by existing water purification schemes, and is 20,000 times more efficient than boiling water over a cookstove. Each unit is less than 70 cm long and 35 cm tall, and can provide drinking water for a community of 1,000 people for 15 years.

A village unit can run 12 hours a day, requiring maintenance only twice a year and a new lamp every other year. It uses just 40 watts of electricity and can be powered by small photovoltaic panels or a battery.

Besides improving a village water supply, the purifier can help rural women. "[T]he UV disinfection system could greatly improve women's quality of life by reducing their workloads," says Gadgil.

Since 1994, versions of the purifier have been field-tested in Orissa and Uttar Pradesh. Urminus Industries of Mumbai (Bombay) built the units for these tests using lamps and bacteria-testing kits provided by LBNL.

## Clean Water for all.

Pictured left, UV Waterworks, an affordable and practical means of providing communities in many nations accessible and safe drinking water. WorldHealth International, based in Napa, California, will produce the first units this summer. Urminus will begin production in India soon afterward.

# GLOBAL CHALLENG

*REPSO managers were asked to consider a clear public interest goal: How could renewable energy to the environm*

**Mr. Iván Azurdia,**
Fundación Solar, REPSO Guatemala:

The renewable energy technologies (RETs) that can best support Guatemala's development goals are hydropower, biomass cogeneration, geothermal, wind farms, and stand alone PV systems, especially for productive uses applications. The Guatemalan government is committed to sustainable development which will facilitate RETs adoption, which in turn can foster economic growth while at the same time reducing GHGs emissions. However, the National Ministry of Energy and Mines should take concrete actions to promote renewables, so they have a fare shake of the evolving market.

The primary way in which Fundación Solar is trying to effect the commercialization of renewables is through a four-sided approach:

- Policy Dialogue and Institutional Reform.
- Support to the private sector developers in preparing sound pre-investment project studies.
- Design and development of rural stand-alone projects that can prove the concept of renewables at the field level.
- Coordination of private sector vendors so they respond to market pull by providing technology that is robust and reliable.

In Guatemala, global climate change and environmentally sound projects are being mutually reinforced via market forces coordinated with sound government policies.

**Ms. Grace Yeneza,** Managing Dir
Preferred Energy Inc, REPSO-Philipp

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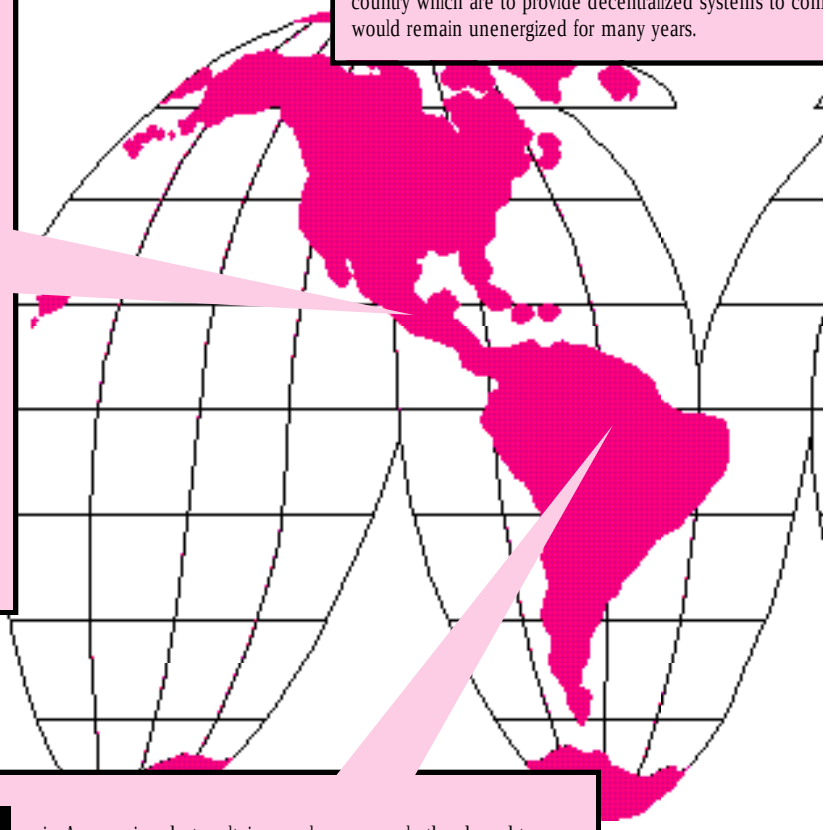


**Dr. Osvaldo Soliano Pereira,**
REPSO Manager, Brazil:

Different renewable energy technologies can match particular requirements of Brazilian rural power niches. In general, renewable energy sources are the most suitable solution to not only the unelectrified poor rural areas of Brazil, but also those in which kerosene is burned for lighting and diesel is used in some productive activities. In most cases renewable energy can replace them in the least costly and cleanest way. Biomass, either residues or biofuels, can be extensively used in Amazonia; photovoltaic panels can supply the drought-prone Northeast inland; and wind energy is suitable to applications on the coast.

The way REPSO-Brazil is effecting commercialization of renewable energy technologies in Brazil is to create opportunities for the use of renewables through the support of new financing mechanisms such as the Renewable Energy for Rural Electrification World Bank loan and the IDB's Sustainable Markets for Sustainable Energy Program. In the policy area we are supporting Brazil's newly-established regulatory agencies and the National Renewable Energy Program (PRODEEM).

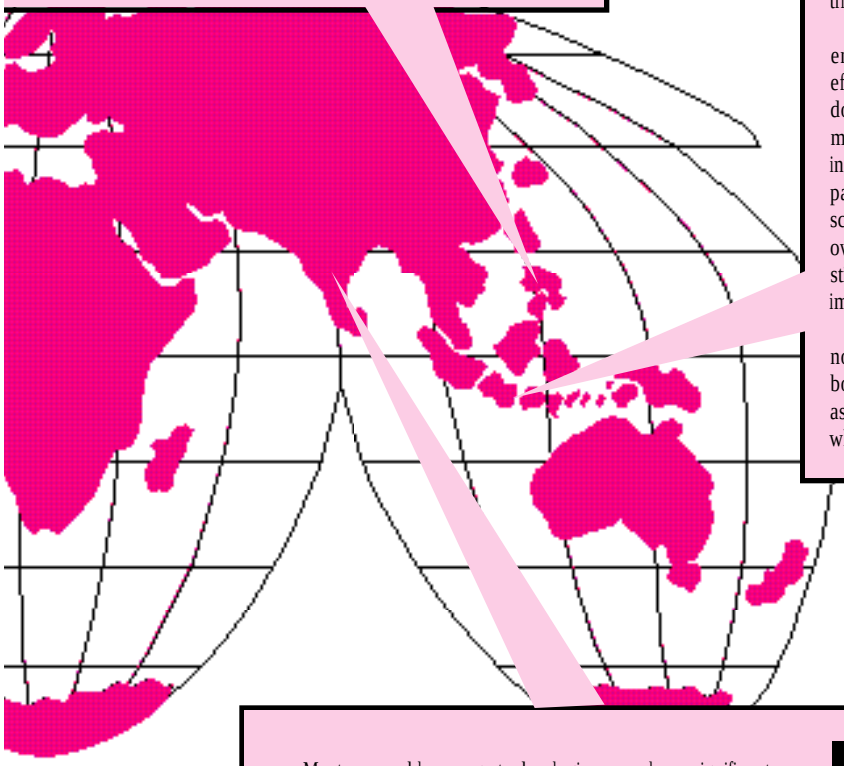
All of the activities described above contribute to the reduction of greenhouse gases in the atmosphere and can increase sustainable economic development.

# AND OPPORTUNITIES

*upport your country's public interest goals while at the same time allowing your country to contribute eing of the planet?*

We are working on wind mapping and policy to allow for hybrid sys-ems (fossil fuel and renewable energy applications), as well as straight enewable energy solar and wind.

In the policy arena, we are trying to make a space for hybrid projects o occur. What we're doing essentially is helping private developers to evelop and implement them so that there will be more renewable nergy projects implemented in the future. In the other areas I men-oned, we are bridging the gap between technology and financing by elping developers see the commercial value of renewable energy pro-cts and also trying to connect investors, including foreign investors, with ocal businesses.



**Dr. Lolo Panggabean,**
RENI Manager, Indonesia:

Small and mini- to micro-sized hydro power will be the best candidate, except in the small Sunda islands, Nusa Tenggara Timur, where sources of hydro are scarce. Hydro will not increase greenhouse gases in the atmosphere on one hand, and on the other hand will contribute to the supply of electricity for development.

The best way to effect the commercialization of renewable energy in Indonesia at the moment is to strengthen the existing efforts of the government, since the sale of electricity is best done through PLN. This means cooperating with the government's PJB I and PJB II power generation program by bringing in developers and financial institutions, local and foreign, to participate. It also means cooperating with the current PSKSK scheme in which renewable energies are given high priorities over fossil fuels. (Unfortunately the current PSKSK scheme is still not in the desired format, even though it is being improved.)

Small hydro development is in line with the plan of PLN, if not its highest priority for regional development. This is true both from the standpoint of environmental preservation as well as from the standpoint of the capital investment requirement which has become a heavy burden for PLN.

Most renewable energy technologies can play a significant role in achieving India's developmental goals, since India by virtue of its geographic location near the equator at the foot of the snowy Himalayas is uniquely endowed with all forms of renewable energy. The Government of India has been actively promoting a shift towards renewable resources with the objective of reducing the dependence on imported fuel and reducing greenhouse gas emissions.

Our idea is to create effective delivery mechanisms that will be developed by local organizations. In cogeneration, our efforts are directed towards improving energy efficiency in sugar factories and enhancing the use of cane field residues as an off-season fuel.

With PV systems, our efforts are to promote commercial applications for attracting more private capital to this market.

**Dr. B.S.K. Naidu, REPSO**
Manager, India:

Efforts in the small hydropower sector focus on developing model PPAs and improving policy and regulatory environment. Future wind programs will be directed to the determination of wind energy potential at higher mast heights and the introduction of next generation wind farms in the country.

Programs at the India REPSO are aimed at developing relationships with strategic partners who subscribe to the Indian ethos of caring for and sharing nature and employing renewable energy as an instrument for sustainable development.

# Biomass Plantations and Carbon Storage:

## Initial Results from Brazil

*by David Taylor*

Besides providing renewable energy, biomass plantations of trees are increasingly seen as a way to offset greenhouse gas emissions. This is likely to have economic payoffs for industrial power users and electric utilities.

Pilot projects under the international Joint Implementation program are leading to a system in which utilities and industries can trade carbon credits from forest systems. Winrock International has been working with these groups to help prepare for such a system.

> "Measurements generally access four carbon pools..."

Eucalyptus camalduiensis is one of the most widely-planted eucalypts in the world, particularly in arid regions.

Since 1993, Winrock's Forest Carbon Monitoring Program has refined methods for measuring carbon stored by trees in forest systems, and has tested these with partners in Brazil, Belize, Bolivia, Guatemala, and the Philippines.

In Brazil, Ken MacDicken, former WI Senior Forestry Specialist, worked with the staff of Mannesmann FI-EL Florestal Ltda., the forestry branch of the Mannesmann steel foundry, to quantify the carbon stored by plantations of eucalyptus trees (Eucalyptus camaldulensis).

Mannesmann maintains more than 68,000 ha of eucalyptus plantations in central Brazil for use in manufacturing steel. The eucalyptus provides vegetable charcoal for the blast furnace process, reducing hematite into iron and releasing $CO_2$. The company harvests 16,000 ha of eucalyptus every year for this purpose.

With MacDicken, Mannesmann compared a five-year-old eucalyptus plantation to an area of 17-year-old cerrado (native vegetation that is a mixture of grassland and low, thick forest).

When the four carbon pools were combined (above-ground biomass, below-ground biomass, leaf litter, and soil carbon), carbon stored in the biomass plantation totaled 138.35 Mg/ha, significantly more than the 118.95 Mg/ha recorded for the cerrado.

In one view, Mannesmann's biomass plantations create a cycle in which carbon released by the steel-making process is partially re-stored by repeated planting of trees. Furthermore, the eucalyptus plantations reduce pressure on the native vegetation, which, like eucalyptus, was harvested for vegetable charcoal. "Plantation-produced charcoal has clearly superior characteristics which the industry's process engineers now prefer," notes MacDicken. "Preference for vegetable charcoal from plantations should help to reduce the size of the market for charcoal from the native cerrado."

Pictured above: Tourists wade in ankle-deep water as they enjoy meals in the soothing ambiance of water cascading from the dam.

Left: A view of the micro-hydro plant.

## VEPRI

Continued from page 1

### Win for Villa Escudero

One environmental contribution of the resort via this project is the displacement of fossil fuel as it supplies a portion of its electricity from self-generated power. Another environmental contribution is that the hydro power plants are one of the guest attractions at the resort and thus increases public awareness of this technology.

The expansion project enables VEPRI to generate an additional 556.4 MWh of electricity per year based on 330 days per year of operation, and savings on electricity expenses ranging from 974 thousand pesos (roughly $25,000-30,000) in 1997 to over 2 million pesos ($50,000) an expected 2.3 million pesos (roughly $60,000-70,000) in 2003.

Based on the extremely positive result to date, VEPRI management has decided to construct one more micro-hydro plant of 62 kW in order to become totally self-sufficient in power generation.

### Assistance from PEI

Preferred Energy, Inc. (PEI), which manages the Winrock REPSO program in the Philippines, has provided a variety of assistance to VEPRI, under the auspices of the USAID Renewable Energy Financing and Technical Assistance (REFTA) Project. PEI assisted VEPRI in obtaining the Environmental Clearance Certificate (ECC) as well as water rights permit for the project, and provided financing from the PEI Capital Investment Fund (CIF) in the amount of 7,350,000 pesos or $279,043.

> "...a showcase for environmentally benign renewable energy..."

PEI uses the VEPRI hydro plant as a model renewable energy project to show to potential investors and government financing institutions (GFIs) interested in financing renewable energy projects. Increasing Philippine GFI's familiarity with this type of technology will decrease the amount of time spent evaluating proposals, which will decrease the transaction costs associated with hydro projects, as well as decrease the perception of technology and credit risks.

### Potential for Replication

PEI has already received an inquiry from a plantation operator similar to Villa Escudero who is interested in installing a microhydro system on his farm.

The Philippines Department of Energy estimates that at least 436 potential microhydro sites exist in the Philippines, with an estimated combined capacity of 27.825 MW. In many cases this potential exists in areas lacking electricity, or in islands and rural areas where local renewable generation could supplant expensive diesel generation, or help stabilize grid power quality. Some of this estimated capacity could be used for on-site power needs for productive uses. Power generated by microhydro and minihydro systems could also be sold to the grid and therefore displace power generated by fossil fuels.

*Contact: Conrado Escudero, President (521-0830/59-3698) and Grace Yeneza, Managing Director, PEI (632-631-2826).*

Managing Municipal Solid Waste:

# Two Strategies and One Success Story

*by Andrea Collins*

PHOTOS COURTESY OF YANI WITJAKSONO

Waste plastic after being cleaned (above). Left, Workers sort the plastic waste.

## The Problem

For urban planners worldwide, two key considerations are how to keep urban populations separated from polluted air, water and soil; and how to collect efficiently and effectively and dispose of the rapidly growing urban waste stream. Recycling into products, and recycling as energy, are two strategies for disposing of inorganic municipal solid waste (MSW).

Yani Witjaksono, president of YBUL, has done work on municipal waste in Jabotabek (the cities of Jakarta, Bogor, Bekasi and Tanggerang). She describes for us the solid waste issues in the metropolis, current methods of waste disposal, and one success story as well.

*Every day the people of Jakarta generate over 25,000 cubic metres of garbage, and one thousand million litres of waste water. Domestic pollution is expected to nearly double by the year 2005. In DKI Jakarta 95% of the collected waste is transported to final disposal.*

*Often disposal sites are nothing more that open dumps. Inorganic rubbish accumulates in drains causing blockages and creating breeding sites for mosquitoes. Some is burnt generating acrid smoke which adds to the already severe air pollution.*

*Waste not transported but disposed of by local people is dumped on vacant ground where it is burnt or picked over by chickens, goats, dogs, and cats, a process that removes food scraps and encourages the breaking down of other organic matter in the soil.*

*What remains are substantial quantities of plastic material, largely in the form of plastic supermarket bags. Plastics cannot be returned to nature. These accumulate, are unsightly, and often exacerbate flooding by increasing rain run-off due to interference with the drainage characteristics of the soil.*

## One Solution: Tunggal Jaya Plastics

*We met Untung Basuki two years ago, when a banker from Bank Pinaesaan introduced him to us.*

According to Yani Witjaksono, in 1978, Untung Basuki was a wastepicker working an open dump in Jakarta, one of the more than 60,000 people involved in Jakarta's informal system of MSW recycling.

> "Plastics cannot be returned to nature."

Private collectors and scavengers are important to the waste collection process in many developing countries, either as collection contractors for the city authorities or as informal but highly organized waste recyclers.

Untung Basuki knew the business, especially of the middle men, called lapat, or suppliers, who collected from scavengers and sold to industry. He decided he wanted to become a lapat. *So one day with his entrepre-*

Please see MUNICIPAL WASTE continued on next page

## Plastics recycling in Jabotabek

A certain percentage of raw material for plastic bags is still imported.

Plastics recyclers in Indonesia sell their product to various different industries according to the grade. Prime grade is sold to industries which produce containers or bags, and toys. The second grade is sold to the pail and sandal industries.

According to 1993 figures, the percentage of plastic in Indonesia's MSW (7.7%) is comparable to the U.S. (7.2%), Malaysia (7.0%), the Philippines (6.9%), and Japan (8.5%).

Comparing the amount of plastic in MSW in Jakarta in 1987 with the same in 1992 (9.5 percent versus 7.7 percent), we see that it has not changed substantively. Recycling, the ascending economy, the influx of population into the area, and other factors contribute to the lack of variance. Whatever the reason, the numbers point to the fact that there is still plenty of room to do business in the sector.

## MUNICIPAL WASTE

Continued from page 12

*neur's soul, he connected with a friend who had been a banker in the past.* His friend introduced him to a banker with Bank Mayindo, the embryo of Bank Intan. The Government of Indonesia sponsored a program dedicated to small-scale business and the bank used this mechanism to provide him with a non-collateralized loan of Rp.15 million, at an interest rate of 1% in rupiah.

Untung began hiring his own scavengers to gather plastic bag garbage. He also went directly to the fertilizer industry and asked them to give him their waste plastic. His goal was to gather plastic waste at its source instead of relying completely on scavenging done at the dumps. Using this strategy, and scavengers he hired in Jabotabek, he began a small collectors site.

At this time, after collecting the waste, having people clean, separate, and grade the plastic waste, he is using local technology to chop plastics into small pieces.

When Untung worked as a distributor, his income was Rp.15 million per month.

He eventually acquired a large site in Bekasi in the metropolitan area of Jabotabek.

Recycling and selling plastic to make import substitution products is a very good niche market right now, as the cost of imported materials has increased dramatically with the economic crisis. Currently Untung has 50 people working for him. Before they worked for him, they were independent scavengers.

The machinery that he uses in his plant is imported from Taiwan. Currently, his production involves using six crusher machines and totals four tons per day.

As he has become successful, Untung Basuki has become an active philanthropist. Now 47 years old, he is contributing to the building of a mosque for the community surrounding his plant. For some scavengers who live close to his plant he provides funds for their children to go to school.

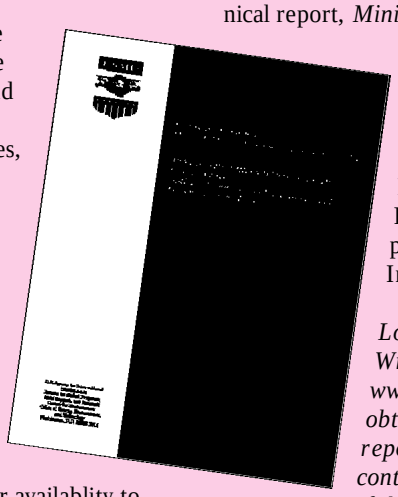
He also provides financing for scavengers. Normally industries pay scavengers and distributors three months after they deliver their waste. Untung pays them in a more timely manner.

Untung said that all of his products sell very easily. He is leaving for Hong Kong, Taiwan, and China in April, to seek opportunities to sell his products in the international market.

## Waste Recycled as Power

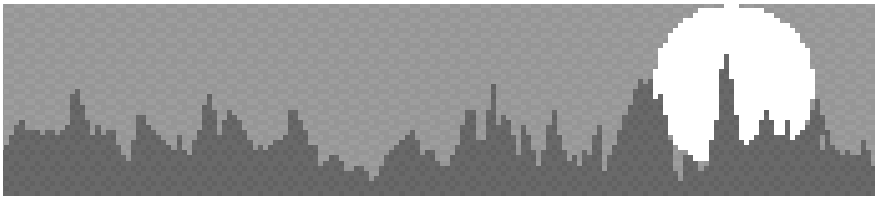
Municipal solid waste (MSW) is defined as the human waste sewage and solid waste originating from residential activities, waste produced by hotels, restaurants, and offices, and packaging materials originating from industry.

Many inorganic components of the stream have a high energy content, and can be mined not only for their availability as recyclables, but for their availablity to produce energy as well, to meet growing urban energy needs via Waste-to-Energy (WTE) systems.



WTE systems are the subject of a technical report, *Mining the Urban Waste Stream for Energy: Options, Technological Limitations, and Lessons from the Field*, funded by USAID Bureau for Global Programs, and recently produced by Winrock International.

*Look for the publication on Winrock's web site at www.winrock.org. To obtain a hard copy of the report, contact Fay Ellis via contacts provided on page 16 of this publication.*



# Related publications from Winrock...

### The Forest Carbon Monitoring Program Working Papers series...

is a collection of concept papers, bibliographies, and "works in progress" reports on forest carbon monitoring. Most have not been peer-reviewed and are subject to review and revision. For more information on carbon sequestration and trees, request *A Bibliography on Carbon Sequestration and Biomass Estimation*, a recent paper in the series. Produciton of the bibliography was supported by the USAID Office of Energy, Environment, and Technology.

See also...*A Guide to Monitoring Carbon Storage in Forestry and Agroforestry Projects*, written for Winrock's Forest Carbon Monitoring Program. For information on Eucalyptus plantations in Brazil, and for information on other international uses of wood crops for electrical power, read *Biomas Fuel From Woody Crops for Electrical Power*, part of Winrock's Bioenergy Systems Report series which is sponsored by the USAID Office of Energy, Environment, and Technology.

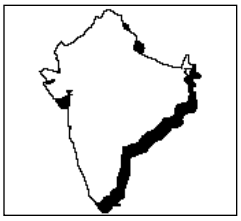
# What's New in REPSO?

## Brazil...

In 1997 the Inter-American Development Bank (IDB) instituted the Sustainable Markets for Sustainable Energy (SMSE) program to mainstream sustainable energy via new and innovative delivery mechanisms appropriate to restructured and competitive energy markets.

As part of Phase II of the program, IDB engaged REPSO-Brazil to perform the function of "listening post" in Brazil, that is, to select and evaluate the important news in areas directly related to SMSE's interests and produce twice-monthly reports on current developments in Brazil.

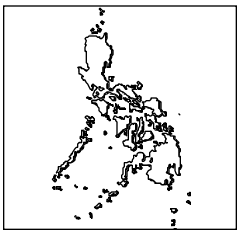
REPSO-Brazil was selected for this work based on an array of qualifications, including its active involvement in the rural energy sector and renewable energy market areas; its substantive working knowledge of Brazilian government perspectives, reform initiatives and implementation efforts; as well as Brazil's language, culture, customs, problems, needs and priorities.



## India...

Based on outstanding performance in the renewable energy sector and genuine leadership qualities, the National Foundation of Indian Engineers has judged Dr. B.S.K. Naidu, Director of the Renewable Energy Project Support Office (REPSO) in India, as the Best Renewable Energy Man of the Year for 1997. The criteria of selection for the award is the revolutionary work done by individuals in the field of renewable energy.

Dr. Naidu also received an Indira Gandhi National Award for Excellence in 1997 from the Andhra Pradesh Central Public Sector Employees Federation.



## Philippines...

Preferred Energy Inc., a Philippine non-profit corporation which manages the REPSO-Philippines, as part of its donor-diversification thrust has been marketing its ability to undertake fee-based short-term assignments in the private sector and other institutions.

In 1997, PEI was awarded projects from the U.S. Export Council for Renewable Energy (US/ECRE) and International Institute for Energy Conservation (IIEC) to conduct market research studies on renewable energy and energy efficiency. PEI recently completed one study, "Renewable Energy High Value End-Users Study."

This expansion, due to the experience and capabilities PEI has amassed in part since 1993, both as staff of the Winrock project office and as PEI, Inc., will enable PEI to more effectively support renewable energy development in the Philippines and will enhance PEI's position as a specialized local organization in the field of renewable energy.


Dr. Naidu receiving the "Best Renewable Energy Man of the Year" Award.

## VIEW

Continued from page 1

growing populations unless we provide rural people the opportunity to generate income without exploiting the existing resource base. Renewable energy sources are widely available and can substantially increase the value added to rural products by rural people.

3) Growing urban populations increasingly demand greater attention to air and water quality and to the management of solid waste. Levels of pollution have become important political issues and governments are seeking alternative models for achieving economic growth while minimizing environmental damage. New approaches to urban transportation are essential.

4) Air and water quality are critical rural issues as well. Clean water is a scarce and expensive resource in large areas of the world, and rural people consistently rank it as their highest concern. Small amounts of energy can often solve the problem. Convincing data also document the scope of negative health impacts that results from cooking indoors using wood and charcoal. At a minimum, public health concerns should drive information campaigns that highlight the least expensive options for assuring clean water and proper ventilation.

Winrock International believes that the world needs alternatives to a carbon-based energy economy, but for a broader set of reasons than immediate reduction of atmospheric $CO_2$. We eventually need to move away from a carbon economy but we need to increase access to clean energy today.


## REPSOurce

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# Monitoring Forest Carbon

*by David Taylor*

Using the carbon monitoring plan developed by Winrock can yield carbon storage values ranging in accuracy from approaching 70% to accuracy within 10-15% of the total carbon sequestered.

As international leaders develop a system for trading carbon credits, project managers need a reliable basis for comparing the carbon storage benefits of forest systems.

Quantifying carbon stored by a specific plantation requires a series of measurements. They generally require permanent sample plots (for a statistically reliable baseline), with trained technicians taking periodic measurements for plots in the plantation as well as for control plots outside the project area.

Measurements generally assess four carbon pools: above-ground biomass, below-ground biomass, soil carbon, and standing leaf litter.

The accuracy of the data obtained using carbon monitoring methods and procedures developed by Winrock depends on the type of system being monitored and the frequency of sampling.

Winrock International

is a private, nonprofit organization that works with people to build a better world—increasing agricultural productivity and rural employment while protecting the environment. Winrock's staff of more than 200 implements projects in 40 countries. Activities are funded by grants, contracts, and contributions from public and private sources. Winrock is headquartered on Petit Jean Mountain near Morrilton, Arkansas, and has offices in Arlington, Virginia, and around the world.

Visit our site on the web:
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