Solar Rural Electrification via Micro-Enterprises, Dominican Republic

Themes

★ Renewable energy
❖ Financing mechanisms and private sector involvement
❖ Technical capacity development
❖ Institutional capacity development
✷ Poverty alleviation (MDG 1)
✷ Education (MDG 2)
✷ Health (MDGs 4-6)

PROJECT DATA

Name: Rural Electrification Based on Solar Energy in the Dominican Republic
Implementing Organization: Association for Solar Energy Development,ADESOL (NGO)
Location: rural areas, Dominican Republic
SGP contribution: $20,500 in 1994
Start Date: ADESOL founded in 1992; SGP grant in 1994

ENERGY OVERVIEW

Energy Resource: solar
Technology: individual PV systems, 20-50Wp
Application: indoor lighting, water pumping
Sector: residential,public facilities (related to health, education and water access)
Cost of each system: between $500 and $1000, depending upon size
Total power provided: 18 kW ADESOL, 150kW Solar Network (assuming average 30W on average per household)
Households Served: 600 via ADESOL and 5,000 through the Solar Network founded by ADESOL

BACKGROUND

Approximately 2 million people – between 300,000 and 400,000 households – in the rural areas of the Dominican Republic have no access to electricity. These people depend upon kerosene for lighting, which is of poor quality, and batteries for other electricity needs, which are costly. The extension of the electric grid is not expected to reach these communities for many years,especially since some of them are so dispersed and demand so little power that even mini-grids are not an economic solution. The lack of electricity means that these communities are extremely isolated, with little opportunity for economic improvement.

PROJECT DESCRIPTION

Overview

ADESOL seeks to remove financial and technical barriers to the spread of solar home systems in the rural areas of the Dominican Republic, thereby improving the quality of life and economic opportunities in these regions.ADESOL, along with its U.S.-based partner Enersol,has developed a model for promoting solar technology called the Solar Based Electrification Concept, or SO-BASEC. Based on the belief that those who benefit from solar electricity are its most important promoters, this model promotes decentralized small businesses and financing systems that enable rural people to learn about and to pay for their own solar panels.This guarantees them full ownership of, and responsibility for, their electricity use, and at the same time enables many more people to access the solar technology. ADESOL believes that it is better for end users to pay the full cost of the solar home systems because this will help ensure the development of a sustainable market for the technology. Subsidies,on the other hand,are based on finite funds and limit the number of people who can access the technology. They also artificially lower prices, which then cannot convey to investors and banks the true potential for profit in the market.

Solar photovoltaic panels installed on a school (Dominican Republic)

Implementation: ADESOL began its work by demonstrating rural residents' willingness to pay for the technology. Grant funds paid the up-front costs for a small number of homes to obtain solar panels,and these people, along with the rest of the village, formed a revolving fund to help others get the panels. After a deposit of approximately $115, residents could pay off the loan at about $6 per month,which was less than what they used to pay for batteries and kerosene.The revolving fund has financed more than 600 solar home systems in marginal rural communities in 18 of the 30 provinces of the country. At the same time, ADESOL trains rural residents as entrepreneurs who could run small businesses selling the solar home systems. These new small enterprises form the Solar Network, which is made up of 16 micro-enterprises. Finally, ADESOL supports community installations, including solar water pumps and lighting for schools,health centers, community centers and parks.

Environmental Benefits

Global: Through the Solar Network set up as a result of

ADESOL's efforts, over 5,000 homes have obtained solar home systems, and numerous other public facilities have been powered by solar energy. ADESOL estimates that over the lifetime of each 50W panel that replaces kerosene lighting, between three and six metric tons of carbon dioxide emissions are avoided.

Local: The local benefits depend upon the setting. In some cases, solar energy is replacing diesel-powered generators, which produce air quality problems as well as significant noise pollution.

Local Livelihood Benefits

Health: Kerosene use in the home creates respiratory and eye problems; these are avoided when solar lighting is used. These benefits are being realized by the people living in the over 5,000 households who have obtained solar home systems through the Solar Network. In some communities, health clinics have received solar lighting, which improves health care. In others, improved access to clean and reliable sources of water also results in improved sanitation and reduced health risks.

Poverty Alleviation:

- *Savings on energy costs:* While the cost of electricity from solar panels may be more expensive than many grid electricity rates, the panels are less expensive than current rural energy options; dry cell batteries, for example, may cost as much as US $30-60 per kWh, while solar panels cost between US $1-$3 per kWh. Thus, households can save money on energy use over time, enabling them to use this income for other purposes.
- *Opportunities for income generation:* The improved quality of lighting and power provided by solar panels enables their users to undertake more income-generating activities than before. For example, Mrs. Sanchez, who lives in Los Amaceyes in Monte Cristi, says that the new 35W panel allows her to carry out her home activities at night and frees up her days for selling juice to generate income, using power from the panel. The income from the juice-selling helps her pay off the loan for the solar system.
- *Employment* The solar energy micro-enterprises supported by ADESOL employ 60 people in running the businesses, assembling the control boxes and installing and repairing systems. Approximately 300 people depend upon the income derived from these activities.

Education: Children can now study at night much better than before. In addition, some schools have also received lighting.

Improved opportunities: Better income generating opportunities and increased access to information via television and radio results in a better quality of life in the rural areas of the Dominican Republic, thereby reducing pressures for urban migration.

National Benefits

The expansion of solar energy in the Dominican Republic reduces the country's dependence upon fossil fuels, which must be imported from abroad. Of course, solar panels must be imported, which also uses foreign exchange, but solar panels are less subject to price fluctuations than are fossil fuels. Additionally, the use of solar power in rural areas, where conventional grid-based power might involve large energy losses during line transport, helps the country use electricity more efficiently.

Capacity Development

ADESOL has focused significant energy on capacity building, mainly to stimulate the development of small electrification businesses. It offers courses covering technical issues as well as how to start and manage a micro-enterprise. In the past ten years, ADESOL has trained 222 Dominicans, as well as NGO representatives and Peace Corps volunteers, through 34 training courses. A new training center was recently built in Bella Vista, Sosua, which also acts as a demonstration site for new applications of renewable energy technology. For example, nearby are two potable water systems, one powered by solar energy and the other a hybrid of wind and solar.

Partners

International: Enersol, a U.S.-based nonprofit organization, was founded by Westinghouse engineer Richard Hansen to promote solar energy use in rural areas of the Dominican Republic. Enersol helped to found ADESOL, a Dominican NGO, in 1992, and now all of Enersol's work in the Dominican Republic is channeled through ADESOL. ADESOL benefits from its affiliation with Enersol because it gains access to international information and exposure. The two organizations work closely together to conduct training, test new financing schemes and promote solar energy organizations in other countries. For example, the two worked together to found ADESOL-Honduras in 1997.

National: PRONATURA, an environmental fund in the Dominican Republic, has supported ADESOL from the beginning. PRONATURA also coordinates the SGP, which has provided several grants for ADESOL's work. In addition, ADESOL works with the National Director of Parks to provide solar electricity in protected areas. It has also collaborated with numerous NGOs within the country, including the Dominican Social Churches Services and the Society for the Integral Development of Northeast, to put solar energy to use.

LESSONS LEARNED

Environmental Management

One of the most important lessons to draw from the ADESOL experience is that when users are responsible for the full cost of the technology providing their electricity, they are more aware of how this electricity is used. It provides a good incentive to use electricity efficiently and to properly maintain equipment.

Barrier Removal

Financial: ADESOL's main focus has been finding creative ways to help rural families afford solar home systems. Underlying all

of its approaches is the belief that users should pay the full cost of the systems so that markets can develop to reach the widest range of people who could benefit from the solar energy.

ADESOL has found revolving credit funds to be effective ways of maximizing the impact of its own limited financial resources. ADESOL extends loans to end users who, in turn, purchase solar home systems from one of the micro-enterprises in the Solar Network.The end user pays back the loan over no more than two years.The solar panel itself is used as collateral for the loan.While some solar panels have been removed from homes for lack of payment, the end users always started paying again and the panel was replaced.ADESOL's loan arrears rate is very low, at approximately 3%.

Another method ADESOL has employed to leverage funds is to take some funds from the revolving fund and place them in a U.S. bank account.This "Fondo Solar" now acts as collateral for ADESOL or another NGO to take out a loan from a local bank, and then extend loans to end users. While the bank required 100% collateral funds for ADESOL's first such loan,the next time it only required 80%.Thus,the bank began to assume partial risk in the loan.

ADESOL has demonstrated that,with effective financing mechanisms, rural Dominicans are willing to pay for solar-powered electricity. Several lessons have been learned along the way:

A decentralized network of solar home system micro-enterprises is able to reach more communities. Each micro-enterprise is independent and can make its own decisions about how to best reach its particular community. Yet at the same time, by being linked together through the Solar Network, the micro-enterprises gain access to the financing mechanisms managed by ADESOL. In addition, ADESOL maintains strict quality standards for solar home systems,and periodically audits bookkeeping to help avoid billing errors.

A fixed interest rate for loans helps protect funds from money devaluation. ADESOL uses a fixed rate of 30%, while for the past ten years Dominican pesos have lost about 14% of their value each year.

Clients must have a minimum level of income generation so that they can repay the loan.The micro-enterprise performs a client evaluation before a loan is made, and the client must demonstrate some earnings potential.

Payment schedules can be set according the type of income-generating activity available in a region. For example, a cattle raising district will have a monthly repayment scheme, while agricultural zones have payment schemes timed to correspond with the harvests.

Institutional: ADESOL has been very successful at building the institutional infrastructure necessary for solar energy to reach many regions of the Dominican Republic. Due to ADESOL's strong belief in a market-based approach, it chose to support the development of micro-enterprises. The SGP June 1998 report on rural electrification in the Dominican Republic notes that two other projects used funds to employ a person to manage sell, finance and install the solar panels. ADESOL believes that their operational costs are higher than they would be under a micro-enterprise scheme, and that micro-enterprises are able to promote and sell systems more quickly. On the other hand, another organization called ADEPE did use the micro-enterprise scheme and seems to have been very successful.

An important lesson to draw from ADESOL's experience with micro-enterprise development is the strong need for ADESOL to maintain a close relationship with the micro-enterprises to ensure quality standards and proper financial management. ADESOL's "Solar Network" is made up of 16 micro-enterprises, all of which have access to the ADESOL's revolving fund; they also must meet quality standards for their products and services, and their bookkeeping is periodically audited. ADESOL's role is key, because it enables the micro-enterprise to assure its customers of quality products and professional management.

Policy

ADESOL notes that high import taxes on solar panels are a significant barrier to their work, but it is not clear what, if any, efforts are underway to address this with the government.

Scaling Up

This micro-enterprise model for spreading solar energy use has been shown to be very adaptable for scaling up with a minimum of additional grant funding.As noted above, other organizations in the Dominican Republic have adopted the model successfully. A for-profit company, Soluz Dominicana, has begun selling solar home systems in the rural regions of the country, installing the systems and charging a $10-$20 per month fee for service. Part of ADESOL's goal was to demonstrate a willingness to pay in the rural regions, thereby stimulating market development,and in this respect ADESOL appears to have succeeded. The model has also spread internationally. ADESOL, along with its US-based partner Enersol, launched ADESOL-Honduras in 1997.

ADESOL believes that its ability to generate interest by private companies in servicing this region depended upon clearly demonstrating the rural population's willingness to pay for the solar technology. To do this,ADESOL avoided subsidies for the purchase of technology whenever possible. According to ADESOL,the drawbacks of subsidies are that they:

Limit the dissemination of the technology because subsidy funds are finite

Do not allow sufficient recuperation of funds to demonstrate the potential for profits to investors or banks

Create falsely low prices,which damages the ability of small to medium-sized businesses to gain clients

Mask the consumer's true willingness to pay for the technology.

ADESOL's experience suggests four necessary conditions in order to disseminate photovoltaic technology in rural areas for domestic use. They are that:

The proposed beneficiaries have sufficient knowledge and confidence in solar technology

The beneficiaries desire the technology, and are willing and able to pay for it

Commercial suppliers must exist in the local market, and be able to meet the demand for installations as well as for replacement parts

There must be an adequate number of trained technicians who can install and maintain the systems.

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