Linking Micro Hydro Power and Forest Conservation, Dominican Republic

Themes

★ Renewable energy
✲ Innovative technology applications
✲ Linkages with other environmental goals
❖ Technical capacity development
❖ Policy and legislation
❖ Awareness,culture and practices
✷ Education (MDG 2)

PROJECT DATA

Name: Electrification of the El Limón Community
Implementing Organization: El Limón community (CBO)
Location: rural Dominican Republic
SGP Contribution: $27,500
Start Date: September 1997

ENERGY OVERVIEW

Energy Resource: water power
Technology: micro hydro
Application: lighting, information access, computer access
Sector: Residential, public spaces (related to education)
Size of micro-hydro system: 2.5kW
Households Served: 65 (350 people)

BACKGROUND

Many people in the rural areas of the Dominican Republic have no access to electricity.They use kerosene for lighting and costly batteries for other electricity needs.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. Without electricity, these communities are extremely isolated, with little opportunity for economic improvement.

In El Limón, located in the mountains 60 km west of Santo Domingo, kerosene was used for lighting,causing severe indoor air quality problems. Due to insufficient rainfall for agriculture, the town's main sources of income were raising goats and making charcoal.The nearby forest was being rapidly depleted as townspeople harvested it to produce charcoal.However, in the early 1990s a regional community development agency lent money and technical assistance to build an irrigation system. This system, which water from a stream 6 km away, required significant community investment and organization to build. Thus,the irrigation project not only enabled the town to grow its own crops, but also built their organizational skills for other projects.This high degree of community organization,as well as the existing irrigation infrastructure, made it possible for the community to go on to use water power to generate electricity.

Micro-hydropower project brings electricity and computer access to students (El Limón, Dominican Republic).

PROJECT DESCRIPTION

Overview

This project introduced an innovative micro hydropower system in El Limón,providing electricity for lighting homes and the local school. From the start, the project has been integrated into other development projects in the area. Because of this, and due to strong existing community organizations and intensive capacity development,the project has contributed to livelihoods in more ways than anticipated. It has also resulted in local environmental management activities; because of their dependence upon water for power, the community has initiated efforts to protect the forest within the local watershed.

Implementation

Jon Katz, a physicist at Cornell University, first suggested the idea of using the irrigation system to generate electricity during a 1996 visit to El Limón. He helped the community find funding for the project, including from SGP, Cornell University, and Rotary International, and designed the hydroelectric system. The community spent 18 months building it, each person giving one day per week to the project.The infrastructure was very challenging to build;the 135 concrete poles were particularly difficult to erect.These difficulties might have been insurmountable if El Limón's community were not already so strongly organized.

A hydroelectric committee was established,which collects electricity tariffs for maintenance and future repairs. Tariffs are approximately $2 per month, which is about what community members used to pay for kerosene. The committee required written promises to pay from each household before installing house wiring.Later on,the Inter-American Foundation donated money for laptop computers and video equipment, and Katz

designed a method of Internet access at the school that does not depend upon telephone lines, which are not available in El Limón (the system uses a digital radio, a repeater and a modem).

The project has made the community increasingly aware of the need to protect their water resources,and therefore the nearby forest.This is led them to reach out to other communities, educating them about how micro hydro power works, and actively discouraging degradation of the watershed. In fact, upon discovering an instance of illegal logging, the El Limón community contacted government officials, who then acted to stop this.

Technology

The micro hydro system in El Limón is a bit unusual in that power is generated and distributed at 240V alternating current, whereas normally in the Dominican Republic power is distributed at 120V.There are several reasons for the difference. First, 240V allowed the community to use a reasonably priced conductor, which has only 5% power loss.Second,since power can be generated at 240V, this avoids having to purchase a step-up transformer for the powerhouse. Third, 240V electrical devices are not widely available, which means it is unlikely that outsiders would attempt to steal power, which is a common problem in the Dominican Republic.

The turbine is located in a cement building in the forest above the town. After passing through the turbine, the water continues down to the community to be used for irrigation.Electricity is distributed via power lines suspended on 135 locally made cement poles.These poles,which weigh over 500 pounds each, were extremely difficult to make and to erect, and required a high degree of community collaboration.However, they proved their worth in 1998 when they withstood Hurricane George's 160km/hour winds.

To use the electricity, each household is equipped with a converter, a small transformer, a rectifier, and a filter capacitor to convert the voltage to 12V direct current. Breakers are also enclosed in the steel box with the converter, in addition to the manual breakers inside the homes to limit usage. This is important, because each of the 65 households connected to this system is limited to 35W so that the school and computer center can be allocated 200W. The household electrical allowance is enough for a few compact fluorescent light bulbs and a radio; a small black-and-white television can be used when the lights are turned off. Initially, community members were not happy with these limitations, but after realizing that three solar panels per household would be required to generate this amount of electricity 24 hours a day, there were no further objections. Only one wealthy household in El Limón has been able to afford even one solar panel.

Environmental Benefits

Global: 65 households no longer use kerosene and instead rely on hydroelectric power, thereby reducing greenhouse gas emissions.

Local: Since the hydroelectric system was built,the people of El Limón have begun to protect the local forest.The forest provides a filtering system for the area's sparse rainfall,and without it hydroelectric power would not be possible. For example, when a neighboring community began to cut down trees there, residents of El Limón alerted the government, which stopped the cutting. El Limón has also begun an educational and capacity development effort to help other local communities understand the benefits of the forest.

Livelihood Benefits

Health: According to members of the local women's association, the elimination of kerosene has reduced the incidence of asthma and colds, especially for the children.

Education: Electricity in the school has provided lighting and allowed for use of computers, with Internet access. Now, a Peace Corps volunteer teaches computer classes there. In addition, lighting in the homes helps children to study better. Prior to the project, very few children in Limón studied beyond the 7th grade.

Information access: The town is now connected to the Internet via the computers installed at the school. Twelve residents now have email addresses.

Capacity Development

This project has placed a heavy emphasis on capacity development. First, the project has helped the community build its capacity to manage its resources, and surrounding resources like the forest. SGP helped to organize workshops to train the community in accounting, project design and strategic planning, helping them to take charge of their own development. Evidence that the project has helped in this regard includes steps taken to protect the forest and finding new uses of electricity, such as for computer access. Second,El Limón now plays a role in helping other communities achieve similar successes. El Limón leaders travel to other communities giving presentations, and have produced a video about their own experience. They have given about 40 presentations, and are helping to carry out feasibility studies in these communities. Now, three other communities are developing similar projects.A new Rural Technology Center is under construction in El Limón, funded by the Inter-American Foundation,which will serve as a regional base for outreach and computer learning.The community has even developed its own website, which shares information about El Limón's various community projects, including the micro hydro project.

Partners

International: Jon Katz from Cornell University played a key role in initiating the project in El Limón.He also helped to leverage funds from the United States, including from EcoPartners, an initiative of Cornell University, and Rotary International. The Inter-American Foundation has also provided funding, both for the computers in the school and now for the Rural Technology Center.

National: SGP Dominican Republic has played a particularly active role in this project by organizing training and other activities to support the capacity development process in the com-

munity. Government authorities,when called upon by El Limón, did take action to stop forest destruction, but there is no information about any long-term partnership on this level.

Regional: El Limón has actively sought partnerships with other communities in the area,with a particular goal of helping those communities to understand the benefits of the forest and to encourage them to help protect it.

LESSONS LEARNED

Environmental Management

The El Limón project illustrates how the introduction of micro hydropower can translate into local as well as global environmental benefits.The steps toward forest and watershed protection are a direct result of the introduction of micro hydropower.

In addition,the project shows how energy projects can be integrated into existing infrastructure. The community had already built its irrigation system, and this project added a power distribution system to it.The project also tests an innovative electricity distribution system, at 240V alternating current with step-down transformers to 12V direct current at each household.One of the main challenges with this system is that transmitting power at this voltage requires very sturdy poles to avoid breakage. Communities less well-organized than El Limón might not be able to handle construction on their own.

The project also has found effective uses for the electricity at the times it is produced.Electricity produced by the water during the day is used at the school, where it powers computers and lighting. At night, the electricity is used for lighting homes. However, given the relatively low amounts of water available, there is not enough electricity to power refrigerators and other electric appliances, especially at night when the electricity is being used for lighting homes.

Barrier Removal

Awareness: The El Limón project has been extremely effective at reducing informational barriers to the implementation of energy projects. El Limón itself is very well organized, and through the project the community has gained a good understanding of micro hydro power systems. In addition, El Limón residents have been exceptionally good at sharing their experience with others. Community leaders have given 40 presentations and three communities are now undertaking projects. Part of the impetus for this effort is the need for the cooperation of other communities in protecting the forest and watershed.

Technical: The technical expertise necessary for the El Limón project came from a U.S.-based physicist with an exceptional dedication to the El Limón community. Great emphasis was placed on teaching community residents to construct many elements of the system themselves. El Limón is also sharing its experiences with other communities in the region. However, those involved with the project indicate that any project such as this will require extensive technical assistance from a skilled person who is consistently available throughout the construction period.

Financial: The project's infrastructure costs have been paid for by grants facilitated by the U.S.-based physicist involved in the project. This might seem odd for a village that has already demonstrated its ability to repay a $75,000 loan for the irrigation construction project. However, the project organizers felt that asking the community to pay for capital costs was unjustified in this case, particularly since the project design was very innovative, and loans might not have been available for this untested design. This seems to be a reasonable justification, especially since the project was challenging even for the well-organized El Limón community, and since residents have since become very involved in sharing their experience with other communities who may now be able to build similar systems.

Policy: It appears that some policy already existed to protect the local forest,since when a neighboring community was cutting down trees El Limón was able to ask the government to stop them.This illustrates an important role for communities in ensuring the implementation and enforcement of existing policies. If communities are aware of the need to protect an environmental resource, are aware of existing laws, and have sufficient motivation, they can play a key role in making sure that policies lead to real and positive environmental outcomes.

Scaling Up

This project has scaled up its efforts in two major ways, both related to capacity development. The project's impact in El Limón proper has been intensified due to the increased ability of the community to manage its resources and leverage others, as exemplified by the addition of computers and Internet access to the school and the efforts to protect the forest. Second,the project is scaling up in the sense of actively sharing its experiences with other communities would could undertake similar projects. So far, three are doing so, and out of the 26 communities that El Limón residents have assessed, 17 appear to have potential for micro hydro power.To develop its micro hydro system, El Limón relied upon significant outside assistance, facilitated by connections with Cornell University. This level of assistance may no longer be necessary, thanks to the on-the-ground experience that El Limón itself now possesses. Yet, financial assistance, or loan mechanisms, will have to be accessed for other communities to achieve similar results.

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