SUSTAINABLE ENERGY SUPPLY TO ISOLATED RURAL COMMUNITIES TO ENHANCE PRODUCTIVE ACTIVITIES: FIRST YEAR ADVANCES

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ABSTRACT

Five Work Groups from Argentina, Chile, Paraguay, Peru and Uruguay of renewable energy specialists and sociologists are carrying out this technology transfer project funded by OAS since 2004.

Three of the groups have just finished a similar project that provided services. This project will enhance productivity in isolated rural communities using the renewable energies locally available. In each country, four different productive activities will be supported. It is expected that the results will be socially more significant and sustainable.

Using the methodology developed in the first project, several meetings were held with each community leaders and a general enquiry was performed to identify the suitable renewable energy systems to be provided. In a second instance, general workshops were organized where the systems to be installed, its characteristics and the participation of the members of each community were analyzed and discussed, reaching general consensus.

Keywords: technology transfer, renewable energies, social impact, sustainability, international project.

1. INTRODUCTION

In view of the success of their first technology transfer project funded by OAS (1), the three Work Groups from Argentina, Paraguay and Uruguay, that had developed it, invited other two Groups from Chile and Peru to carry out this new project. It has also received funds from OAS in a three-year schedule from 2004 to 2006.

The aim of the project is to provide renewable energy systems to enhance productive activities in isolated rural communities. These systems will be a showcase of sustainable solutions to energy needs of people who live without a reliable supply of conventional energy and develop artisan production.

In each country, four different activities in at least two communities will be supported, using renewable energies available in situ.

The selection of the communities and their productive activities was performed carefully with the participation of sociologists and energy specialists. Activities as the drying of aromatic and medicinal herbs, goat cheese production, eco tourism, artisan fishing, drying of llama meat to prepare “charque” or vicuna wool washing and dyeing for artisan weaving appeared as valuable in the project context.

Several communities, beneficiaries of the first project- have not been considered for the second one because there were no interesting productive activities to enhance.

After one year of project development, the first results obtained in Argentina, Chile, Paraguay, Peru and Uruguay are described.

2. PRODUCTIVE ACTIVITIES SELECTION

The first phase of the project was the selection of the productive activities to be supported, including the characterization of the communities in their social, demographic and organizational issues.

The methodology employed was implemented in the first transference project and was updated to fit the new challenges of this project. At each community, several meetings were held with its qualified representatives and a carefully designed enquiry mostly related to energy issues was performed (2, 3, 4, 5, 6, 7).

An array of suitable renewable energy systems that use the resources locally available was offered to the communities. The possibility of installing similar systems to those that will be designed and provided by the project in other communities was one of the criteria employed in the selection.

The final decision on these systems was taken in a workshop attended by all community members where the characteristics of the systems to be installed were analyzed and discussed. In the following paragraphs a more detailed description of the methodology used in each country is given.

3. ACTIVITIES IN ARGENTINA

The election of the communities and of the productive activities to enhance was the main objective of the first year of the project. Considering the distances involved and the interest of demonstration possibilities, the group decided to work in the Province of Salta. Given the experience obtained in the first project, the sociologists of the argentine group participated in meetings with field experts working in the Province of Salta in national social assistance projects and NGOs. Several new elements were added in the decision process, with respect to the first project. They are: the results and development of previous social actions, the predisposition of the community to get involved in these actions, the level of isolation and the type of productive systems in place.

The communities chosen were Campo Largo and the Producers and Artisans Association of Molinos.

Campo Largo is a rural isolated community on the river Itaú, in the phytogeographical region of the Yungas, a sort of rainforest in Salta. Their main economic activities are agriculture and animal breeding for their own consumption and for the local market (Fig.1). They have been able to preserve seeds for several generations and the production structure is based in the satisfaction of their own needs. For the last two years they have been helped by the Catholic Church and an NGO as technical support to production and social organization. They are very far from the grid and have no electricity.

The members of the Producers and Artisans Association of Molinos are periurban workers in the Calchaquí Valley, have been supported with technical assistance for more than 10 years by an NGO and have received some financial aid from several national programs. Their isolation from conventional power supply is of socioeconomic type(Fig. 2). The Calchaquí Valley is an intermountain arid region.

In both communities there were meetings held where the project was presented and working agreements and compromises were accepted to be able to start the participative diagnoses that would allow to determine the convenient productive lines for the project action.

3.1 Campo Largo Community

In Campo Largo, the two lines of prior interest detected

Fig. 1: Corn field in Campo Largo, Province of Salta

were the improvement of the peridomestic production of food with irrigation and new ways of processing the production so as to postpone it to non-harvesting periods and the mechanical milling of corn to produce corn flour, the base of their meals and a crushed ration for pork they could eventually sell in the local market. For the first line there are two possibilities for water provision, a micro hydro to power a pump in a spring and PV pumping from the Itaú river. Solar drying can preserve agricultural products for a delayed processing and a mill could be powered by PV panels..

3.2 Producers and Artisans Association, Molinos

In Molinos, the priority was given to the manufacture of byproducts of llama, vicuña, alpaca, etc and the improvement of the services offered by the artisans´ inn.

Fig. 2 : Semidomestic vicuña bred by the Producers and Artisans Association in Molinos, Province of Salta

Solar dryers can be used to produce "charqui" (dried meat) of llama meat. Solar water heaters can provide hot water for washing and dyeing of vicuña wool, for the inn bathrooms and a passive retrofit of some of the rooms can provide heating in winter.

The renewable energy applications to be implemented are very diverse, covering a wide variety of subjects. They are also applicable to many communities in the Province of Salta.

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4. ACTIVITIES IN CHILE

4.1 Introduction

In 1992, in Chile, only 53% of rural households had electricity. This meant that nearly 240.000 rural homes didn't have electrical energy supply. In 1994, started the *PER* (*Rural Electrification Project*) that had as its stated objective to bring electrical supply to 90% rural homes by 2006.
The strategies to bring electricity to households have been multiple. For many remote places the only alternative has been the use of renewable energy sources (mini hydro; solar and wind power).

As a project, the *PER* has been quite successful, but in 2002 there were in very remote places nearly 80.000 homes without any power supply(8).

The emphasis of the *PER* program has been to supply minimal energy to a household not including productive processes.

After studying different options, the production of goat cheese was one of the productive activities selected. At several hundred places in the countryside, this activity is very important for very low-income families that live in isolated communities.

4.2 Overview of the selected activity

Goat cheese production is a centuries old process. In general outlines the following basic steps are followed:

- Between 4 to 6 weeks after giving birth, at least the 80% of young kids are taken from their mothers and sold for food.
- Afterwards, manual milking is continued on a daily basis.
- Fresh cheese is made each day in a special shed, (Fig. 3) where hygienic precautions are taken. Milk is pasteurized, whey is added and the fresh cheese is put in molds for maturing.
- Cheese is taken to market on a weekly basis using light pickup trucks and for remote places mules or horses.

Fig 3: Interior of a cheese production shed. It must be cool, well aired and very clean

In central Chile, adequate pastures are in the Andes at altitudes above 2.000 meters.

Almost all labor is manual. Milking is a specially time consuming process, with severe hygiene standards.

A typical family operation has a herd of about 100 goats, a few dozen sheep and enough dogs and horses to manage the herd. At present, individual producers are establishing themselves in associations so as to promote better quality production.

The communities selected are concentrated on the high Rio Maipo valley. This mountain region has over 80 different "majadas" or places where goats are raised. Since it is also near Santiago, it is an excellent place to start a project of this kind.

4.3 Renewable energy systems

The conventional solution to goat cheese production is to have a central factory but this solution is not feasible in the places considered.

The solutions using renewable energy can have a vital role in the following parts of the process:

- Electricity for milking machines.
- Solar energy to improve hygiene or even for pasteurization of milk.
- Electricity for cold storage of cheese.
- Use of electrically controlled valves to divert springwater to feed new grasses.

A typical milking machine consumes a nominal power of around 1 kW, provides 2 milking stations and can milk a herd of 100 goats in about 90 minutes.

The preliminary design of a PV system uses two 100 Wp PV panels, a controller with power inverter and storage batteries. This system can provide around 1.5 kWh per day of electricity. This is enough for the milking machine, a small cold storage unit and other marginal uses of energy. It also is transportable, since it needs to be put into place at the beginning of the production season and then transported down at the end of autumn.

The proposed system has been evaluated in preliminary form (9). It has been shown that it is economically attractive for the following reasons.

- Increased production, and better final price.
- An important increase in quality, especially as regards to overall sanitation.

If these improvements are combined with goat breeds that have higher milk production, the economic advantages of the system are even better.

5. ACTIVITIES IN PARAGUAY

In Paraguay, the communities chosen for this second project were the same where the actions of the first project took place.

Deeper socioeconomic analysis were made and several new variables relative to production were introduced. This allowed to take into account not only the infrastructure and tools of the traditional production processes but also decision making, cultural and gender issues. One of the communities belongs to the Nivacklé people.

Fig. 4: Interview to members of members of the Nivacklé people at Yacac Vash

5.1 Nivacklé Community of Yacac Vasch, Departamento Boquerón.

The *Instituto Nacional de Tecnología y Normalización, INTN* (National Institute of Technology and Standards), responsible for the project in Paraguay made an strategic alliance with the *Departamento de Asuntos Indígenas* (Native Affairs Department) of the *Gobernación de Boquerón* (Province of Boquerón) and the Department with the Mennonite advisor of the Community (Fig. 4).

In agreement with the productive lines promoted by the *Gobernación* and the Mennonite advisor and with what the community demanded, the project will support with renewable energies the production of sesame and food for their own consumption. The possibility of improving the use of mesquite (algarroba) and the production of its flour is another subject still open..

5.2 Punta Diamante Community, Departamento Ñeembucu

The members of the community are *criollos* (Fig. 5). Their main productive activities are agriculture and animal breeding for their own use. Some of them own cows and produce cheese in an artisan way. In this

community the promotion will be focused on cheese and honey production.

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Fig. 5: Meeting at the church in Punta Diamante

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6. ACTIVITIES IN PERU

In Peru, the Project is being executed in the country communities of San José de Tía and San Francisco de Raymina, both at 3700 meters above sea level, located in the province of Vilcashuamán in region Ayacucho.

A Community Nucleus of Sustainable Human Development (CNSHD) has been organized in both communities. It is constituted by a group of 10 people from the community who will have the responsibility of carrying on the project of Sustainable Productive Development with renewable energy. To make this possible the CNSHD is organized according to the structure defined for this body, that is to say, it counts with a leader for every community: Juan Julio Gamboa Gutiérrez in San José de Tía and Orlando Ramírez Soca en San Francisco de Raymina.Furthermore, they have been subgrouped around the three following lines of activity:

1. Management and administration
2. Technological support
3. Publicity and sales

There will be four people in each line and two of them will simultaneously belong to two lines in order to have a better relation among them. The project of San José de Tía is related to the production of 300 to 500 kilograms a month of dry cochineal insect and in San Francisco de Raymina 500 to 1000 kilograms a month of dry peppermint, lemon balm and sage. In both cases the renewable energy technologies deemed useful in both cases are solar dryers and fotovoltaic systems.

7. ACTIVITIES IN URUGUAY

In Uruguay, electricity is available to more than 98 % of the population. There are few remaining energy- isolated communities. Nevertheless, electricity costs turn out to be too high for its use in thermal applications such as drying. This situation gave the words “isolated” and “inaccessibility to conventional power supply” a new, wider socioeconomic meaning, not only the restricted geographical use.

Renewable energy specialists and sociologists prepared a preliminary list of communities where the project could develop its activities. The criteria for selecting these communities were that they were isolated and well organized, eventually with already established external aid. The fact that the systems designed and provided by the present project could be easily implanted in similar communities was positively considered in the selection. The communities that were beneficiaries of the first project did not appear in the list because there were no adequate productive activities to enhance.

After visiting the more promising communities, four productive activities were selected: the drying of aromatic and medicinal herbs in Calmañana that is connected to the grid, eco-tourism in Serranía de Laureles and artisan fishing and ship-restoring woodwork in Laguna de Rocha. Using the methodology implemented in the first project with the due update and adaptation, several meetings with each community leaders and a carefully designed enquiry mostly related to energy issues were performed. With all the information obtained, several sustainable renewable energy systems were proposed to the communities(10,11).

In workshops (Fig. 6) that took place at each community, the results of the enquiry were shared with them and the characteristics of the systems to be installed were analyzed and discussed.
Two of the mentioned workshops are described with greater detail.

Fig. 6: Calmañana, Uruguay, meeting with the women of the communities.

At Calmañana, an agricultural cooperative of women producers of dried aromatic herbs, the dryer accepted will use solar and wood combustion energy. The size chosen is suitable for only one small producer. The materials to be used are cheap and available on site and the cooperative intends to build similar dryers for all the members in the long term.

At Laguna de Rocha, a small village where fishermen live with their families, the installation of a small windmill was proposed (10, 12). The electricity generated would be used to produce ice for refrigeration of fish, shrimp and crabs. Also the small workshop, where they build and repair their boats, would be improved by the introduction of electricity.

There is a refrigerated container on site that was donated to the community several years ago but is too large for the production scale (Fig. 7). Additionally, it runs on a diesel

Fig. 7: Laguna de Rocha, Uruguay, Meeting with fishermen and view of the refrigerated container.

generator and its operating cost cannot be afforded by these people. There is an agreement to use the container partially to stock ice.

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8. CONCLUSIONS

This paper reports only the first year of this three-year project and the partial conclusions are stated with the description of the activities of each country.

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