

## Biogas from Sewage and Residual Waters in an Educational Institution, Ecuador

### Themes

- ★ Renewable energy
- \* Innovative technology applications
- \* Linkages with other environmental goals
- ❖ Technical capacity development
- \* Education (MDG 2)

### PROJECT DATA

**Name:** Sustainable Pilot Project for Biofertilizer and Biogas production derived from Sewage and Residual Waters

**Implementing Organization:** Fundación Ecuatoriana Santa Maria del Fiat (NGO)

**Location:** coastal Ecuador

**SGP contribution:** \$24,115

**Start Date:** November 2000

### ENERGY OVERVIEW

**Energy Resource:** biogas

**Technology:** biodigester

**Application:** cooking, waste management

**Sector:** educational institutions

**Total capacity:** 12 m<sup>3</sup> of sewage processed per day; 20 m<sup>3</sup> of waste water recycled per day

**Number Served:** 1200 people (1000 students, plus 200 in orphanage)

### BACKGROUND

Santa Maria del Fiat is a large, educational complex located on the coast of Ecuador on the Chongon Colonche mountain range, in the buffer zone of the Machalilla National Park. This educational center, which includes a primary and a secondary school and university-level distance learning programs, hosts about 1000 students, 200 of which are boarding students. The school's orphanage houses another 190-220 children. The school did not have an adequate sewage system, and simply dumped biological waste and residual waste water off the cliff into the ocean, where it threatened marine biodiversity. In addition, nearby open spaces were used as dumping grounds, which caused bad odors and was beginning to contaminate the ground water and become a health hazard. The center was also making use of large amounts of water in this drought-prone region.

### PROJECT DESCRIPTION

#### Overview

This project has successfully addressed the waste problems of this educational complex through the installation of biogas units, which have at the same time reduced energy costs for cooking, and produced fertilizer for use and for sale. In addition, a water reclamation system was installed to make use of the waste water, which is re-used in toilets and in watering plants.

### Implementation

The project built a biodigester into which human and animal waste is deposited in order to produce biogas (methane), and fertilizer. During the school year, the waste of 500 people is required to operate the system effectively. During the summer, manure from surrounding farms and vegetable matter is used, and humidity and nitrogen levels are measured and adjusted as needed. The school's stoves were modified so that biogas could be used, and now the school uses 60% less butane gas for cooking. In addition, the school built a water reclamation system, which cleans soapy water for use in laundry facilities, toilets and plant watering. (Since biogas production requires a certain amount of water, more efficient use of existing water sources was necessary.) The biogas unit also produces a fertilizer, BIOL, which the school is selling, and also using in its own orchards.

There was strong community involvement in the planning and execution of this project. Representatives of "zonal committees" helped make decisions about the design of the project. During execution, students at the school participated in workshops to learn about biogas and alternative energy, and underwent training to enable them to make presentations about the use of biogas to the surrounding communities. Two biodigester units were built for demonstration purposes.

### Technology

The biodigester unit built and operated by the school manufactures methane gas from human waste, manure and vegetable matter. The waste water reclamation system makes use of a fat trap and biological filter to make soapy water usable for toilets, laundry and watering plants.

### Environmental Benefits

**Global:** The school has reduced its use of butane gas for cooking by 60% through the use of biogas, thereby reducing greenhouse gas emissions. In addition, marine biodiversity is protected, because biological waste and waste water is no longer being dumped over the cliff and into the ocean. Thus, this project addresses both the Framework Convention on Climate Change and the Convention on Biological Diversity.

**Local:** The more efficient use of water has resulted in several local environmental benefits. First, this is a drought-prone region, and is subject to climate variability due to the El Niño effect. The school is placing less pressure on water resources, and therefore is improving the region's ability to deal with droughts, and other effects of climate variability. Second, the school is planting and watering more trees, which improves the local habitat. Related to this, it is reported that the use of the fertilizer produced by the biodigester reduces problems with insects, thereby reducing the use of pesticides, and also slows the proliferation of weeds, which in turn reduces the use of herbicides.

### Livelihood Benefits

**Health:** This project has very important health benefits. Since biological waste is now placed in the biodigester instead of

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being dumped in the local area, the risk of disease is lowered, and the risk of contaminating the water supply is also reduced.

**Education:** The improvements in sanitation and the local environment, in addition to the savings in energy costs that accrue to the school, hopefully can result in an improved learning experience for the young people who attend the school.

**Income generation:** The school now needs to purchase 60% less butane gas, the price of which has been increasing. Secondly, the school now sells the fertilizer, called BIOL, and 45% of the sale revenues return to the school. Finally, the water reclamation system means the school needs to purchase less water. Apparently, the school has used at least some of these savings and additional revenues to pay someone to maintain and operate the biogas system.

### Capacity Development

The school has used the project to build the capacity of young people attending the school in understanding alternative energy use. Using model biodigesters, 11th and 12th grade students make presentations in the local community about how the biodigesters work, and in general about energy, waste and the environment.

### Beneficiaries

The primary beneficiaries of the project are the 1000 students attending programs at the school, and the approximately 200 children in the orphanage. In addition, the surrounding communities have benefited via the educational efforts undertaken by the school.

### Partners

The school has worked with the local community in establishing this project. During the summer, the school makes use of local manure and waste products to supplement the waste fed into the biodigester.

school located on the coast in an ecologically sensitive area, the environmental benefits accruing from the biogas installation and the waste water reclamation system are quite significant. There may be good potential for implementing similar systems in large institutions to achieve similar effects.

### Barrier Removal

**Technical:** This project is one of the few successful biogas projects in Ecuador. Therefore, it serves as an excellent demonstration of this technology. The simultaneous installation of a waste water reclamation system helps highlight this technology as well, which can be important because biogas production requires significant amounts of water.

**Information/awareness:** Since the project was implemented at a school, it has been particularly successful at raising awareness about the new technology. The school is strategically located, next to a religious sanctuary which attracts religious visitors and tourists. As a result, the school gets good exposure. School children have been involved in most aspects of the awareness-raising campaign, which has involved making and distributing 1000 posters and brochures and creating a video for distribution nationally and abroad. Media outreach is also planned, making use of these tools. As pointed out by the SGP coordinator in Ecuador, establishing a website would help greatly in disseminating lessons.

### Scaling Up

The school has set a target to encourage the installation of at least two additional biodigesters in the community as a result of the outreach efforts and making use of their improved knowledge about the technology.

In addition, UNICEF has expressed interest in the project, and plans to study the technical aspects of both the biogas and waste water reclamation systems for possible implementation on a much larger scale in the city of Quito.

## LESSONS LEARNED

### Environmental Management

This project illustrates the very important role biogas can play in improving waste management as well as reducing greenhouse gas emissions. Since this system is implemented in a large

## SOURCES CONSULTED

Project Record ECU/00/003, SGP Project Database,  
<http://www.undp.org/sgp>  
GEF Small Grants Programme, Ecuador: Project summary, 2003.