

New Era. **Biogas Gas Plants in Nepal: An Evaluation Study**. UNICEF, Nepal. July 1985. 87p. BSP Lib Temp No. 107.

Introduction

To check further deforestation and stop the burning of dung, the government launched a biogas plant construction programme in 1975/1976 by providing interest free loans to construct the plants. In the following year the government again offered low interest loans for constructing plants. However, because of the high cost of plant construction the programme has mainly benefited the richer section of society.

In 1980, a 50 percent subsidy of the cost of a biogas gas plant and a 50 percent loan was made available to small farmers who wished to install a plant for a group of not less than 4 families. So the name community biogas plant was coined. However, the small farmers would still have to repay the loan. This was a problem for them since they only have a subsistence level of income. To solve loan repayment, the gas from the biogas plant was used as fuel in a dual – fuel engine to drive a mill. The mill would then generate income by processing grain, and thus, the community owners would be able to repay loan money.

It is nearly a decade since the biogas plant construction programme was launched in Nepal. Nearly 1,600 biogas plants have been constructed all over Nepal, most of them in the Terai. Of these plants, 23 plants are community owned biogas plants. So it is necessary to evaluate the working condition and economics of biogas plants. Another major reason for conducting this study is to see how the subsidy programme for community biogas plants has benefited small farmers.

This study attempts to evaluate the working of the biogas plants, both individually and community owned, with emphasis on the management, maintenance, and economics of the plants. It also deals with the socio-economic characteristics of the plant owners versus non-owners.

Objectives

The specific objectives of this study are as follows:

- To examine working conditions of biogas plants, gas supply and end uses of biogas and slurry;
- To make an economic evaluation of biogas plants, including a cost analysis of community owned and individually owned plants and to compare biogas plant with other alternative energy sources in economic terms;
- To assess the saving in firewood and time for users of biogas plants;
- To examine the technical feasibility of the plants in terms of reliability, dependability, repair and maintenance simplicity, availability of skilled manpower and building materials;
- To study the institutional organisation of community biogas plants;
- To assess health and sanitation benefits and social acceptability; and
- To evaluate the improvements necessary to make biogas plants more effective and less expensive.

Approach and Methodology

Since the main purpose of this study was to evaluate community biogas plants, samples of the family owned biogas plants were taken in the same district where the community biogas plants existed.

Altogether 10 community biogas plants were selected for the study. Nine of these plants were supported by UNICEF/UNDP through Agricultural Development Bank's SFDP programme. HMG-N/USAID's Resources Conservation and Utilisation Project supported one plant. These plants' sites were from Morang in the east to Dang in the west and covered nine districts of which seven districts were in the Terai. Two sites, Kaski and Gorkha lie in the Hill districts.

Twenty families owned biogas plants were sampled (according to criteria as described below) in the districts where the community biogas plants were chosen for the study. At each community plants site, two family plants were selected. While selecting the plants it was ascertained that the plants were located far apart, established in different years and included both the drum and dome design plants. All of the selected family owned plants were operational. The last criterion was set because the data collected from the sample households would be used for cost-benefit analysis, and analysis of maintenance and operation problems, and other technical problems.

Besides, the above sample, the non-owners of biogas plants were also sampled at the same sites. These samples were included in the study for the purpose of comparing the socio-economic status of the users of biogas plants and non-users of biogas plants. An equal number of non-owners of plants were randomly sampled.

Main Findings

Despite the government's encouragement to farmers to install biogas plants by providing subsidies for community plants and loans for the individual plants, the increase in the number of biogas plants is low. The main reasons are high capital cost, low livestock holding among the farmers, no direct visible benefits and lack of adequate after-sales-service for the existing plants.

So far biogas seems only to have attracted rich people. Easy availability of loans from the ADB/N to install the biogas plants and the bright gas lamps provided by the biogas plant seem to be the major motivating factors. However, the survey found that almost half of the lamps were not working because the lamps are highly vulnerable to breakage and hence need frequent repairs.

Unusually high costs incurred for repair and maintenance of lamps seems to be one discouraging factor. Another benefit of the biogas plant is the cooking facility, which makes easier and more convenient, while saving some firewood. It was observed during the survey that many households continue to burn firewood to cook snacks and *kholey* (gruel) for the livestock). Most of the plant owners still do not visualise biogas as a direct money-saving benefit since in many places firewood is still available from the forest free, or at low cost. In addition the rich households who could afford a biogas plant have a number of servants to do domestic chores and run errands.

The major motivating factor for the establishment of the community owned biogas plants appears to be the available 50 percent subsidy coupled with the 50 percent loan on plant cost, and mill installation. The plants are primarily used to produce substitute fuel for diesel engine-powered grain-mills and only rarely for cooking and lighting. Income from the milling operation has enabled the community owners to meet loan payback obligations.

The economic analysis of the community biogas plants showed that the saving in diesel from the dual-fuel engine was not as high as expected. It was previously thought that the saving in diesel from the dual-fuel engine would make the mill more profitable since less diesel would be used. But the mills have had to be operated mostly on diesel alone, because the plant are unable to generate enough gas during the winter season, customer demand for processing grain is very high. The prevailing high consumption of diesel may be attributed to inefficiency of the engine resulting from faulty installation of the hullers and engine. As a result many community plant owners found themselves in much higher debt than they should have been. They seemed to have developed the feeling that if the mill operated on diesel fuel only, their income would have been much higher.

Biogas plants were constructed for farmers who had at least 3 to 6 large livestock (i.e., cattle and buffalo) on the assumption that an adult animal drops 10 kg to 15 kg of dung per day. In fact, the survey found that an average of only 5 kg dung was available per livestock per day owing to grazing practices and saving dung for manure to meet contingent situations. Consequently the majority of the plant owners could not feed their plants adequate amounts of dung, which resulted in low gas production. In addition, prevailing low temperatures for 3 to 4 months during winter brings down gas production to a level just sufficient for cooking once a day.

Besides the low availability of dung for the plant, the main technical problems experienced were leakage of gas through the main valve and maintenance of the lamps.

Outputs sludge, the important by-product used as organic fertiliser, was found to be used in compost form by all plant owners.

The family's servants manage most of the individually owned biogas plants. The servants do all the necessary work such as collecting dung, mixing with water and feeding.

Owner-members, usually on a rotation basis, manage the community biogas plants. All the group members contribute an equal amount of dung and output sludge is shared among them equally. Only the mill operator, who is usually one of the owners, is on the pay roll.