Viability and Desirability of Mini-and Micro-hydropower

- Dr. R.D. Joshi[18]

Introduction

Public sector efforts to introduce electrification in the rural hills began in 1975 with the establishment of the Small Hydropower Development Board. This initiative was directed mainly towards electrification of district headquarters. Thirty hydropower plants in a micro range of up to 100kW and a mini range from 100kW up to 1,000kW, with a total capacity of 5,400kW, have been completed under this initiative. These plants, however, proved to be a financial burden.

Private sector efforts in electrification of the rural hills began in the mid-seventies with the addition of electricity-generating facilities to turbine mills. These plants are designed for the electrification of sparse settlements in the rural hills. The delicensing of micro-hydropower plants (MHP) in 1984, the introduction of subsidies on the electrification components of MHP in 1985, bank financing at priority sector interest rates, development of local manufacturing capabilities, and promotional efforts by a number of agencies facilitated the phenomenal growth of MHP in the private sector. The total capacity of the MHP plants installed and being constructed is now approaching 1,900kW.

In spite of the unique promotion of MHP in Nepal, its growth is too slow to meet the government's goal of developing 5,000kW MHP capacity within the Eighth Five Year Plan period (1992/93 - 1996/97). It is in this context that the viability of MHP and the approaches for its dissemination are examined.

Viability of Micro-Hydropower Plants

Technical Viability

MHP technology is still evolving. Technological innovations introduced in MHP are recent and have not passed the test phase. The variety of poorly matured technologies used in the field may often mean that MHP looks as if it lacks credibility. However, in reality, the main innovations introduced into MHP, such as load controllers and current cut-outs, are fairly reliable. The large number of MHP installations in North America, using non-conventional hydropower technology similar to that of Nepal, bear testimony to the technical viability of MHP technology.

The current development and trials of MHP technology are geared not towards proving the possibility of alternatives to conventional hydropower technology but towards

18 Reader, Institute of Engineering.

technically-acceptable low-cost solutions. Technical failures of MHP have been reported. In many cases these failures are due to the excessive efforts to cut down the plant cost. In order to discourage such efforts, electrical and mechanical guidelines for MHP design and installation have been prepared. *Ad hoc* designs or rural technology still dominate civil works. A sizeable portion of the MHP failures are associated with civil works. To accelerate the promotion of MHP, the following measures are recommended: (a) support to R&D activities; (b) establishment of equipment testing facilities; and (c) preparation of mandatory design manuals.

Financial Viability

Entrepreneur-owned Unsubsidised MHP

The stand-alone[19], one kW Bhadaure MHP in Kaski district is an example of this type of MHP. A case study of this MHP indicated the attractiveness of this MHP with a payback period of four years. This case illustrates that there are settlements in Nepal where MHP can be financially viable without subsidies.

Entrepreneur-owned Subsidised MHP

This type of MHP is predominant in Nepal. All the MHP in the non-remote areas of Nepal are entitled to a subsidy equivalent to 50 per cent of the electrical equipment costs, whereas those in the remote areas are entitled to 75 per cent of the electrical equipment cost. A financial analysis of the add-on type, three kW Angaha MHP in Palpa district indicates the attractiveness of the project with a payback period of five years. A moderate tariff of NRs 0.75/W/month on this plant allows us to generalise on the outcome of the analysis. Add-on MHP plants are, as a rule, more financially viable than stand-alone MHP. Relatively rapid dissemination of the one kW range peltric type stand-alone[20] plants is an exception to this rule. Relatively low per kW cost, negligible construction time, relatively higher cost subsidies, and the ability of peltric sets to command a relatively high tariff explain the financial attractiveness of peltric sets. A financial analysis of a typical peltric set indicates that a tariff of NRs 1.45/W/month can give an attractive payback period of five years. The financial performance of large stand-alone installations very much depend upon end-use development. For example, the 27kW Tamghas MHP plant, which is the second largest plant in this category, is performing well due to its well developed end use, whereas the 50kW Barpak MHP is not performing well due to the relatively poor end-use development. The financial analysis of a typical large MHP (50kW) plant shows that a regular tariff of NRs 1.92/W/month yields a payback period of five years. This clearly illustrates the relatively poorer performance of stand-alone plants.

Informal Community-owned Plants

This type of plant, which has emerged mainly in Mustang, is non-commercial and community-owned. Such projects are financed by government subsidies, additional

19 MHP used solely for electricity generation.

20 Easy to install, low-cost generating set consisting of a micro peltric turbine and an induction generator. These sets are available off-the-shelf and can be carried by a porter.

subsidies from donors, which vary widely in range, contributions from community members, and bank loans, normally small. In spite of the informal nature of management, the plants are running relatively well. The success of this type of plant is attributed to the homogeneity, cohesive nature, and relative affluence of the community which is characteristic of Mustang.

With these plants, once the loan is repayed, the tariff is fixed so as to cover the salaries and the day- to- day maintenance costs. Whenever the need for costly repairs arises, the funds required are raised from the community. The sustainability of this type of plant depends, to a large extent, upon the viability of the community structure itself. More experience and analyses are required to arrive at a firm conclusion regarding the wider applicability of this type of approach.

Formal Community-owned MHP

The Ghandruk MHP plant, commissioned in 1992, is the first plant of this type. Recently, a second plant of this type - a 100kW Siklis plant - has been commissioned. The Ghandruk plant was financed through contributions from donors (CIDA and ACAP, the promoters, 57.5%; government subsidy, 12.5%; cash and labour contributions from the community, 17.5%; and bank loans, 12.5%).

The Ghandruk plant plans to raise seven per cent of the plant cost annually from tariffs. The revenue will cover the salaries - 2.5 per cent, maintenance fund - 1.5 per cent, and the loan repayment/capital replacement fund - 3.0 per cent.

At present, the tariff is NRs 0.50/W/month for domestic consumers, NRs 0.75/w/month for hotels, and NRs 0.25/W/month for daytime industrial loads. The plant is expected to remain sustainable if the tariff increment is kept in tune with inflation. The plant is formally managed by an Electrification Committee. This type of MHP requires relatively large subsidies, and the institutional viability of such MHP plants is still to be tested.

Desirability of Micro-hydropower Plant Promotion

Affordable energy is an important prerequisite for economic development. In the rural hills, 99 per cent of the energy requirements continue to be met from biomass, the supply of which is not sustainable. Therefore, energy scarcity is regarded as one of the constraints to rural development. For the remote hills, MHP is the best alternative for supplying energy for rural development, and the reasons for this are given below.

- Biomass is not convenient for providing motive power.
- Solar and wind power are not competitive.
- Fossil fuels are not competitive due to the high transportation costs.
- The supply from the grid is not competitive due to dispersed and small loads.

Rural electrification efforts with private MHP in Nepal have been encouraging from the rural economic development perspective, because it has become a common practice for MHP entrepreneurs to integrate end uses with the plant. Nepalese MHP owners, with access to electricity, are gradually becoming the driving force behind rural development. It is indeed an attractive proposition to pursue rural electrification as a means of rural development, because of the immense interest of the rural population in rural electrification and mobilisation of considerable local resources for this purpose.

Approaches to Micro-hydropower Plant Promotion

Ownership

Compared to community ownership, ownership by entrepreneurs is a more efficient and sustainable mode of MHP operation because community-owned MHP requires higher subsidies than entrepreneur-owned MHP. The government's subsidy policy does not differentiate between entrepreneur- and community-owned MHP. The development of community-owned MHP is a result of the efforts of the non-government sector. A workable and sustainable form of community-owned MHP is still to evolve. In this respect, the existing community-owned MHP plants are valuable and should be closely monitored.

Plant Type

Stand-alone plants, compared to add-on plants, are capable of making a greater contribution to rural development by providing energy for productive activities. These plants, as indicated earlier, need greater financial support than add-on plants. Therefore, stand-alone plants should be promoted by providing additional financial support.

End Uses

The development of end uses is crucial to the sustainability of stand-alone plants. End use promotion should receive the same priority as MHP promotion. Wherever feasible, MHP entrepreneurs should also own end uses. As a rule, the capacity of the plant should be compatible with the end-use load.

Promoting Agency

Until recently, the ADB/N assumed the overall responsibility for MHP promotion. Now, it is limiting its role to banking, and no other agency has taken over the overall responsibility from the bank. Thus, MHPs have suffered from a lack of patronage. The designation of an appropriate agency to assume the overall responsibility for MHP promotion is vital for its proper dissemination.

Subsidy

Financial viability is site-specific. The existing subsidy policy divides Nepal into two zones - remote and non-remote. This division, however, is too broad to make the subsidy policy effective. It would be more desirable to divide Nepal into territorial units, according to economic development; this could have a decisive impact on the financial viability of MHP. 'A Study on Economic Viability of Micro-Hydropower Plants' (WECS, 1994) recommends that 50 per cent of the electrical components' cost be financed through a revolving fund throughout Nepal and, for remote areas, an additional support of 25 per cent of the mechanical components' cost should be financed through the fund.

Other Support

For the desired dissemination of MHP, an increase in financial support should be complemented by infrastructural support such as service centres to support MHP technically, manpower training, consumer education, research and development activities, and equipment testing facilities.