Micro-hydro: Institutional Issues

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Present Energy Scenario in Nepal

The energy situation in Nepal is characterised by a very low per capita energy consumption of about 14 GJ. Since economic development and the standards of living of the people are directly proportional to the per capita energy consumption, significant increase in energy consumption is necessary to meet the national goals.

The total energy consumption in the year 1992/93 was estimated at about 270 million GJ. The energy consumption growth in the past decade has been about 2.4 per cent per annum. The residential sector consumes 91 per cent of the total energy. About 91 per cent of the energy demand is met by traditional sources — fuelwood, 68 per cent, agricultural by-products, 15 per cent, and animal waste, eight per cent. The share of petroleum fuel, coal, and electricity in the total consumption are estimated 7.2, 1.0, and 0.9 per cent respectively.

A Case for Alternative Energy

Nepal's electricity demand is steadily rising, at the rate of 14-15 per cent per annum but the electricity supply is lagging behind the demand. The deficit is likely to continue to increase until additional supplies from new projects are realised.

Nepal spent about 24 per cent of its earnings from merchandise export in 1992/93 in the import of fossil fuel. This indicates the limitations of substituting traditional fuel sources by fossil fuels. High transportation costs and poor affordability in the rural hills and mountains are additional limitations to substituting traditional sources with fossil fuels.

Heavy reliance on fuelwood has caused irreversible environmental damage in the country. It has also increased the work burden on 78 per cent of the rural women and a greater number of children have to now allot 20 per cent of their time to fuel collection. Moreover, the dwindling supplies of fuelwood have forced people to burn larger quantities of dung and agricultural residues for fuel, thereby depriving the soil of valuable nutrients and organic conditioning materials. As a result, soil fertility has declined drastically.

The present energy situation must be improved to allow the country to achieve its development targets. There is an urgent need to gradually move away from forest-based energy sources so as to maintain the ecological balance and make energy resources

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sustainable. One viable option, among many others, would be to resort to alternative energy technologies (AETs) which have the ability to perform effectively under arduous conditions. Micro-hydro, an alternative energy source, has proven to be a viable source of electricity and shaft-power in the rural areas of Nepal.

General State of AET Development and HMG Policy

There has been a number of efforts to develop AETs, particularly in the private sector. Several of donor agencies have been supporting various AET projects. Also, an appreciable infrastructure for R&D, fabrication, promotion, and dissemination has been developed, especially in the field of micro-hydro and biogas. In addition, positive developments in solar energy cannot be ignored.

In the past, HMG/N's policies on AET development have been criticised for inconsistency and irregularity. Lately, the importance of alternative energy has been felt at the policy- and decision-making levels, as reflected by the Eighth Five-Year Plan. This plan contains policies and programmes, including provisions for an institutional set-up for MMHP. The Eighth Plan anticipates the investment of NRs 1.61 billion for AETs, of which HMG/N will contribute NRs 0.33 billion. The highest share of the government budget for AETs is for biogas (NRs 250 million), followed by micro-hydro (NRs 50 million).

Main Institutions Involved in Micro-Hydro Development

Government Agencies

The ministries directly involved in the MHP programme are the Ministry of Water Resources (MOWR) and the Ministry of Finance (MOF). Institutions such as the National Planning Commission and the Water and Energy Commission Secretariat are responsible for policy-making and planning related to the development of the energy sector, including micro-hydro.

Semi-government Agencies

Agricultural Development Bank (ADB/N)

Among the semi-government institutions, the ADB/N, with its 238 field offices, 395 Small Farmer Development Projects (SFDP), five training centres, and two Appropriate Technology Units (ATU), stands as a principal development and financial institution. Although its activities are mainly in the agricultural and rural credit sector, it is an established and active promoter of AET. It has already invested more than 80 million rupees to install more than 80 per cent of the total number of micro-hydro installations for agro-processing and rural electrification in the country. The government subsidy on micro-hydro-based rural electrification is also channelled through the ADB/N. Until recently, the ADB/N played a key role in the promotion of MHP. However, it has withdrawn its overall support for MHP and limited its role to financing only.

Nepal Electricity Authority (NEA)

NEA, the only public utility responsible for generating and distributing electric power throughout the country, also supplies electricity to isolated areas, through a number of small hydropower plants. It was established in 1985 after merging the Nepal Electricity Corporation and the Electricity Department of the HMG/N. The Small Hydropower Department of the NEA is responsible for promoting MMHP. NEA previously supported the use of locally-manufactured equipment. However, due to low efficiency, this approach has been abandoned.

Non-government Organisations (NGO)

Among the numerous NGOs in the country, the Annapurna Conservation Area Project (ACAP) and the Association of Micro-Hydro Manufacturers (AMHM) are actively involved in the development of micro-hydro in Nepal. ACAP is a project of the King Mahendra Trust for Nature Conservation (KMTNC), a leading non-government environmental organisation. ACAP has successfully implemented a number of MHPs in the country. They include the 2.5kW Khuldhighar MHP plant, the 50kW Ghandruk MHP plant, and the 100kW Sikles MHP plant.

International Non-government and Donor Organisations

As emphasised in the previous sections of this report, part of the credit for the present state of MMHP development in Nepal goes to various international donor agencies and international non-government agencies. These agencies are listed below.

1. United Mission to Nepal (UMN)
2. Swiss Federal Institute of Technology
3. German Technical Cooperation (GTZ)
4. Association for Context Appropriate Technology (FAKT)
5. Swiss Association for Technical Assistance (SATA)
6. United States Agency for International Development (USAID)
7. Intermediate Technology Development Group (ITDG)

Private Companies

Much of the development in the field of MMHP in Nepal is a result of entrepreneurship of private sector organisations. They were able to develop MMHP because of the support of ADB/N and international donor communities. They were also able to generate support from local entrepreneurs who showed a keen interest in installing MHP. A list of the main private sector institutions involved in MMHP is given below.

- Balaju Yantra Shala
- Nepal Yantra Shala
- Kathmandu Metal Industries
- National Structure and Engineering Company

- National Power Producer
- Thapa Engineering Industries
- Agro-Engineering Works
- Nepal Machine and Steel Structure
- Butwal Engineering Works
- Development and Consulting Services
- Nepal Hydro and Electric Private Limited
- Centre for Rural Technology

Research Institutes

Research Centre for Applied Science and Technology (RECAST)

RECAST has been involved in the improvement of traditional water wheels, the development of MPPU and low lift water pumps, the replacement of cross-flow turbine blades with high density polyethylene (HDP) material to lower the cost of turbines, and so on.

Royal Nepal Academy of Science and Technology (RONAST)

RONAST is involved in the improvement and promotion of appropriate indigenous technologies. It has, so far, not played a significant role in mini- and micro-hydro technology dissemination. It is presently associated with the Information Network on New and Renewable Energy Resources and Technologies for Asia and the Pacific (INNERTAP) to provide information on renewable energy in Nepal.

Institutional Issues in the Development of AETS

Implementation Aspects

At present, all the surveys and design work for MHP development are being carried out by the manufacturers. An outcome of this approach is reduced installation costs. In the drive to achieve lower per unit costs with little or no involvement of professionals, undesirable compromises in survey and design are often made which affect the overall output, reliability, and safety as well as the environment. Furthermore, there is no institutional set-up to regulate equipment quality standards. There is also lack of proper documentation on designs, equipment specifications, and operation and maintenance guidelines.

Management

The financial management, plant operation, and maintenance capabilities of local entrepreneurs are very poor. Proper book-keeping is practically non-existent. The plant owners' perceptions of the value of training and motivation of their employees are limited. The educational backgrounds and level of training provided by the manufacturers to the plant operators vary considerably. In this respect, private utility

MHP differs strongly from NEA-owned MHP. All NEA-owned MHP plants have at least a formally educated and trained technician supported by a large number of foremen, helpers, and electricians, whereas local MHP entrepreneurs act as, or depend on, a single operator who is also responsible for maintenance as well as administrative matters.

Water Rights

Water management is a burning issue in MHP plants. Several MHP plants have failed due to water rights' problems. For example, eight per cent of the turbine mills have failed due to riparian conflicts alone. *Chatta(s)*, in general, do not interfere with irrigation. Turbine water mills, which have longer canals and longer duration of operation, seem to interfere with the use of water to some extent. Conflicts about turbine mills have surfaced in this respect. MHP plants normally have long canals and the possibility of water-use conflicts between MHP and irrigation is greater than between turbine mills and irrigation. Water rights' conflicts are often exacerbated when the irrigation water users and electricity users are different.

Ownership

Three types of ownership have emerged in MHP – individual, community, and formal company. Individual ownership is predominant by far. In this type of ownership, the sense of purpose is clear. Therefore, in general, such plants are relatively better-managed in terms of operation and maintenance. The only effort to form a company with private participation was made by SCECO (Salleri-Chialsa Electrification Company).

Promotional Activities

In order to improve the economic viability of MHP, it is necessary to integrate promotion of end uses along with promotion of MHP, at least during the initial stages of development. This fact was well recognised right from the initial stages of MHP promotion. However, there are no institutional arrangements to cater to the promotional activities required for MHP development, apart from a few scattered efforts by private entrepreneurs and NGOs.

Financing

Subsidies from the government and assistance from international donor agencies are important inputs to MHP development. Loan assistance from commercial and development banks has played a critical role in achieving the present state of MMHP development in Nepal. However, lack of coordinated efforts on the part of donors, bureaucratic delays, and inconsistent government support have made achievement of the desired target, of making MMHP financially sustainable, difficult.

Technical Support

The lack of adequate technical support, in the form of training, research, information dissemination, and quality assurance, has posed impediments to MMHP development. The absence of an institution to deal specifically with alternative energy development

was felt for a long time. Consequently, a coordinating body consisting of representatives from various institutions involved in AETs, was formed under the Water and Energy Commission Secretariat (WECS). However, it has remained practically ineffective due to various reasons. The existing training programmes are confined to building equipment related to MHP units. In these training programmes marketing aspects have not been dealt with. Most manufacturers train their clients during the MHP installation process. Instructions and the training imparted to ensure the smooth operation of the plants seemed to be inadequate .

Institutional Efforts

The ADB/N played a pivotal role as an executing agency translating government plans and policies relating to MHP into action. Unfortunately, in recent years, it has limited itself financing only to MHP. On the technology development side, RECAST, Development Consulting Services (DCS), Intermediate Technology Development Group (ITDG), Kathmandu Metal Industry, and some manufacturers are active from time to time. The development of the Peltric Set, *Bijuli Dekchi*, and so on are some of the important recent developments. The proposal to establish an Alternative Energy Promotion Centre in the Eighth Five Year Plan is a positive indicator in this respect.

Recommendations

MHP, by virtue of its various characteristics, should develop rapidly in Nepal. However, there are a series of constraints that obstruct its rapid development. Most of the problems can be directly linked to the lack of an institution dedicated to its development. A Central Micro-hydropower Promotion Centre (or a separate wing in the envisaged Alternative Energy Promotion Centre) within the government organisation, but as autonomous as possible, should be formed to coordinate the development of MHP. The main responsibilities of such an institution should include:

i) coordination and facilitation of research and development,
ii) preparation of guidelines and manuals for all MHP-related work,
iii) quality control,
iv) facilitation and coordination of training programmes, and
v) facilitation of financing mechanisms.