

Chapter 1

Introduction

The energy needs of the people of the Hindu Kush-Himalayan (HKH) region are not being met adequately. Traditional energy resources, such as fuelwood, are dwindling fast, and more modern resources are difficult to provide as a result of the many constraints. The per capita energy usage in these areas is very low and not sufficient to support initiatives to improve living conditions, create employment and income enhancement opportunities, and contribute towards overall development such as infrastructural development. Suitable and reliable energy resources need to be developed and implemented in this area, keeping in mind the specific features of the mountain region, which differ significantly from those of the plains or even hilly areas nearer the plains. The level of development in this region is very low, the people are poor, access is difficult, the population is scattered, and awareness and know-how about machinery are limited. Energy sources and systems for these areas must be reliable, and, preferably, such that the local population can easily adopt and manage them without outside assistance. Micro-hydropower (MHP), which builds upon the traditional technology of water wheels (*ghatta[s]* or *gharat[s]*), is now recognised to be the most suitable, environmentally-friendly option, at least cost, for many such areas.

Private, community-based, and decentralised MHP installations are now meeting energy needs in many mountain areas in China, Nepal, and Pakistan to a significant extent. While appropriate support arrangements have been put into place in China, they are highly inadequate in Nepal and Pakistan. As clearly recognised during various meetings, consultations, and field studies, appropriate and adequate institutional support and interventions need to be designed and provided to the different professionals engaged in various aspects of MHP implementation. Without this support, the performance and viability of many MHP schemes are unlikely to be satisfactory. This is because these MHP schemes are designed, manufactured, and installed indigenously and are owned, managed, operated, and maintained by local people in remote areas.

The main needs identified were related to the improvement of quality and performance through development and dissemination of training programmes, manuals, standards and guidelines, back-stopping (provision of back-up support) for and advice to the managers/operators, and proper maintenance and repair systems for MHP plants. In order to try and fulfill these needs, ICIMOD has attempted to design and implement quality training programmes and to prepare and disseminate appropriate information manuals on various aspects of MHP implementation. In all, four such manuals, on site survey and

layout, design and manufacture, installation, management and operation, and maintenance and repairs, have been prepared for technicians and owner-managers engaged in the implementation and operation of MHP plants in the HKH region. This manual is one of this series. These activities are part of a project designed and implemented by ICIMOD and supported financially by the Norwegian Government.

1.1 About this Manual

This manual is mainly intended for owner-managers and operators of private MHP plants who mostly have to rely on themselves or local technicians to identify any malfunctions in the equipment and to carry out subsequent repairs. ('Private' is taken here to mean all plants not owned or managed by a government body or a central electricity utility and to include community and entrepreneur owned plants.) Many of these owners or operators are unable to carry out repairs properly as a result of a lack of expertise and knowledge, of proper tools and instruments, and of workshops and allied equipment. The wide variety of equipment and different designs that exist in the HKH region are further impediments. (In Nepal alone, three distinctly different designs of crossflow turbines are being produced by manufacturers as a result of a lack of agreed standards or any form of supervision or coordination.) Nevertheless, most design concepts and many important components are the same. This manual is intended to provide the basic information needed for diagnosing and assessing malfunctions in MHP plants, deciding on the course of action for repairs, and carrying out many basic repairs, including assembly and disassembly, so that the owners/operators of such plants are able to carry out or organize repairs properly. Many repairs will still have to be referred to properly qualified and equipped technicians and workshops, and some suggestions for repairs at these places have also been included.

One of the keys to reliable operation is routine, preventative maintenance, i.e., regular inspection, lubrication, cleaning, and replacing of worn items; and responding to concerns identified during inspections immediately rather than waiting for machinery to break down before taking action. If minor repairs are not carried out in time, the plant may break down completely, resulting in significant additional cost, loss of income as a result of the delays in repairing the affected part, and possibly more damage to other more expensive parts.

One of the purposes of this manual is to provide a list of items for recommended appropriate, routine preventative maintenance for a typical MHP plant and to give details about how to implement it. Manufacturers' maintenance schedules and the periodic checks described in this manual must be carried out if the machinery installed is to give reliable service for a long time. Further information on regular inspection is provided in another manual in this series entitled 'Management and Operations Manual'.

Even when a preventative maintenance scheme is carefully implemented, occasional break-downs will still occur. Sometimes after repairing or replacing parts of the plant, difficulties may be experienced in getting the new component to function correctly. To assist in problem solving, many of the common problems encountered in MHP plants are listed in this manual, together with their causes and recommended corrective actions.

In some installations, agro-processing machines, such as oil expellers, rice hullers, and flour grinders are also driven by the MHP plant (either directly via an intermediate shaft or through electric motors). However, this manual does not cover the maintenance and repair of end-use machinery other than the electric generator.

Basically, the information provided in this manual is applicable to plants with a capacity of up to 100kW. However, plants larger than 50kW usually incorporate more safety related equipment and also need sophisticated tools and workshop facilities for repair. Therefore this manual is more relevant for smaller plants with a capacity of less than 50kW. Most of the private and community-owned plants in Nepal, Pakistan, and India fall within this range, and the manual should be of use for the more than 1,000 such plants that already exist.