

Chapter 9

Management, Operation and Maintenance

9.1: Background

Regardless of who has ownership of an MMHP plant, what is important is that it is kept optimally operational and that the tariff rates are affordable to consumers. It is not necessary for the owner and the manager of the MMHP plant to be the same. In cases of entrepreneur-owned MMHP plants, it is normally the entrepreneur himself who manages the plant. In community-owned plants, attempts to manage the MMHP plant directly by the committee have not generally been successful. A more manageable system is to contract the management out to an entrepreneur or a professional/suitable manager.

Management, operation, and maintenance (MOM) of MMHP plants, especially in the informally-managed sector, have been weak links in the use of MMHP plants to meet the energy needs of rural areas. The management has largely been *ad hoc*, unsystematic, and inadequate. This has led to the following problems.

- Waste of resources: bank loans, subsidies, entrepreneur's/community's time, effort, and money
- Inconvenience and hardship to users: could mean going back to manual processing or travelling further to another mill. In cases where electricity is supplied, it means going back to inferior quality kerosene or resinous wood lighting. In some cases, the bulbs or wiring are damaged.
- A bad name for the technology

Many difficulties of this nature have been reported, and they are largely due to the lack of skill and knowledge on the part of the MMHP plant managers/operators. External intervention and support can improve the situation and lead to better managed and run MMHP plants. The main areas in which improvements can be made are given below.

- Training in management, operation, maintenance, and repair
- Monitoring, assessment, feedback, and improvement
- Technical support and backstopping, viz., stocking of spare parts, technical advice, and information regarding maintenance and repairs

9.2: Various Aspects of Management

In addition to the technical aspects of running an MMHP plant, there are managerial aspects that are just as important for successful operation, as described below.

Load management. Managing the load properly increases the revenue from the MMHP plant, maximises its use, and could lead to lower energy costs for the consumer. The energy produced, and hence the load factor of the MMHP plant, is an easily measured quantity (for electricity). Finding new and useful ways to use the power available and to increase the

consumption of the available energy by the existing customers should be a major goal of the MMHP plant management.

At the start of operations, the plant factor of the MMHP plant will be low. Sustained effort is required to increase electricity sales to earn extra revenue for the MMHP plant, thus improving its finances. As there is no 'fuel' cost there is little extra cost in selling as much power as the MMHP can generate. New and imaginative ways of selling energy need to be developed.

For MMHP-operated agro-processing, careful load management can reduce costs and provide improved services. For example, in the slack season, users can be requested to come only at designated times so that the machines run continuously for a few hours rather than having to stop and start as customers arrive. This also makes more efficient use of the operator's time rather than it being wasted in waiting for customers.

Accounting/book-keeping. This is an important but often neglected aspect of MMHP. In Nepal, many of the turbine mills have had difficulties with financial management of the plant due to, among other reasons, lack of proper book-keeping. This has led to mismanagement of the MMHP plant's income, failure to pay back bank loans, and inability to carry out essential repairs due to lack of funds.

Accounts of services provided need to be kept (e.g., grain milled, oil expelled, etc), income, and expenditure. This will assist in financial planning, making loan repayment schedules, and working out how much profit the MMHP plant is making.

Public/customer relations. Good public and customer relations are essential for running an MMHP plant well, especially a privately-owned scheme. An MMHP plant providing electricity is a natural monopoly and a bad public image could lead to non-payment, refusal to take up connections, sabotage, etc. In cases where plants have been erected with partial government subsidies, failure to have good public relations could lead to resentment on the part of consumers; in such cases the public may believe that the entrepreneur is profiteering, taking undue advantage of his monopoly situation, misusing public funds, etc. These views might appear to be irrational, but good public relations will assist greatly in allaying suspicions and getting cooperation from customers.

Elements of good public relations are reliable and prompt service at fair prices and good behaviour. Careful attention to the customers' needs would also be helpful in this respect.

Expansion/improvements. As the load and usage grow and as the equipment and structures begin to wear, investments will have to be made to keep them in good working condition and sometimes even to replace them. This will also need to be planned for and money needs to be set aside for such work.

Reliability of supply. As the consumption of electricity increases and people get used to using electricity, it becomes more and more important to have a reliable supply of electricity from the MMHP plant. Consumers will become less tolerant to interruptions in the supply as they become habituated to and dependent upon a regular electricity supply. Supply reliability is important both in public relations' terms and in terms of income for the MMHP. There have been reports that the consumers were reluctant to pay the bills, because the electricity supply was poor quality or unreliable.

Revenue collection problems. An MMHP plant with low downtime, reasonably priced rates, a reliable supply, and good public relations should have few problems in revenue collection. Labour services in lieu of cash payment of bills is one possibility of getting around the problem of lack of cash resulting in non-payment. This has advantages for the MMHP owner as well in that he has available labour resources in case of emergencies, or at times of labour shortage.

Training/improving management and operating skills. This is an area that has received very little attention, even though its importance is accepted by all. Operators and managers need to be trained properly on different aspects of MMHP such as operation, maintenance, accounting, end uses, how to increase electricity sales, public relations, technology advances, etc. Training should be scheduled in such a way that there is least inconvenience to customers.

Planning for maintenance shutdowns. There should be as few unscheduled shutdowns of the MMHP plant as possible. This requires careful management and planning. Customers should be informed in advance of the shutdown and the period should be chosen so as to cause the least inconvenience to users. The role of planned, preventive maintenance is crucial in reducing downtime as a result of breakdown of machinery. Operators and managers need to be trained in this concept. Replacing equipment and components before they cease to function reduces downtime to a minimum.

Salaries and payment to employees. Salaries made to operators and other employees should be adequate and in line with the going rate for similar work. Inadequate salaries could lead to a high turnover in operators, and this will affect plant operations badly. Employment and payment terms should be clearly understood and accepted by both sides.

9.3: Operation

In operating an MMHP plant, there should be a set of routine procedures for starting, stopping, and load connecting for operators to follow. Weekly, monthly, six-monthly, or annual maintenance schedules must be part of the O&M manual. Standard responses to normal operation and maintenance problems should also be spelled out in the O&M manual. There should be a minimum of situations in which the operators (or the manager) do not know the correct response to a problem. The O&M manual need not necessarily be in book form. For small plants, wall charts with pictures and diagrammes showing the various steps and procedures would be adequate.

9.3.1: Log Book

It is also essential for all MMHP plants to maintain a log book. A correctly filled out log book makes it possible to check how the plant is operating, to analyse problems, and to schedule shutdowns at the least inconvenient time for consumers. Having to fill out a log book and to record all the actions taken or not taken ensure that the required work gets done.

The log book should contain at least the following information. Time, date, voltage, power used by consumers (for ELC), any unusual event, any special action taken in case of breakdown or malfunction, temperatures of machines, and operator's signature.

9.3.2: *Safety*

The powerhouse should be well lit, clean, and free of clutter. Unauthorised persons should not be permitted to enter the powerhouse. Moving parts, such as belts, pulleys, and flywheels, should have guards around them so that they are not easily touched.

The operators must not wear loose clothes and jewellery or have loose long hair that might get caught in the machinery.

9.3.3: *Sensing Signs of Malfunction*

While operating the machines, operators must always remain alert to any unusual sounds, temperature rises, and other indications of possible malfunction. An early response to malfunctioning could save the plant from more severe damage and, consequently, great expense.

9.3.4: *Adopting a Suitable Operating Procedure*

The powerhouse equipment is operated according to a procedure given by the manufacturer, and this procedure should be followed by the operators. Routine actions, such as starting, stopping, connecting the load, normal shutdown, and emergency shutdown, should follow set procedures. These procedures need to be practised and followed by the operators.

9.4: **Maintenance**

9.4.1: *Regular Maintenance*

MMHP plants that are well maintained have very few or no unplanned shutdowns. The maintenance schedule should be organised so that it causes the least inconvenience to consumers. Good maintenance practices by properly trained and skilled operators reduce downtimes and the need for repairs.

9.4.2: *Repair and Maintenance Manuals*

All MMHP plants should have an O&M manual also, which can be referred to when needed, containing information on repair and maintenance. The repair and maintenance section must have procedures for dismantling and assembly of the equipment, how to identify components for replacement or repair, and special handling procedures, if any. Provision of the manual should be part of the supply contract with the manufacturer. The manual should have the following information.

Spare parts. List of spare parts with their names, specifications, and where they are available. Recommendations on which spares to keep in stock.

Daily, monthly, and annual maintenance. List of work that is to be carried out at different time intervals and the format for recording the same.

Records to be kept/powerhouse log. List of readings and observations to record and the format.

Trouble shooting guide. The O&M manual must have a trouble shooting guide which deals with common faults, their diagnosis, recommended actions to be taken, and instructions on where and how repair personnel can be contacted.

9.4.3: Regular Maintenance Inspection

A sample portion of a maintenance schedule is given in Table 9.1. below.

Table 9.1: An Indicative Maintenance Schedule for MHP Plants

Maintenance Schedule	All year	Drought	Floods
Weir and intake 1. Check for boulder damage 2. Check for leaks, undercutting		monthly monthly	daily daily
Regulating sluice 1. Check operation 2. Grease screw 3. Adjust	monthly monthly	as needed	as needed
Settling tank 1. Grease flushing sluice screw 2. Drain and clean	monthly	monthly	daily
Channel 1. Inspect for leaks, overflowing 2. Drain and clean 3. Clean culverts 4. General repairs	every 3 months annually	weekly monthly	daily daily
Forebay tank 1. Clean screen 2. Grease valves 3. Drain and clean	daily monthly	monthly	daily
Penstock 1. Visual check for flange leaks 2. Repaint 3. Visual corrosion check 4. Inspection of supports	monthly every two years yearly 6 monthly		

9.5 Spares, Tools and Consumables

The stock of spares, tools, and consumables to be kept by an MMHP plant depends on its access to materials and technicians, the degree of reliability the plant needs to provide, and the amount of money available. If conditions permit, spare parts' stock for five years of operation should be kept; otherwise, at least one set should be kept.

For those spares that are not kept at the plant, information on who supplies them, how much it will cost, and how to acquire them must be easily available (specifications, address of agents/suppliers, etc).

The MMHP plant must keep a full set of hand tools like spanners, screwdrivers, files, hammers, hand drills, etc. The range of tools to be kept should be carried out in consulta-

tion with the manufacturer and he should give a quotation for this along with the equipment. The full list should also be included in the manual.

It is not advisable to keep consumables stocked for more than one year's requirement. A system of regular replenishment is preferable to keeping a large stock, as the chances of spoilage, pilferage, and so on increase with the quantity of stock kept.