

## 4. HIGH PRIORITY ISSUES OF MMHP

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### **Policies and Government Support**

During Session 5, a number of experts presented their views regarding some important aspects of MMHP. The first speaker, Mr. Alex Arter of SKAT, talked about 'Policies and Government Support for the MMHP Sector'. He stated that a policy environment conducive for promotion of MMHP usually has three possible components; i.e., policies, legislation, and material incentives. While there may be a considerable amount of stated support, as was the case in Nepal, implementation practices could greatly influence the outcome of policies. Policy objectives for MMHP development were watershed management, coordination with the overall energy policy, and other macro-policies such as agriculture, rural development, and industries. Other objectives could be promotion of MMHP use and encouragement to private sector participation. The main thrust in the legislation had been deregulation aimed at inducing private investors, allowing 'market' tariffs, and simplified licensing. Other useful legislation mechanisms were waiving water-use royalties, access and sale of electricity to the grid, and fiscal incentives. In some cases 're-regulation' was introduced in the garb of deregulation. Incentives might also become dis-incentives if proper care was not taken. In practice, the incentives might also not be certain and consistent. Sometimes, implementation practices had been such that financial risk to the investor had not decreased and many conflicts remained. Consequently, Mr. Arter concluded that the situation regarding private investment in the MMHP sector was still in the embryonic stage and a financial payback dilemma persisted. Similarly, the role of donors and development agencies was uncertain. The main concern for forums, such as this meeting, was to discuss ways and means of making MMHP more competitive. During the discussions it was asked what were the main reasons for the policies not achieving the intended objectives. The response was that usually the objectives were not clear and implementation practices were problematic.

### **Indigenous Technology Issues**

Mr. Allen Inversin then spoke on the subject of 'Indigenous Technology Issues'. He stated that many technology-related issues could significantly affect the viability and attractiveness of indigenous MMHP options and could affect the opinions of the decision-makers. First among the important issues raised was costs vs quality; did the effort to reduce the cost of indigenous technology actually diminish its efficiency and reliability and thus discourage further dissemination? Mr. Inversin went on to highlight various aspects of the issue, quoting some examples. Lower costs were important, however, the quality and life were more important and, if *lowest life-cycle costs* were estimated, more reliable but expensive/imported turbine equipment could be a better alternative. If this line of thought was to be countered, a careful survey of a proper sample of installations must be undertaken to assess the true costs of technology. Under these circumstances, there was a need to put a mechanism into place to ensure quality control, including replacement/correction of flaws observed in installed equipment. The second issue raised by Mr. Inversin concerned 'Honesty in Labelling'. In many cases the rated outputs of MMHP plants were unattainable. Most probably this was due to the lack of expertise of the manufacturers/installers. However, such false claims could cause discredit for the technology as a whole as well as disillusionment of the owners. To deal with such circumstances, a special organisation could

be authorised to test the equipment for claimed outputs. This organisation could also set performance standards and enforce guarantees from the manufacturers to their clients.

Mr. Inversin also suggested that the traditional low-cost designs of civil works must be investigated to determine an optimum trade-off. He, however, warned that increased use of concrete might not solve the problem. Appropriate guidelines must be drawn up by the experts in the field. Governments had been variously criticised for not taking appropriate action to promote MMHP. However, a survey might be useful to find out whether the lack of interest was not due to the fact that they were not adequately convinced about the viability of the technology. Studies could reveal that the necessary convincing of the concerned agencies, based on facts and other supporting material, had not been attempted. Listing objections/arguments from the government side could also be helpful in developing arguments and also in undertaking other efforts to make MMHP more viable. Mr. Inversin further pointed out that complementary efforts were usually missing in the implementation of MMHP projects. Such efforts should be in the form of R & D for end-use development and should include appliances, preparation of various guidelines/standards, organising of training programmes for different groups, and establishing working relationships with other relevant government agencies. He felt that a centralised organisation to support MMHP development could play a better role by making complementary efforts as well as arranging funding.

The follow-up discussions mainly dwelt upon indigenous technology issues. It was observed that indigenous development helped an area in other ways also. The response was that indigenous technology development was not being rejected. Studies were suggested to assess how cost-effective indigenous technology was.

### **Plant Utilisation**

Mr. Reinhold Metzler then presented his views about increasing the plant factor through better utilisation of available power. He stressed the need to develop attractive end-use applications and then develop the power from MMHP to meet the needs. He gave the example of the role of oil refineries in the development of automobile vehicles around the turn of the century, in order to bring about increased sales of refined oils and stated that end-use development was also very important for the promotion of MMHP technology. Governments should be persuaded to support such endeavours and provide the necessary incentives, especially for productive applications such as rural industries. In this respect, the quality of electricity and the reliability of supply were very important.

During the discussions that followed it was suggested that end uses must be financially rewarding for people in particular areas. Some people had been using MMHP electricity to distil brandy from apples. Another important end use in many countries was selling electricity to the grids. The possibility of building ropeways in Nepal could also be explored.

### **Training and Promotional Aspects**

The fourth speaker, Dr. Adam Harvey, then spoke about the training aspects involved in the successful and sustainable promotion of micro-hydro. He remarked that effective institutional support was necessary. Training programme(s) would be effective only when the system they taught was effective. Training was needed at every level; at the level of

senior decision-makers, the purpose would be to inspire confidence and win over the support of key individuals. Based upon the past experience gained by the Intermediate Technology Development Group (ITDG) in the U.K., Nepal, and Sri Lanka, the following could be considered as 'Golden Rules': thorough preparation over a long time; use of participation techniques; worked examples on important topics; very careful selection of participants to ensure that they were really the concerned decision-makers and would remain so for some time to come; clear selection and statement of the overall objectives, as well as the objectives of each component of the course; and follow up training and networking activities. Dr. Harvey then presented a set of strategies as sub-objectives for training. These included accredited feasibility studies; a participative planning process encompassing different energy options; commitment to an infant programme; availability of funds (credits, local investment, subsidies) and accurate cost projections; ownership and management of schemes by accredited bodies; establishment/existence of authorised coordinating agencies for rural energy in each country; and development of end uses by affiliated agencies. The above sub-objectives could be refined to develop various components of the course and perhaps a series of courses for people having different roles.

It was necessary to convince the decision-makers about the value of technologies that needed subsidies. In this respect only those schemes ought to be accepted that had sufficient local business and revenue. Many other arguments had to be thought over and developed. During the discussions, the idea of attempting to convince decision-makers was supported; however, it was also pointed out that bureaucrats were usually transferred from one post to another. The response was that selection of the participants was even more important here and that perhaps second level professional personnel, who might stay in their posts for longer periods of time, should be selected to attend the training course. It was also suggested that the course contents ought to be interesting, convincing, and not very technical.

### **Management and Operations**

Lastly, Mr. Lahiru Perera of ITDG, Sri Lanka, spoke about 'Critical Factors Related to Management, Operations, and Repairs'. He reviewed the current situation in the HKH Region and observed that access to information, adequate training, and skill development were crucial for improving the situation. Training was especially important for operators and managers. He also suggested the evolution of arrangements for repairs in a given area where a cluster of MMHPs existed. Studies of maintenance and repair practices undertaken by private entrepreneurs operating successful plants in the remote areas were also likely to be a useful learning exercise, and this knowledge could be disseminated to other areas also. During the discussions it was pointed out that plant breakdowns and the consequent repairs were very serious impediments to the MMHP programmes and caused serious financial difficulties for the owners in many cases. The response was that there were three possible options to overcome these difficulties: a) more reliable and expensive equipment; b) more training and experience for the managers and operators; and c) development of adequate repair facilities. The costs for these choices could be considerable. However, for the long-term sustainability of the programme, this extra expenditure was necessary.

### **Group Discussions**

On the third morning (6th Session), the participants broke into five groups and held discussions about formulating a strategy and on outlines of the important aspects to be

discussed (see Annex 4). The coordinator of each group then made interim presentations before the plenary body, and these were followed by brief discussions.

Mr. Ueli Meier made the presentation for Group One on **Technology** and stated that, at present, MMHP plants in the HKH Region lay within two extremes, i.e., those completely bereft of governors/controls and fairly sophisticated equipment which was especially for supplying electricity to the grid. Many plants fell in between. The number of plants belonging to the first extreme category was quite large in the private sector. The level of controls and sophistication should be objective-specific and site-specific. Standardisation for the first category was likely to be difficult and not really necessary. However, for the MMHP plants needed for grid connection or such end uses, reliability of plants and quality of electricity needed to be improved. Under some circumstances, enhancement of reliability was necessary even for the first category; therefore, appropriate technological improvements must be developed and introduced for the equipment as well as for civil works. Generally, the more remote and difficult a site, the more reliable should be the technology, including the instrumentation and controls.

A number of issues related to technology were raised from the floor. A question was asked concerning how viable were the low-tech MMHP plants. Mr. Meier responded that, for many situations, e.g., for agro-processing or electricity for lighting in the accessible areas where repairs could be carried out easily, such plants were acceptable. In such cases, the minimum level of instrumentation would be voltage and ampere-meters, and the generator should be capable of withstanding the run-away speed. The discussion proceeded to consider who should oversee or bear responsibility for quality control. One suggestion was that manufacturers or their associations must be made responsible, since manufacturers might lose their business eventually if the quality was not good. It was also pointed out that introducing quality control measures during manufacture did not solve all the reliability problems and would increase costs. Therefore, a suitable course of action was to draw up adequate quality control guidelines and the manufacturers or millers' associations could persuade their members to follow them.

The presentation for the Second Group on **Economics, Funding, and Viability** was made by Mr. D. Adhikari. He remarked that MMHP plants could compete well with other energy options such as diesel engines. However, policy support and financial support were still necessary as the present level of available incentives was inadequate. He also pointed out a number of limitations in the current MMHP technology. Mr. Adhikari suggested that policy and fiscal support should be provided for isolated MMHPs as well as grid-connected plants, since grid connection was likely to be one important future direction for MMHP. A clear and consistent policy and other support must be given concerning tariffs, buy-back arrangements, etc. With large-scale participation of the private sector in MMHP, new issues could also emerge, e.g., water use rights. Adequate legislation would be necessary for such difficulties.

During the discussions, a comment was made from the floor that the current policy environment for private indigenous MMHP was not adequate. Wherever such policies existed, ambiguities also existed and there were almost always problems with regard to implementation. This situation was not very helpful. Many participants emphasised that grid connection of the isolated plants was probably the most promising direction for the future, since up to 100 per cent plant factors could be achieved in this way. This aspect, therefore, should be given due consideration.

The presentation for Group Three, **Implementation, Operation, and Management**, was made by Mr. W. Siraj, who highlighted the current status in the region and observed that MMHP plants in Sri Lanka and China were being operated by trained operators. In the rest of the region, although some training programmes were developed and conducted (mainly in Nepal), they did not meet the training needs adequately. In Pakistan, no arrangements were available. Consequently, the level of plant utilisation was low, breakdowns were frequent, and a large number of plants had gone out of operation permanently. Mr. Siraj therefore suggested that attempts be made to refurbish such plants wherever the possibility existed. Funding must be increased to enhance the installation rates, grid connections must be encouraged, and appropriate steps taken to make this possible. During the discussion, it was suggested that lower limits on power to be connected to the grids were not necessary and must be removed.

The presentation for Group Four on **Enhancement of End Uses** was made by Mr. Allen Inversin. He listed the number of end uses currently prevalent, as well those that could be introduced in future. These included rural industries, agro-processing, ropeways, irrigation, cooking, and grid interconnections. The speaker discussed the viability and practicality of these alternative uses and short-listed those which were most promising. Among the promising uses were agro-processing applications of MMHP which had been encouraging in Nepal; however, more improvements were needed in the technology, training, and repair facilities and the rates of installations needed to be enhanced. In the case of pump irrigation, the experience was limited; however potential existed in many areas; some initiatives could be taken with the right inputs. At present, lighting was the most prevalent and appreciated end use. Battery charging could also be combined to allow the benefits of lighting to reach further afield. Mr. Inversin also put forward a proposal whereby MMHP installations for the communities could be funded by donors and, in return, villagers would grow a wood-lot for their own use on a sustainable basis.

During discussions, it was stated that ropeways could be successful in some areas. The speaker, however, felt that, in remote mountain areas the payload was not adequate enough to make ropeways economically viable. Questions were also raised about the actual success of the wood-lot idea. How would the system be looked after in the long run? The speaker responded that this was only a basic idea and many details needed to be worked out. It was also suggested that pump irrigation could be combined with domestic water supplies for the villagers.

The Group Five presentation (**Planning Policy and Institution Supports**) was made by Mr. P. Venkata Ramana who briefly reviewed the prevalent situation, especially its deficiencies, and made the following suggestions: support for end-use development was necessary; NGOs, the private sector, and people's representatives needed to be encouraged; long-term and consistent policies should be evolved; decision-makers and potential financiers needed to be sensitised; incentives for good performance should be introduced; policies to improve the manufacturing base and quality control should be developed; and coordination between concerned agencies should be improved.

During discussions it was stated that the public power sector in India was quite large and it did not consider MMHP to be viable. This aspect should be thoroughly covered while developing a training programme for the decision-makers of the region. Selection of participants was important: for example they should really be the concerned people who

would remain so for some time. A question was asked concerning whether there had been a request to the Government in India to de-license and promote MMHP. The speaker responded that the Government of India had undertaken many initiatives in the field of renewable energy. Thus, there was no pressure on it in this respect.

**Session Seven** was held on day four to finalise the recommendations of the groups, and it was chaired by Mr. Lahiru Perera with Mr. Allen Inversin as the Rapporteur. Mr. Ueli Meier made a presentation on behalf of Group One on Technology issues. The highlights are given below.

- There was a need and room for the improvement of indigenous technology; policies and legislation should be supportive of efforts to improve the viability of existing technologies.
- Among the components to be improved were: intake (due consideration to floods and desilting); power canals (optimum costs should include investment and O&M); forebays (avoid vortex formation); trash racks (compulsory, adequate design gap, to withstand pressure head, to function even at 50% blockade, easily cleanable design such as vertical bars); penstocks (optimal diameters to withstand water hammer); gate valves (compulsory, to control water and to avoid freezing of water in the penstock); turbines (predictable performance and adequate lifespan); generators (standard voltage and frequency, to withstand runaway speed, induction generators should be encouraged); controls/governing (sophisticated equipment for grid connections to make synchronisation possible, for other plants as simple as possible but as good as necessary, encourage some automation); control panels (to indicate basic readings, minimum/maximum cut-out relays, new ways of metering/accounting for energy sold); and guards for equipment and human life.
- Technology development should proceed from the simple and cheap to the reliable and more expensive.
- Costs would decrease if sufficiently large numbers were being manufactured and installed.

During the discussions, additional suggestions were made concerning the improvement of technology and the accompanying cost escalations. It was suggested that desilting systems should be incorporated in canal and intake design and automatic trash rack cleaning must also be included in more sophisticated plants; trash racks should be of parallel bar type to facilitate cleaning. Corrosion allowance in the penstock was discussed and it was suggested that it was usually much smaller than the thickness required for handling, so specification was not necessary. Vortex formation was not dependent upon the forebay size, but on depth of penstock inlet below the water surface, among other factors. It was generally agreed that the quality and reliability of the equipment needed to be improved, even if it involved an increase in costs; maintenance procedures would also have to be improved through training, and this could be expensive. Unmanned (automatic) plants may be less expensive in the long run. It was also suggested that the reliability of civil works was as important as that of the equipment. The improvements in equipment quality must also be based on feedback from the field. A question was asked about the mechanism for such a feedback. The customers were usually not qualified to assess the quality of equipment, therefore they could be choosing the cheapest equipment. The general consensus was that technology improvement was necessary and opinions from the field must also be taken into account in the improvement process.

Mr. Alex Arter presented the conclusions of Group Two regarding '**Economics, Funding, and Viability**'. Reviewing the current situation, Mr. Arter noted that in Nepal there were declared policy options with regard to sustainable energy supply in the rural mountains. The group had attempted to rate various energy options for the rural areas on the basis of such factors as initial costs, sustainability, transportability, and so on. The results showed that fuelwood and other biomass were more attractive in the short term but MMHP came out better in the long run. The grid connected MMHP fared best. Mr. Arter then made the following suggestions with regard to policies, legislation, funding, and training needs.

- Policies should be transparent for the setting-up of tariff rates, buy-back arrangements, and guarantees for grid-connected systems. One basis for tariff setting could be the principle of 'avoided cost'.
- With more private sector plants the water-user right issue would become important. A clear policy/legislation was necessary to encompass priority listing of water uses and the level of compensation for discarded MMHP plants in favour of other end uses.
- Basically the MMHP should be looked at as a profit-making venture. However, if social obligations and benefits were also apparent and profit was not viable then transparent policies could provide support to the investors.
- Commercial banks must also be encouraged to make MMHP one of their loan portfolios.
- Subsidies should be provided on the product (e.g., kWh supplied) not on capital investment.
- Awareness-raising programmes for policy-makers, especially those concerned with tariff- setting for buying power from the private sector, should be organised.

The discussions that followed were extensive and involved. Many participants had serious reservations about the rating of MMHP compared to other energy options, both regarding the methodology adopted and the actual ratings, which were presented in a tabular form. It was finally agreed to remove the table from the presentation. The idea of subsidising the product rather than capital costs was also debated. Some participants felt that subsidies were needed more during the investment phase rather than later on. Also, Operation and Maintenance (O & M) should not be subsidised. Others, however, felt that focus on production was also important and incentives to run a plant efficiently were lost if subsidies were only available for installations. This had happened in other countries. Two points of views seemed to prevail; i.e., a focus on financial viability only and an accounting of other benefits for the nation in determining economic viability. Many participants felt that MMHP had other considerable benefits also, therefore they should be supported financially as well as policy-wise.

The conclusions from Group Three's deliberations on '**Implementation, Operation, and Management**' were presented by Mr. Wahaj-us-Siraj. He noted that, at present, in China, decentralised MMHP plants were fairly advanced, grid-connected, and usually well utilised. In India, MMHP had not been emphasised in the past; existing plants were in the government sector, and the utilisation level was low. Private plants existed in Nepal and Pakistan only. The rate of installations had gone down considerably in Nepal, but they were steady in Pakistan. However, the overall impact of MMHP on the energy scene of both

countries was negligible. Similarly, the training system in China was adequate, but this was not the case for India, Nepal, and Pakistan. Mr. Siraj made suggestions for the future and emphasised that training courses for managers and operators should be a regular feature of any MMHP programme. Regular maintenance was very important and a system must be evolved to create awareness among the owner/managers in this respect. It was necessary to have reliable, good quality electricity supplies; therefore, quality assurance/control and design standards should be implemented and monitored. Operation and management should also be healthy and competent. Mr. Siraj also suggested that an independent institution was necessary to introduce and certify manufacturing quality, standardisation, training of operators and managers, and evaluation of the plants. There should be no size limits for supply to national grids, and sale/lease of public sector plants to the private sector should be encouraged.

With regard to training needs and awareness-raising, Mr. Siraj suggested that regional seminars/meetings be held regularly to exchange information and ideas and to raise awareness. In addition, the owners/managers must be advised to maintain a stock of crucial spares; technicians from the workshops in adjoining areas should be trained in repair practices for the MHP plants; regular interaction between the owners, operators, and manufacturers should be organised in order to share experiences, especially with regard to performance and O&M; and mobile workshops should be established by implementing agencies.

During the discussions, the involvement of local NGOs to provide assistance for training operators and managers was suggested. The feeling was that this was a useful idea and ought to be explored further. In response to questions about the training currently available for the private sector, it was stated that some training facilities were available in Nepal for managers and operators. However, it was not a regular process. Some participants emphasised that training at this level was important, on the site as well as at a central convenient place. A concern was also voiced regarding the establishment of a new institution; where would the funding come from, for example? With regard to leasing out or selling sick government plants, some reservations were also expressed, however the idea was supported by many participants.

Mr. Reinhold Metzler presented the findings and recommendations of Group Four concerning 'Enhancement of End Uses'. He first talked about the experiences to date and stated that electricity for lighting was still the predominant and popular end use; however, most people in the remote areas were too poor to afford it, especially in Nepal. Some participants favoured subsidies to support electrification through MMHP at the same level provided for urban populations. However, it was strongly felt that there was a need to focus upon increasing the financial viability of the MMHP plants so that their implementation was not subject to policies and actions of governments or donors only. In order to achieve this, efforts in the past had been focussed upon **reducing the cost of technology**. However, for the future, it was recommended that the focus of activities should be on **increasing the financial returns** by maximising the productive income- and employment-generating end uses of available energy. Mr. Metzler then discussed some possible end uses and these are summarised below.

Ropeways. This option of transport involved significant investment; also the payload, and therefore income, was likely to be quite small in the remote areas.



Agro-processing. Nepali experience in this area was positive, and some applications, such as oil expelling, were quite beneficial for the customers as well as the plant owners. However, problems also existed with the MMHP as well as with the processing machinery.

Pump irrigation was likely to have high potential and profitability, provided strategies could be evolved to resolve management and other related issues. The option was worth exploring further.

Cottage industries. While the potential and range of industries for the remote mountain areas were substantial, inputs were required to ensure success; e.g., credit, technical expertise, financial/business management, availability of suitable equipment, product quality assurance, raw materials, transportation, etc. Addressing these inputs would require a multidisciplinary approach and assistance from numerous parties, which could be a challenging job.

Cooking. Some form of energy had to be used by everyone for cooking, MMHP had been considered as one alternative to replace fuelwood/biomass. However, the nature of cooking loads, both magnitude as well as timing, posed severe problems for small plants. Research and Development (R&D) in the development of low-wattage cooking devices had not been successful, the devices developed so far were expensive. Moreover fuelwood/biomass was the traditional, low-cost choice for rural areas.

Lighting was a popular end use, but it incurred sizeable expenses and did not generate income except for commercial establishments. Battery charging could spread the benefits to wider areas and would be helpful in raising load factors.

Grid interconnection. The experience within the region was negligible, except in China. Other mountain countries outside the region had made considerable achievements, and rural entrepreneurs had been earning considerable incomes by selling electricity to national grids.

Mr. Metzler then made the following recommendations for promoting selected end uses for income-generation; i.e., agro-processing, irrigation, and energy sales through grid interconnection.

Agro-processing. Initially, to focus on rice hulling, grain milling, and oil expelling; to organise study tours for professionals concerned with MMHP development to China to learn from their experiences; meetings of relevantly experienced experts to assess the status of available technologies; to undertake market studies and evaluation studies for the existing machinery; to organise R&D to improve technology; to promote end uses; and to create awareness among bankers/financiers concerning the income-generation potential of MMHP.

Pump irrigation. To evaluate existing experiences; organise study tours in South Asia to evaluate experiences and to support pilot irrigation schemes.

Grid interconnection. To organise study tours for decision-makers to Europe to show grid interconnections for MMHP plants; national power authorities to evolve strategies for buying back electricity from private plants; development of guidelines for standard interconnections and protection systems for small plants; and to initiate pilot grid interconnection schemes.

The group also identified the need for a national institution for proposing initiatives, arranging funding, and contracting appropriate organisations to implement the above-mentioned actions.

During the discussions, it was observed that the source of funding for the recommended institution could be difficult to come by, and that it could end up as a bureaucracy. It was also pointed out that some end uses, which were labelled as non-productive, could be very essential. A participant felt that battery systems could be expensive. The response was that it was not necessarily so, some cheaper alternatives were already available. Performance of the Indian equipment was also reported to be problematic. A participant remarked that storage or some other use of energy during the night would increase plant factors, say through heat-storage cookers. The discussion then focussed on grid interconnection; some participants felt that this option was not for Nepal at present; however, others felt that opportunities were there. One participant stated that rural electrification was not attractive because it was expensive. It was also pointed out that one World Bank study stressed utility efficiency. One reason for non-viability could be that a lot of money was being spent on rural electrification. However, another viewpoint was that, in a way, petrol, gas, and kerosene were all subsidised.

Mr. P. Venkata Ramana presented the recommendations of Group Five which was working on '**Planning, Policy, and Institutional Support**'. These are summarised below.

- Policy formulation and institutional support for end-use development, including soft loans.
- Fostering NGO and private sector involvement at the local level.
- Promotion of MMHP through demonstration.
- Fostering long-term and stable policies/funding/incentives.
- Conceptualising MMHP as an integrated energy service within the framework of policies relating to fuelwood plantations and rural income generation.
- The training programmes for rural development authorities/policy-makers to include cost-benefit analyses of MMHP, including social and environmental benefits.
- The 'life-cycle costing' approach, including maintenance and repair (M&R) cost, should be used to determine viability rather than Rs/kWh.
- Incentives for good performance, e.g., maximum kWh available or utilised, to be instituted.
- The policy environment for micro-hydro to be improved in contrast to mini-hydro, which seems to be better off at present as an option for grid connection.
- To create an association/agency in Nepal as an executive body of the interest groups in the private sector (NGOs, manufacturers, consumers, and government representatives), to be funded by its members to perform the following functions: to realise recommendations such as the above; to initiate dialogue with policy-makers on various issues; to facilitate coordination, to ensure quality, to promote awareness; to inflate stability of favourable policies; and to formulate guidelines for feasibility, implementation, evaluation, etc.
- To sensitise State Electricity Boards (SEBs)/Power Departments in India to MMHP and to create separate cells, etc.
- In Pakistan also, an association of implementing/promoting agencies was recommended to improve coordination; improve manufacturing; promote successful

mechanisms for people's participation; and sensitise NGOs, donors, and communities to MMHP promotion.

During the discussions, a number of queries and observations were made regarding tariff policies and demonstration. It was also observed that most recommendations had government officers as the intended target group and governments generally did not favour micro-hydro in particular. The overall viability of MMHP (especially MHP) again became a point of discussion, and it was expressed that plants such as *Ghundruk* (Nepal) had demonstrated the viability of such schemes satisfactorily; given the correct inputs, including adequate management systems. Other plants could also perform well if the management and other aspects were adequate.

#### Training Programme Outlines

Outlines of the Training Programme were presented by Dr. M. Abdullah. He stated that the proposed training programme for decision-makers had been prepared with the following objectives:

Familiarisation of the participants with:

- 1. MMHP in mountain areas as a significant and viable contributor to rural development and rural electrification (overall objective);
- 2. evaluation of MMHP feasibility documents;
- 3. assessment and comparison of every different option; and
- 4. optimum division of responsibilities among the parties involved.

About 20 participants would be selected from senior (preferably topmost) government levels of the participating countries. Participants should be working in areas concerned with rural development, rural electrification, planning, finance, environment, and implementation of MMHP programmes. Officers from development banks and donor agencies would also be invited to participate. The duration would be for about 10 days, preferably in surroundings away from homes/offices, but in a stimulating environment and in comfortable conditions.

The following course contents would be taught:

- 1. The role of appropriate energy systems in rural development.
- 2. Rural electrification as a contributor to rural development - integrated approaches. Options available for supplying electricity. Adoption of an unbiased approach for instance listing of the merits of diesel sets and recognition of the site-specificity of MMHP.
- 3. What is MMHP?
- 4. Institutional arrangements for MMHP. Five crucial approaches to MMHP.
- 5. MMHP - economic feasibility (should also include social benefits, indirect economic benefits, and long-term national interests); financial feasibility and constraints; environmental considerations; evaluation criteria.
- 6. Funding sources for MMHP (e.g., multilateral sources, regional aid organisations, development banks, commercial banks, NGOs, private sector, etc.). Policies and practices of such sources.