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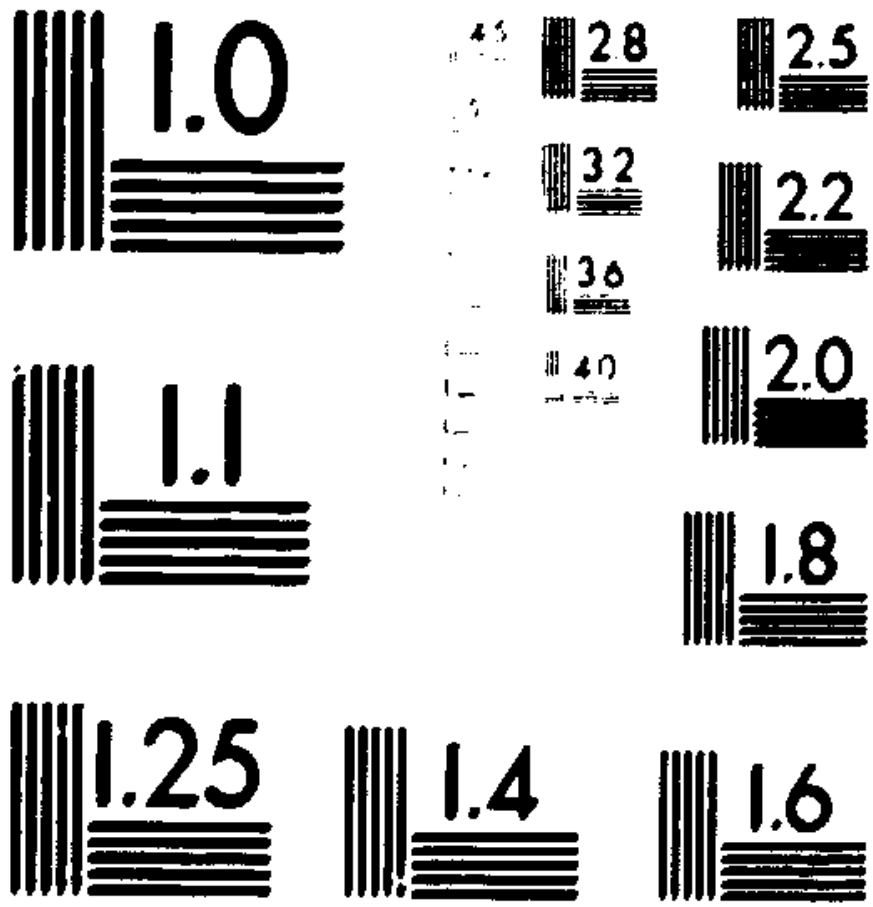

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NEPAL - SHP NATIONAL NEEDS AND REGIONAL SIGNIFICANCE

1. Overall Planning

There is still no evidence about the existance of commercially exploitable fossil fuel resources in Nepal. The traditional source of energy being utilized is the firewood. The excessive reliance on forest for energy has created such alarming situation in the country that it may lead to irreparable damage and destruction of water, soil and other basic elements of environment. However, Nepal is bountifully endowed with the one essentially untapped power resource, i.e. "Hydro-power". The estimated theoretical hydro-power potential is about 83,000 MW of which about 27,000 MW could be economically developed in Nepal. However, so far, less than 0.5 per cent of economically feasible potential has been exploited in Nepal.

With a view to pave the ground for systematic development of hydropower in Nepal, three following main categories were being made.

i. Large-scale projects (upto 4000 MW) for meeting the long-term energy need of the country and possibly for multipurpose use and for export of energy to neighbouring countries.

ii. Medium-scale projects (upto 300 MW) are meant for internal consumption in urban areas and industrially prospective locations of midlands and southern Terai plain.

iii. The third category of projects (say upto 5MW) are small-scale projects for meeting the energy needs of remote isolated mountainous regions, as well as for educating the rural people of the region about the practical and multiple use of electricity.

2. Organization

With a view to enhance the development of small hydropower development in Nepal, Small Hydel Development Board (SHDB) - an autonomous Government Board, was created in the year 1975 under the Ministry of Water Resources. The Minister of Water Resources is the Chairman and the Chief Engineer of Electricity Department is the Member - Secretary of the Board. Directly under the Board there is a Central Project Office in Kathmandu, headed by the Project Director. Below this there are five regional offices to co-ordinate and supervise the projects in their respective development regions.

The specific responsibility of the Board is planning, construction and operation and maintenance of small hydroelectric plants in the capacity upto 5MW in the remote and backward hilly areas in the northern part of the country.

3. Project Selection

Compared to other countries of the world the hilly areas of Nepal are quite densely populated. Most of these hills are traversed by large as well as small perennial rivers and generally the village settlements are located quite near to these rivers and rivulets.

For several centuries the villagers have been utilizing the streams for a motive mechanical energy using simple water wheels. But with the construction of few small and medium scale hydroelectric projects in the past three decades, the local population of the hilly area became quite keen and aware to utilize the river potential for the generation of electricity. So recently the demand for the construction of small hydropower stations are coming up from all over the country.

SHDB/Nepal with its limited resources is facing tremendous task in fixing priority for the selection of the project and supply area. At present SHDB/Nepal has the following selection criteria:

i. District headquarters (Nepal is devided into five development regions and 75 districts);

ii. Villages with cottage industries;

iii. Places of tourist interests;

iv. Multipurpose project, i.e. electricity combined with irrigation and water supply.

The funding for the activities of SHDB/Nepal is obtained through the Government of Nepal budget and bilateral and multilateral assistance. So far it has completed 10 projects and currently 20 projects are under construction. The Board has plans to prepare feasibility studies and detailed engineering design for another 10-15 projects within the next 2 - 3 years.

4. Constraints

The number of isolated plants to be considered under SHP programme are numerous and also due to geographic inaccessibility and hydrological conditions of the regions, the following main problems are presently being faced in developing small hydro-electric plants in Nepal:

i. Shortage of technical manpower;

ii. Difficulties of transportation of men and materials due to non-availability of motorable road at site;

iii. Economic and financial constraints;

iv. Large seasonal variation in hydrological regions;

v. Absence of similarity of generating equipments resulting difficulty in operation and maintenance.

5. Needs and priorities identified by National Focal Point (i.e. SHDB/Nepal)

SHDB/Nepal with its ten years of experience in SHP development has identified the following needs and priority subject areas and projects, which are also of regional significance:

5.1 Establish hydrological analysis method suitable for ungauged streams for SHP generation in Nepal

Most of the SHP sites in Nepal are located in the very remote part of the country, and to establish and manage proper (permanent) gauging station in all these small streams is practically impossible. However, without proper hydrological studies, estimates of flow in the river will continue to be in error with the consequent high cost of over- or under-designed hydropower projects.

Therefore, SHDB/Nepal believes an analytical method should be worked out to obtain the hydrological data from these ungauged and partially gauged streams. The analytical method if developed properly could also be utilized by other countries of this region with similar conditions.

5.2 Rationalized design for SHP civil works (Design manual)

SHDB/Nepal has undertaken a number of SHP projects in different hilly areas of the country. The demand for construction of such projects are increasing quite rapidly. SHDE with its limited technical manpower resources is facing tremendous job to cope with the increasing number of investigation and design works.

So, if there are several SHP projects at hand, the design could be rationalized and relatively inexperienced engineer and other manpower could be trained and used in this field.

A rationalized design is one in which design principle and construction details are standardized but the overall sizing is adopted to match the site. Unlike diesel plants, SHP plants cannot be mass produced, each must be designed individually as each site is unique and has its own peculiar problems. Design rationalization will reduce job repetition and consequently utilization of the scarce technical manpower will be maximized. SHDB/Nepal consideres this subject to be also of regional significance.

5.3 Utilization of computer facilities for SHP development

For the ever increasing job of SHDB/Nepal the use of computer facilities are quite obvious. Besides storing a number of different information, it can also help in design computation.

Recently, a research proposal on optimum design system for SHP projects using the computer programme has been submitted to SHDB/Nepal by a local consultant (IDS). SHDB/Nepal is seriously thinking of using computer facilities, especially to also develop point 5.2 above, i.e. design manual.

5.4 To improve the present technical capability of local Electro-Mechanical Equipment Manufacturers

At the moment, only few turbines upto 100 KW capacity have been manufactured locally. Sofar, only crossflow turbines have been tested with the imported generator. Several improvements are required in this field. Collaboration with experienced foreign manufacturer could be very useful.

5.5 To develop economic criteria for selection of most feasible SHP generation - Development of Master Plan for SHP in Nepal.

SHDB has certain criteria and priority for the selection and development of SHP in Nepal. But after electrification of few villages, the demand for electricity in large

number of villages and settlements in the remote hilly areas of Nepal are growing very fast. Taking this into account with the existence of large number perennial streams in the mountains, development of a Master Plan for SHP in Nepal seems to be an urgent necessity.

6. Joint/co-operative research projects

Some of the activities and items mentioned under Section 5. can be incorporated in this Section 6. However, some of the joint/co-operative research projects are briefly mentioned below.

6.1 Electronic Load Controller - ELC

Local manufacturers in Nepal are producing turbines of less than 100 KW capacity, with the imported generators. However, due to high cost, the electromechanical equipment supplied by local manufacturers generally does not include any automatic governor. In Nepal the delicencing policy of SHP projects upto 100 KW has encouraged village community and private entrepreneurs to come forward with more mini hydro projects.

However, in order to implement such programme on a large-scale, it would require cheap as well as reliable electro-mechanical system.

In this context, research project on Electronic Load Controller (ELC), undertaken by the HRC could be quite useful in Nepal. The research project could be further

developed in co-operation with HRC and SHDB/Nepal (local manufacturer).

This item is interrelated with the item 5.4 of Section 5.

6.2 Maximum utilization of local materials - reduction of cement use

As mentioned earlier, most of the SHP projects in Nepal are located in the very remote part of the country where road transportation facilities are not available. Therefore, the transportation cost of construction materials, which is not available at the site is very high. For example, the transportation cost of cement at some sites are 7 to 8 times higher than the actual cement price at the factory.

Therefore, joint research programme could be worked out in the design of hydraulic structure for SHP, where the use of cement can be minimized and the use of local materials can be maximized.

This item is interrelated with the item 5.2 of Section 5.

6.3 Optimum design systems for SHP projects

SHDB/Nepal, at the moment, is considering a research project proposal for optimum design systems for SHP project, submitted by a local consultant (IDS).

The primary objective of the proposed research is to improve the technical and economic efficiency of SHP projects by developing a computer-based design system.

The estimated total budget for this research project is about US$100,000 for three year period. However, the cost and total time could be reduced with the further review of the proposal and availability of specialist manpower in this field.

The most immediate benefit of this research will be the savings in the cost of design and construction of SHP projects. It will provide considerable savings of scarce technical manpower and project time; and also improve technical efficiency by facilitating rational site selection and quality control.

At this moment, this research proposal has not been implemented due to financial and manpower constraints. SHDB/Nepal considers this research proposal useful not only for Nepal, but with some modifications, it can equally be applied to other countries from the region for same reasons as well. Therefore, SHDB/Nepal suggests that this be taken up as a joint/co-operative research project.

7. Decentralization of RN-SHP activities

i. A Seminar/Workshop could be organized on Design of Hydraulic Structure for SHP Projects in 1986 in Nepal, provided that financial resources can be secured.

ii. The SHDB/Nepal would welcome any activity in the future to promote the decentralization of SHP programme.