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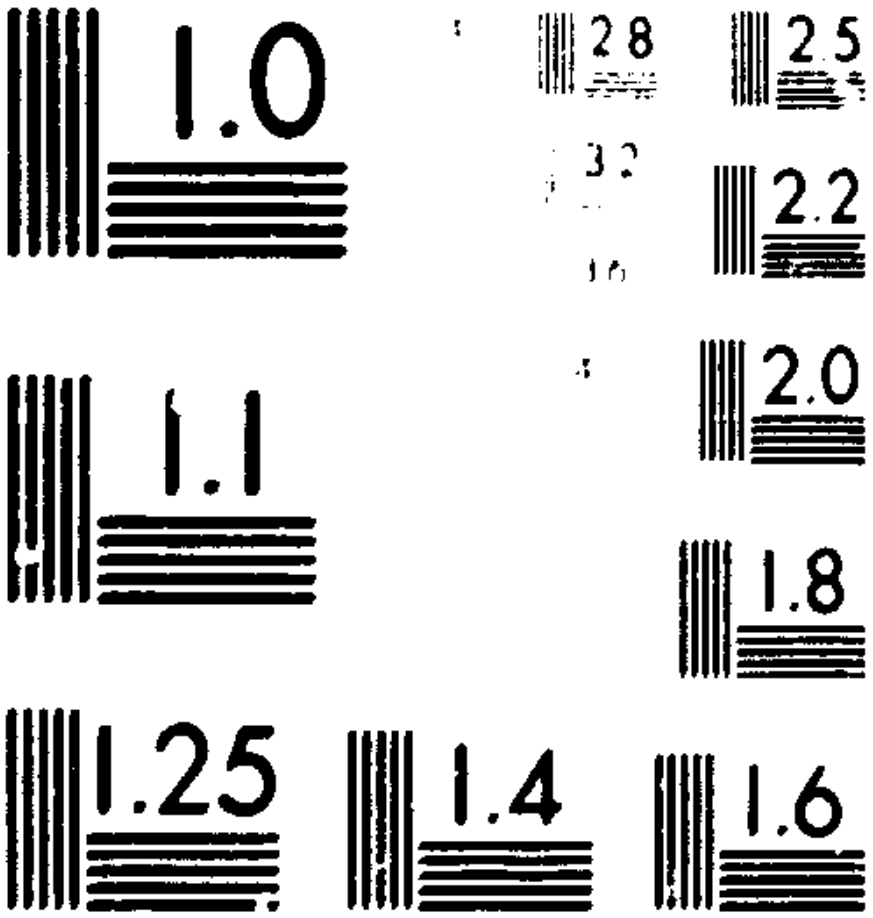

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REGIONAL NETWORK SYSTEM FOR SHG-MHG ACTIVITIES FOR MEMBER COUNTRIES OF ESCAP REGION *

by

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1. INTRODUCTION

In November 1980 a visit was made by a group of United Nations Experts in Hangzhou, China to discuss on small - mini hydro system needs for the region. This was part of the seminar/workshop held on small - mini hydro system by UNIDO as an extension of the previously held meeting in Khatmandu, Nepal. At the conference, mention was made of the need of a regional centre on SHG-MHG. At the same time the Chinese Government were interested in putting up a regional centre for research, development and training on activities pertaining to SHG-MHG at Hangzhou.

In anticipation of the need to create a regional network system on small - mini hydro power a meeting was planned in July 12th to 17th 1982 to discuss matters pertaining to:

(1) Deliberations of the creation of the ESCAP regional network system on SHG-MHG and to promote co-operation in SHG-MHG power development and application among member countries.

(2) Identification on the national level of the member countries for research and development as well as for training which will form the basis for developing the work programme of the regional centre for mini small small hydro power generation at Hangzhou for the period from 1982 - 1984.

(3) Exchange of views on the management and operation of an Advisory Board and its organisational linkage with UNIDO, ESCAP and other relevant U.N. and non U.N. agencies and organisations within and outside the ESCAP region.

2. ACTIVITIES OF SHG-MHG

To organise an efficient regional network system on SHG-MHG activities means that these activities have to be considered from the point of view of system management training, development and research and also in terms of implementation and construction. On identifying these activities it is expected that a clearer view of the problems and need would help in the planning and assessment of the future regional network system. The activities/needs in SHG-MHG can be under the following headings :-

(i) Feasibility Studies

Generally, feasibility studies of SHG-MHG involves the knowledge of a potential site from the point of view of hydrology, contours, economic and financial analysis together with other associated aspects. Although there are methodologies whereby these studies can be shortened there is a need to identify proper procedures and a methodology of work that needs to be carried out in order to avoid pitfalls which could be costly on implementation of the SHG-MHG schemes.

(ii) Design

In designing a SHG-MHG system there is a need to know the nature and type of the system to be constructed. These can be derived from the feasibility studies and reconnaissance surveys etc. in other words the availability of material, methodology of transport and constructional method together with water transport system as well as the methodology to simplify construction of SHG-MHG system has got to be known.

(iii) Construction

Undoubtedly construction comes after the planned design work has been completed but in the field of SHG-MHG these factors may take place concurrently when changes in the design of the system takes place. Constructional techniques as at the present moment involve only conventional methodologies. These can change as there is an increase of new materials available for construction.

(iv) Manufacture

Current designs of turbines for SHG-MHG have been found rather expensive for SHG-MHG applications. Furthermore, these designs are only miniaturised versions of the large equipment. Increased activities in the local manufacture of turbines for SHG-MHG can change the technology together with introducing new types of water energy harvesting equipment.

(v) System of Management

There are two methods of management systems available in the implementation of SHG-MHG activities. These involve :-

(a) a centralised system, and
(b) a decentralised system

Each of these systems have got their merits depending upon their requirements and the needs of SHG-MHG.

(vi) Research and Development

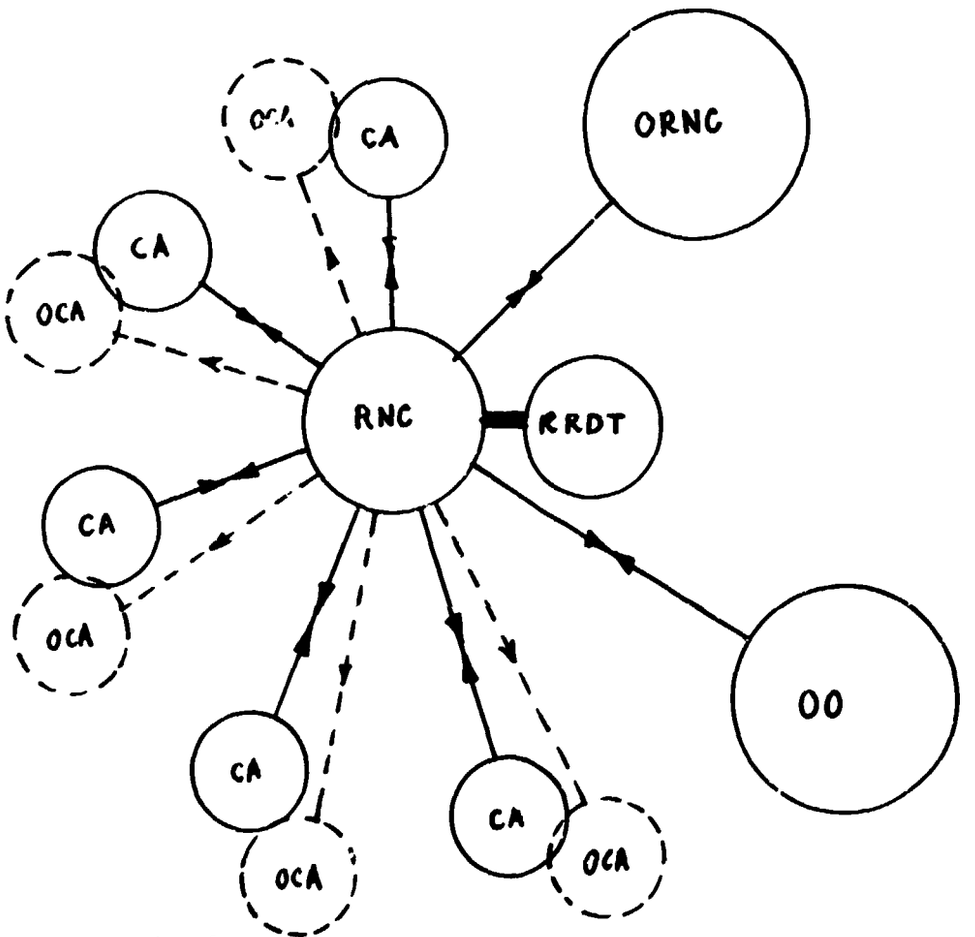
Currently there is very little work done in areas of research and development for SHG-MHG systems especially those pertaining to governor control, types of turbines, automatic stations etc. etc. The introduction of research and development into these areas would help to change the face of SHG-MHG technology in this new age.

(vii) Operation and Maintenance

Undoubtedly with its simple approach SHG-MHG systems need to be operated and maintained to a certain level. This means that trained personnel are needed for such areas.

3. CREATION OF REGIONAL NETWORK CENTRE

Having defined the SHG-MHG activities that could involve the centre, the centre can then be built on the basis of each being a secretariat to member countries in the ESCAP region. The centre will be linked to the respective agencies involved in SHG-MHG activities of their resident countries. It should be noted that government agencies that are not associated in the actual work of SHG-MHG activities will not be involved in the first stage of the system. All activities taking place at the agencies involved in SHG-MHG development will report to the centre on its activities such as research work, development, training, etc. The structure of the Regional Network Centre is as shown below :-



RNC-regional network centre
RRDT-regional research, development & traning centre
CA-country agency
OCA-other country agencies
ORNC-other regional network centres
OO-other organisations

It should be noted that although this is a Regional Network Centre, its involvement does not go into areas of activities such as research, development or training. This centre is actually a centre where all administration takes place in terms of the following :-

(i) Information

The centre will be involved in receiving papers, video tapes, drawings, etc. from member countries on quarterly basis. This information will be stored and at the same time sent to the respective agencies in the member countries so that the information can be utilised in existing constructional works, planning schemes, etc. The centre would also compile other works involved in SHG-MHG activities of research, development and training natures from other bodies involved in SHG-MHG studies so that the centre would have full information on all aspects of SHG-MHG development throughout the world.

(ii) Conferences

The Regional Network Centre will be responsible for organising all conferences on SHG-MHG activities. The organisation can be initiated either from the Regional Network Centre or from an agency of the member country. These conferences should be put up on an yearly basis and additional seminars/workshops can be organised by the Regional Network Centre together with the agency of the member country when deemed necessary. In other words all conferences involved on the international level must go through the Regional Network Centre prior to its taking place.

(iii) Authorities Involved

It is very important that there should be minimum red tape when it comes to activities between the Regional Centre and the agencies of member countries involving SHG-MHG. Currently it is found that these red tapes have hindered the progress of SHG-MHG activities especially when non involved government agencies come into the picture. The result of this means that the Regional Network Centre when tying itself up with the respective agencies involving in SHG-MHG of member countries should deal directly with the respective agencies. These would cut down the time and work taken in trying to either organise seminars/workshops or exchange of personnel. A direct link would help in the establishment of closer network system making it more effective on all levels of organisation, contacts, etc. etc. Although there may be political differences between one country and another, the establishment of this link may cut down the unnecessary red tape involved even to the extent of transfer of information, knowledge and personnel.

(iv) Exchange of Training Personnel and Experts

The formation of the Regional Network Centre as a secretariat for SHG-MHG activities in the region should involve the exchange of training personnel and expert on SHG-MHG activities. The Regional Network Centre should then have a complete list of experts, training personnel from the member countries and with this would be able to provide a pool of experts who could be sent to the countries requiring help in the form of experts or training personnel. The availability of this pool would definitely minimise the cost involved for SHG-MHG implementation and studies to a member country as this contribution comes in the form of a United Nations personnel. It should be noted that at the moment a large number of private consultants are trying to break into the development of SHG-MHG activities with little regard for the needs of the country. These consultants

are willing to increase the cost and bring in advanced technology where it is not needed at the expense of a country's financial difficulties.

(v) Standardisation of Systems

In one of the activities of the Regional Network Centre standardisation would be an issue which could help in establishing a common knowledge of procedural activities, methodologies and availability of equipment. With the panel being set up on SHG-MHG standards at the Regional Network Centre, the countries of the region should then try at their very best to follow these standards and this would open up a common area of interest which would thus enhance the activities of the Regional Network Centre. Standardisation should be to the extent of standardising even to the very detail of SHG-MHG system of construction, management and supervision (from the centralised and decentralised level), local manufacture of machines plus all other associated activities.

(vi) Dissemination of Information

As mentioned earlier in the first stages of the formation of the Regional Network Centre only the agencies of the member countries involved in SHG-MHG activities are to be linked to this centre. On the second stage it is important that the centre sends information on the socio economic aspects, funding procedures, funding availabilities and other activities in order to encourage SHG-MHG in the respective countries. This is also to encourage the knowledge of SHG-MHG activities on the non-technical level so that decision makers of the countries can participate in SHG-MHG activities from the point of view of developing the country's needs as well as in the long term hydro energy harvesting activities.

4. NEED FOR RESEARCH AND DEVELOPMENT IN THE FIELD OF SHG-MHG

As a direct result of increasing fossil fuel costs and the extended lead times inherent with large projects, SHG-MHG installations are being developed to help reduce energy costs and combat inflation as well as to help reduce oil imports with changing energy economics. It is the trend with many countries today to evaluate or revaluate their SHG-MHG potential and embarking onto full scale involvement in SHG-MHG, However, the main challenge is : HOW TO MAKE SHG-MHG PROJECTS ECONOMICAL? Following this, question of cost, research and development is now to be seriously considered in the subjects of project feasibility studies, turbine design and efficiency, construction methods and construction period, operation and maintenance etc. The following are areas of work needed :-

(i) Feasibility Studies and Analysis

(a) The methods of survey on energy utilisation in areas close to the potential sites is crucial to establish the economic value of the energy and thus provide a basis for estimation of project benefits. Work can be put into the search for new systems for this field to obtain maximum data in minimum time and at the same time delivering the required accuracy.

(b) New techniques in survey work for determining the most suitable sites need to be devised.

(c) Possibilities are in using projection and regression techniques and use of empirical formulae and last but not least, the use of the rule of thumb. Based on actual experience at previous installations it can provide a starting place for sizing equipment.

(d) Information and a basic knowledge of equipment alternatives as well as approximate costs, an initial approximation of site feasibility may be developed.

(e) Research into computer and computer aids for project analysis for optimum design and costing may also be devised to reduce time and cost of feasibility studies especially when a large number of projects are to be implemented concurrently.

(ii) Design Techniques

(a) Research into the civil work design to reduce construction cost, construction time and improve ease in construction especially in difficult terrain is needed. For example, weir and intake designs can be further simplified to achieve the above mentioned benefits.

(b) Penstock and pipe redesign or for that matter their elimination where necessary will be advantageous. For example, use of plastic pipe with their advantage of easier handling will reduce installation cost and maintenance.

(c) Alternative methods of pipe anchoring for minimum use of concrete should also be looked into.

(d) Minimum foundation and building needs with turbines in weatherproof cubicles will also reduce construction cost in good proportions.

On the electromechanical aspect of SHG-MHG research and development involvement in the choice of turbines can simplify installation and reduce project cost.

(a) Local design and fabrication of turbines should be a continuing exercise with greater emphasis on simplicity, portability and low cost.

(b) The operation of turbines can also be further simplified with the redesign or even the elimination of the common mechanical governor system and also with the use of pulley belting system to replace the expensive gear type speed increaser.

(c) There is also the possibility of using cheap microprocessor modules for full automation of turbines and make do without the use of trained turbine operators. This concept will be very useful in very remote sites.

(iii) Construction

At present the civil construction constitutes the major cost and involvement in a SHG-MHG project.

(a) In places with difficult and harzardous terrain and with no access for heavy engineering equipment, new construction techniques and new material handling methods need to be devised.

(b) Use of cables for transportation of pipes along the pipeline routes and for transportation of concrete and E/M equipment and use of carriages on rail tracks are some of the techniques which are to be further developed.

(c) On the administration aspects, new methods of project management and project evaluation by either centralised or decentralised methods to suit SHG-MHG also need to be thought of.

(iv) Operation and Maintenance

(a) With respect to the remoteness of Mini Hydro sites, the operation and maintenance is to be kept to the simplest and the minimum respectively.

(b) Studies into the design of turbines and also the other infrastructures like penstock, intake structures etc. ought to be optimised for least maintenance or no maintenance at all.

(c) Fully automatic or semi automatic turbine control or a cheap method of remote control will delete the need of a station attendant and hence reduce the operations cost of a SHG-MHG station.

(v) Standardisation

(a) The standardisation of hydroelectric equipment. power-house designs, construction techniques, substation and transmission lines is one area where R & D can be very useful for cost reduction of SHG-MHG projects.

(b) Standard and predesigned components will greatly minimise custom engineering construction.

(c) The elimination of most of the normal custom engineering expense related to small turbine plants and by reducing manufacturing costs through optimisation and standardisation of designs, project cost can be significantly reduced. It can be safely said that standardisation is the single most productive area of cost reduction. This, of course, becomes practical only if the project number is sufficient in magnitude to recover the standardisation cost.

The benefits of standardisation include :-

(i) More economical development.
(ii) Spreading of design costs over multiple units.
(iii) Eliminate respecifying individual components.
(iv) Simplify feasibility studies.
(v) Simplify tender and purchasing activities.
(vi) Faster delivery of items purchased.

For standardisation, the following fundamental parameters need to be recognised :-

(a) Speed increaser, generators, valves and control components are generally available and are essentially standardised.

(b) The propeller type runner provides smallest physical diameter with the maximum output and speed for low head applications.

(c) A complete unit from water intake to electrical transmission is needed to further minimise custom engineering and project cost.

(d) By adaptation of the turbine intake and the draft tube, standardised machines components can be accommodated with minimum loss of equipment performance.

(e) With standardisation of equipment, the operation and maintenance cost can be greatly reduced and requires lesser number of replacement parts, better interchangeability and calls for lesser training of operation and maintenance staff.

Thus, research and development need not only be a continuing exercise but it need be further reinforced with the increasing involvement of SHG-MHG today. As pointed out, one of the most feasible area of study is in standardisation which in itself requires an intensive research and development in SHG-MHG as a whole.

5. NEEDS FOR TRAINING IN THE FIELD OF SHG-MHG AT NATIONAL LEVEL

Since it has already been universally agreed that training is required to excel in any field at all, it is beyond question that training is also required in the field of SHG-MHG. Training is required in every activity in the execution of a SHG-MHG project and the questions we ought to dwell on is the degree of training required, the areas where we need to concentrate on, the training methodology and how training can be achieved at a national level. With the subheadings of the different activities, the needs of training can be discussed as follows :-

(i) Hydrology

The fundamental equipment for the assessment of a mini hydro site is an adequate estimation of the stream flow for the catchment at the flow diversion point. Training in the strea flow information retrieval is needed to estimate the power generation capacity and also the flood magnitude of the proposed site. The hydrologic data for computation of power generation capacity is then obtained from the flow duration curve of each stream. Training is required also in the compilation of data (preferably computerised) and the development of the flow duration curves and associated basic data.

(ii) Survey

A good amount of survey work training need also be executed for the field reconnaissance work, topographical characteristic studies, preparation of site working drawings, civil designs etc. Hence, training for surveyors is deemed necessary.

(iii) Geology

A general training on the analysis of the geology and soil conditions of the project area where there is potential for several mini hydro projects is useful to aid the field engineer in anticipating and recognising the soil conditions. This is also helpful in locating regions likely to have good SHG-MHG sites, especially in developing project design concepts that would avoid potential geology and soil problems.

(iv) Analysis

Training in power market analysis, analysis of energy consumption and maximum demand, demand projections and market survey are some of the factors to be considered in the feasibility stage of a project. With these, the economic analysis to determine viability of each project. All these analysis require a rather comprehensive training as this stage of a project plays a large part in the decision making on whether the SHG-MHG system can be carried out.

(v) Project Management

Implementation of a large number of projects presents a challenge for execution in an orderly and reasonable manner. Consideration have to be given to the organisation or entity which will manage the overall program. The use of network analysis for project forecasting and the manpower requirement plays an important part. Training need also be given for the administration procedures in purchasing, project supervision and construction management, finance etc. with the motive of minimising project cost.

(vi) Engineering Aspects

In-career training for the civil, mechanical and electrical engineers is important for achieving optimisation in the SHG-MHG projects. Training in design work and working towards the local fabrication of turbine and other associated electromechanical equipment is a move to be encouraged to reduce project cost.

(vii) Training of Operations and Maintenance Staff

A training program for the operations and the maintenance group is inevitable for the optimum operation of the SHG-MHG power station.

At the national level, training can be further enhanced by exchange of training techniques, interchange of new design and concepts in this field and possibly an exchange program of staff at national level.

6. REGIONAL CENTRE FOR RESEARCH, DEVELOPMENT AND TRAINING

For what has been earlier said on the need of Research and Development in the field of SHG-MHG, the setting up of this proposed centre will be very timely. Suggestions on the management and operation of this centre is as given below :-

(i) It is proposed that the proposed centre have a very close link with the also proposed Regional Network Centre since the latter will be carrying out the co-ordination work among the member countries. This close link is necessary to avoid duplication of roles and activities. Since the role of the Regional Network Centre does not include work in research, development and training care must be taken to avoid misallignment of policies and prevent multi duplication of work in this field.

(ii) In support of the above point, it is inevitable that the representatives of the member countries of the Regional Network will need to sit in the Advisory Board for this proposed R.D.&.T Centre. Out of this, a steering committee can be formed for guidance in both the planning and the operation stage of this project. For co-ordination it is best if the proposed centre be closely linked with the Regional Network Centre and keep direct communication with the participating countries to a minimum.

(iii) For liaison and co-ordination work with the participating countries, it is proposed that a permanent staff selected from the Regional Network Centre be stationed in the proposed training centre. The selected personnel need to be an authority in this subject to carry out the co-ordination work and also to be able to anticipate the requirements of the participating countries to synchronise with the research, development and training programme.

(iv) The day-to-day management of the proposed centre is best carried out by local personnel to obtain easier interaction with other local Chinese Authorities but experts from the participating countries may serve on temporary or periodical basis by invitation.

(v) As far as its training role is concerned, it is proposed that the centre divide its training programme into two periods i.e. period for local training and period for foreign participation. This is in anticipation of the problem of the medium of instruction i.e. Chinese and English. The foreign training programme can be held in the summer season but this demarcation should not be too rigid as integration between local and oversea trainees is also necessary.

As a result the formation of an Advisory Board comprising of members from participating countries to set goals and policies should be the initial move and within which is a steering committee to monitor the progress of the centre once it is in operation. The proposed centre will be at all times in close link with the proposed Regional Network Centre who will be carrying out the co-ordination work among the participating countries. Lastly it is to be anticipated that problems pertaining to language, standards and also political differences will be inherent.

7. CONCLUSION

In creation of theRegional Network Centre it is important that this centre should not be the same as the Regional Centre for Research, Development and Training at Hangzhou, China. It should be noted that the Regional Network Centre is the Secretariat and the centre for information, organisation and co-ordination of activities in SHG-MHG. In other words this centre should be based in a country where all facilities in terms of transfer of information and organisation is easily available and this centre should also have facilities of direct communication with member countries. The Regional Centre for Research, Development and Training at Hangzhou should only be a sub-centre of the Regional Network Centre. This would mean that the Regional Centre for Research, Development and Training would only have a one line communication with the Regional Network Centre and it should not have any other link of communication to the respective member countries. The Regional Network Centre would hold the responsibility of communication between the activities and the member countries. The Regional Network Centre would then have a permanent staff from the member countries and the United Nations on all levels of office. It is expected that in such a network system activities of SHG-MHG would be enhanced and member countries can benefit the outcome of this system of exchange.