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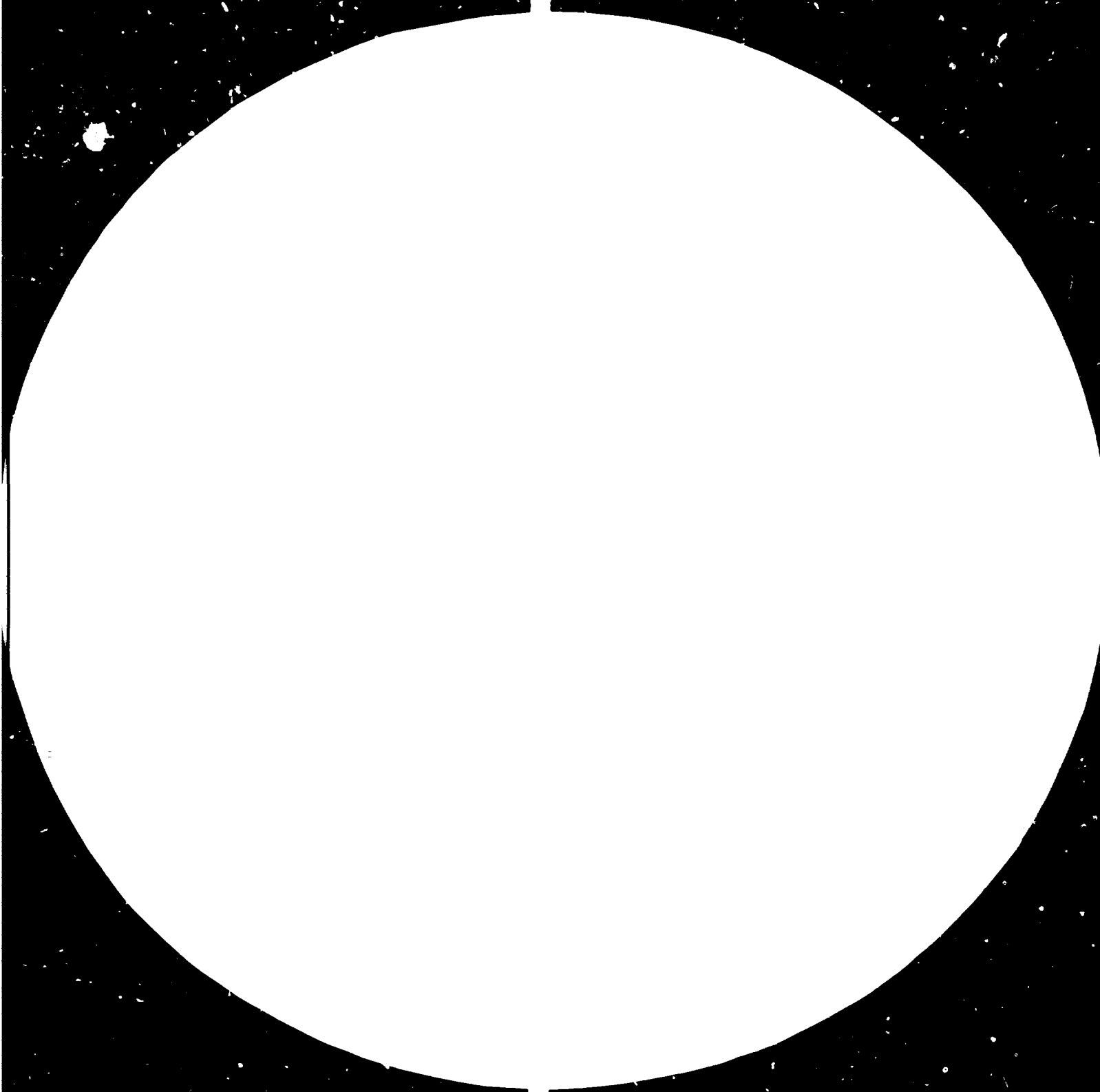

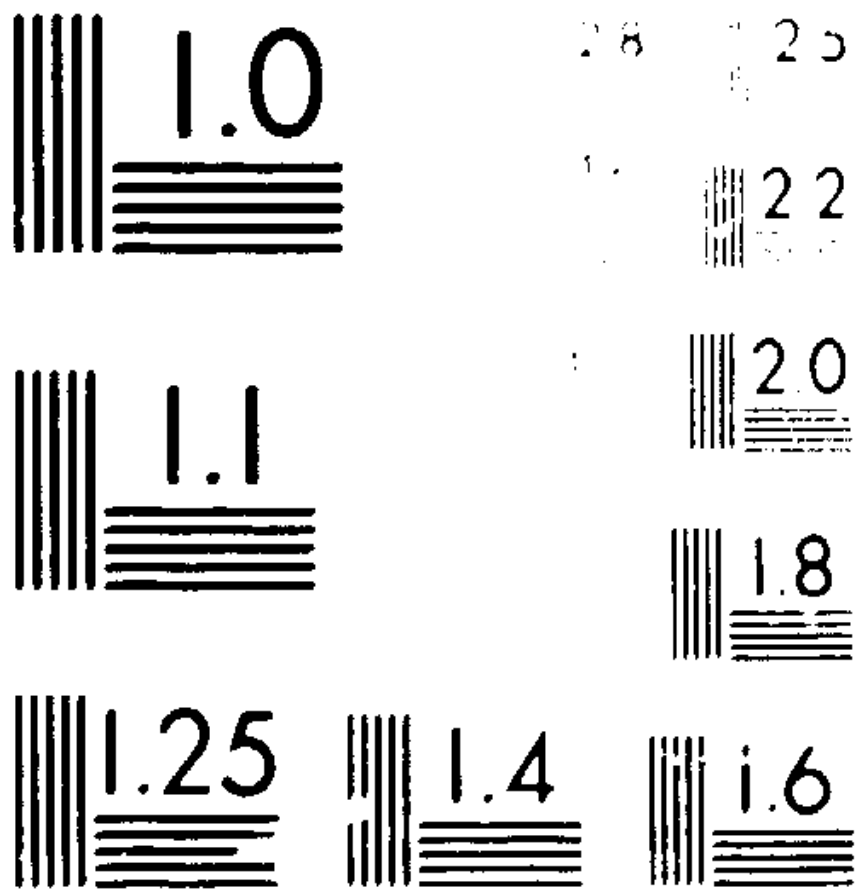
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Joint UNDP/UNIDO/ESCAP/China Senior Expert Group Meeting on the Creation of a Regional Network System and the Assessment of Priority Needs on Research, Development and Training in the field of Small/Mini Hydro Power Generation

Hangzhou, P.R. China, 12-17 July 1982

DRAFT REPORT * (Meeting on Small hydroelectric power generation, ESCAP region).

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I. RECOMMENDATIONS

On the basis of the Working Group elaborations, the two main objectives of the Senior Expert Group Meeting were discussed at a Plenary Meeting and the following recommendations emerged:

ESCAP Regional Network System for Small Hydro Power

1. The Meeting recommends that an ESCAP Regional Network System for Small Hydro Power (RN-SHP) should be established.

2. It should have, as its main objectives, a scope of work covering, inter alia, the following six functions:

   i) Organise an information service (technical and general);
   ii) Accept or recommend candidates for training from other focal points;
   iii) Make available short-term advisory services;
   iv) Undertake R+D projects depending on the facilities available to the focal points;
   v) Organise meetings for the benefit of the Network;
   vi) Establish links with institutions outside the Network.

3. The RN-SHP will consist of a group of focal points/institutions in the member countries interested in participating in the RN-SHP and nominated by the respective Governments.

4. The RN-SHP will have the following institutional structure:

   i) a governing body;
   ii) a technical advisory committee (TAC);
   iii) a secretariat headed by a co-ordinator;

   UNDP, UNIDO, ESCAP, REDP, RCTT and UNDTCD will participate in the Governing Body as voting members and in the TAC.

5. In order to experiment an effectively functioning mechanism of co-operation, the Meeting recommends that the RN-SHP should be started in an interim form, elaborated under para. 10-12 hereunder, as a forerunner to the formal network.

Work Programme of the Hangzhou Regional Centre for Research and Training in Small Hydro Power

6. The Meeting welcomed with appreciation the initiative of the People's Republic of China to establish the Hangzhou Regional Centre for Research and Training in Small Hydro Power (HRC).

7. The Meeting recommends that the HRC should form a part of the RN-SHP.

8. The Meeting recommends that the scope of work of the Hangzhou Regional Centre should cover, inter alia, the following four functions:

   i) Research and Development Work;
   ii) Training;
   iii) Information Services;
   iv) Advisory Services.

9. The Meeting recommends that the HRC should have the following institutional structure:

   i) a governing body, possibly the REDP Steering Committee;
   ii) a technical advisory committee.

10. The Meeting noted the fact that the Government of P.R. China is in the process of establishing the organizational structure of the Regional Centre, and that it would notify all concerned the person designated to represent the HRC and to be the channel of communication (hereinafter referred to as the designated person).

Interim Arrangements for Putting into Operation the ESCAP Regional Network for Small Hydro Power and the Hangzhou Regional Centre for Research and Training in Small Hydro Power

11. Considering the fact that the HRC has already been officially established, the Meeting recommends the following interim arrangements in order to start operation of the RN-SHP as soon as possible:

i) The Secretariat of the RN-SHP will be located at the HRC and operate to support the activities of the HRC for a period of two (2) years, tentatively up to the end of 1984. The proposed interim organization is shown in the diagram on Page 7.

ii) The Co-ordinator will report to the Steering Committee of the REDP through its Senior Co-ordinator, receive the guidance of the HRC - Technical Advisory Committee, promote and co-ordinate the activities of the RN-SHP, and assist and co-operate with the designated person in the HRC.

iii) In order to assist and support the designated person in the HRC and the Co-ordinator of the RN-SHP a Technical Advisory Committee (TAC) will be established. The TAC will consist of senior experts of the participating organizations.

iv) The First activity in the networking operation is to start the information service.

12. Specific activities of the HRC and the RN-SHP will be implemented on the basis of resources made available by UNDP, UNIDO, ESCAP, REDP, RCTT, UNDTCD etc. as well as contributions from donor countries and bilateral and multilateral agencies and organizations of developed and developing countries. In this respect the Meeting recommends that the funds earmarked in the REDP for SHP activities should be allocated to the RN-SHP to enable them to carry out projects during 1983 and possibly in 1984 in order to make its network operational and to strengthen the functioning of the RN-SHP for the benefit of the regional member countries.

13. The Meeting recommends that the TAC should carry out a review meeting by June 1983, to assess the activities of the HRC and the RN-SHP, and to consider and approve the work programme for 1984.

The Meeting further recommends that by June 1984 the TAC should meet to discuss and make recommendations to the REDP Steering Committee through the Senior Co-ordinator as to the future status of the RN-SHP.

14. The Meeting recommends that the first training seminar/ workshop for senior level personnel for a duration of 3-4 weeks, should constitute the first training activity of the HRC for the first half of 1983.

ADDENDUM

In accordance with the agreement reached concerning the time needed for reflection on the management of the network, and that observations may be sent to UNIDO which would then be added as an Addendum to the Report of the Meeting (Page 30 of this report), the following modification of the Recommendations have been received from the Delegation of the People's Republic of China.

"In order to ensure a simplified management system, the following amendments are proposed:

Recommendation No. 4. to read -

"Depending on the recommendations by the Technical Advisory Committee (TAC) and the Regional Energy Development Programme (REDP) Steering Committee in 1984 (Ref. Recommendation 13), the RN-SHP may have the following institutional structure:

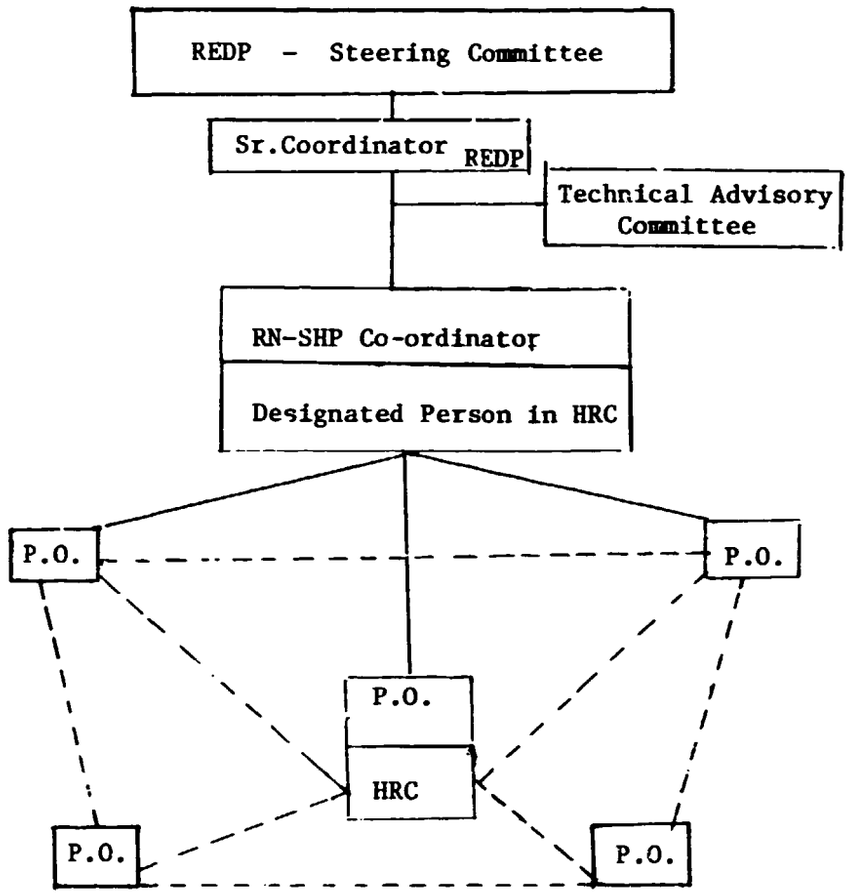
i) A Governing Body
ii) A Technical Advisory Committee (TAC);
iii) A Secretariat headed by a Coordinator, possibly the REDP Steering Committee)."

Recommendation No. 9 to read -

" The eventual institutional structure of the HRC will be decided upon in the light of decisions made as per Recommendations 13 and 4."

The Government of the People's Republic of China, as well as the UNDP Resident Representative's Office in Beijing, feel that these amendments would make Recommendations 4 and 9 consistent with the provision that the first phase be carried out under interim arrangements for a period under two years and the final structure of both the RN-SHP and the Hangzhou Regional Centre be determined at a later date, as per Recommendation 13."

The above amendments have been officially proposed by the Government of the People's Republic of China.



Legend:

P.O.	Participating Organization
REDP	Regional Energy Development Programme
RN-SHP	Regional Network for Small Hydro Power
HRS	Hangzhou Regional Centre

II INTRODUCTION

A: Background Information

In reviewing the energy situation in developing countries within the context of their overall industrialization efforts, the subject of new and renewable sources of energy has become increasingly highlighted, particularly for the majority of the developing countries that do not possess their own fossile fuel resources. The United Nations Conference on New and Renewable Sources of Energy held in August 1981 in Nairobi, Kenya, and particularly the Panel of Technical Experts on Hydro Power, focussed on the significant role which small hydro power could play, specifically in connection with the supply of power to remote and isolated rural areas not covered by the national grid network.

UNIDO and ESCAP have already recognized this potential and organized in September 1979 the First Expert Group Workshop on Mini Hydro Power Generation, Kathmandu, Nepal, with the support and co-operation of the Government of Nepal and the Government of Norway. A Second Workshop, combined with a Study Tour, was organized in 1980 at Hangzhou, People's Republic of China, and Manila, The Philippines, with the support of the respective governments as well as the financial contributions of the Governments of Norway and Sweden, where the experts elaborated further on the various aspects of mini hydro power generation and application. Both meetings urged the need of an international system of network to promote international co-operation between and among the developing and developed countries at the national levels, and recommended the creation of a regional focal point which would stimulate and carry out activities that could be beneficial to the national efforts. This was particularly considered of great relevance in the field of research and development on the one hand, and training of human resources for various disciplines and at various levels, on the other hand.

The People's Republic of China, in response to the recommendations of the First and Second Mini Hydro Power Generation Meetings, took a decision to establish, with the support and co-operation of UNDP, UNIDO and ESCAP, a Regional Centre for Research, Development and Training on Small-Mini Hydro Power in Hangzhou, and with the allocation of national budgetary funds has

initiated the construction work tentatively aiming at the completion of the first phase in October 1982. Further discussions were carried out on the subject between the Government authorities of the People's Republic of China and UNIDO, in consultation with ESCAP and the ESCAP-Regional Centre for Technology Transfer, Bangalore, India, which resulted into an agreement that the work programme of the Regional Centre should be so formulated as to reflect the practical and priority area subjects of the member countries in a goal/objective oriented manner. For this purpose, it was considered necessary to collect information on such priority areas and projects from the member governments of the ESCAP region and to have a small group of senior experts review and assess such information with the objective of formulating a proposal for the work programme.

Through a series of actions initiated as early as August 1978, when a Working Group on Energy Planning and Programming, organized by ESCAP with UNDP support, examined the energy problems of the developing countries of the ESCAP region, and finally at the Intergovernmental Meeting of Development Assistance Co-ordinators convened by UNDP at New Delhi in February 1981, high priority was given for a Regional Energy Development Programme (REDP) to assist on the subject of non-conventional sources of energy and on design and construction of mini hydro power plants, for inclusion in the 1982-86 programming cycle.

One of the proposed components of action, particularly in the field of development and transfer of technology, was to create a network system on a TCDC basis to bolster technology transfer through regional training and exchange of information

It was therefore agreed upon that UNIDO and UNDP/ESCAP should combine their efforts in undertaking further action in implementing their activities in the field of mini hydro power generation within the ESCAP region. To this extent, based upon a subcontracting arrangement between ESCAP and UNIDO, UNIDO was requested to organize a joint UNIDO/UNDP/ESCAP Meeting in the People's Republic of China in July 1982, with the support and co-operation of the Government of the People's Republic of China acting as the host.

B Objectives

The Senior Expert Group Meeting on the Creation of a Regional Network System and the Assessment of Priority Needs on Research, Development and Training in the Field of Small-Mini Hydro Power, had the following objectives:

i) to elaborate on the creation of an ESCAP regional network system on mini-small hydro power, to promote mini-small hydro power development and application within and among the member developing countries;

ii) to identify at the national level of the ESCAP member countries actual needs for research and development as well as for training, which would form the basis for developing the work programme of the Regional Centre for 1982/1983/1984; and

iii) to exchange views on the management and operation of the Regional Centre including the establishment of an advisory board, etc., and its organizational linkage with UNIDO, ESCAP and other relevant UN and non-UN agencies and organizations.

C. Organization

The Senior Expert Group Meeting was attended by twelve (12) participants from ten (10) developing countries. Representatives from five (5) UN Organizations and one (1) representative from OLADE also participated in the discussions. A list of the participants is attached as Annex I to the report. The Programme of the Meeting is attached as Annex II.

Mr. DENG Binli, Deputy Director, Department of Rural Electrification, Ministry of Water Resources and Electric Power, welcomed the participants and officially opened the meeting on July 12, 1982. He stressed the importance of the meeting which will be to discuss the creation of the regional network system, a significant step to the development of the SHG. China was in full support of the regional network system and would contribute all efforts for its early realization. He informed the participants of the tasks the Regional Centre in Hangzhou planed to do

which were:

1. To carry out scientific research and technical development in the field of small hydropower;
2. To train SHP professionals for the developing countries;
3. To exchange technical information on SHP;
4. To provide SHP technical advisory services.

Mr. HSU Hsia-Shih, Director of the Bureau of Water Conservancy and Power of Zhejiang Province, also welcomed the delegates. He recalled the Hangzhou-Manila Declaration which urged the developing nations to initiate and accelerate MHG programmes. The creation of the Regional Network System and the operation of the Regional Centre was a realization of the Declaration. He made special mention of the joint efforts of UNDP, UNIDO and ESCAP in accelerating the development of the MHG in the ESCAP region.

On behalf of UNDP, Mr. Jehan Raheem, Chief, Division for the Regional Programme, Regional Bureau for Asia and the Pacific, also welcomed the delegates. He informed of UNDP's full support of the Hangzhou Centre, and that UNDP would provide equipment for the Centre once its needs were identified. He reminded the participants of their special responsibility to assess the state of the art in Asia and identify areas where regional co-operation was needed. The participants should lay plans for a fruitful collaboration in the field of SHG. He expressed hopes that through ESCAP and UNIDO the Centre could be linked to other Asian Energy Programmes. The Centre's activities could also be linked with Asian lead centres in Indonesia, Nepal and India.

Mr. A. Arismunandar, Senior Co-ordinator of Regional Energy Development Programme (REDP) conveyed the message of Mr. S.A.M.S. KIBRIA, Executive Secretary of ESCAP. Mr. Kibria stressed the importance of this meeting since it provides an excellent opportunity to establish functional co-operation among regional countries on mini-hydro development. The ESCAP Regional Energy Development Programme emphasizes strongly on the establishment of network, inter alia, for MHG development. A regional study was also being planned to assess the potential for local manufacturing of MHG equipment. Further he expected that the

meeting would review the status of work on MHG and recommend suitable measures to overcome the constraints that exist in the spheres of R+D, training, information flow, policy and planning and identify the scope for and the modalities of regional co-operation.

Mr. W.H. TANAKA, Head of Development and Transfer of Technology Branch, made a statement on behalf of UNIDO. He stated that the present meeting had its main purpose to collect the views of senior experts through a brainstorming exercise to draw out a, so-to-say, shopping list of areas and subjects that could be covered by networking system, i.e.

- Joint R+D;
- Information collection and dissemination;
- Exchange of officials and technicians;
- Technical advisory services;
- Joint and co-operative training schemes; etc.

and a R+D and training programme priority list that could be used as a basis for developing the work programme of the RC-SHP. In both cases, an important element was the activities at the national level. Thus, the brainstorming of senior experts engaged in this field as their daily bread was the most important element of the meeting and he expressed his hope that in the 5 days of discussions the meeting would be able to come up with some useful data, suggestions and proposals that could be considered by the RC-SHP and the Government authorities of China as well as by the UNDP and other multi- and bilateral donor agencies and organizations for their financial support.

At the plenary session the participants elected the following officials:

Chairman - Mr. ZHU Xiaozhang (People's Republic of China)
Co-Chairman - Mr. William H. TANAKA (UNIDO)
Rapporteur - Ms. Zenaida A. SANTOS (Philippines)
Vice-Chairman - (Group 1) - Mr. Prapath PREMMANI (Thailand)
- (Group 11) - Mr. P.N. FERNANDO (Sri Lanka)
Asst.Rapporteur -(Group 1) - Mr. Tanaji A. DEODAS (India)
-(Group 11) - Mr. Asif Ali SHEIKH (Pakistan)

It was decided that the plenary would be split into two (2) working groups. Group I was to discuss Regional Networking System and Regional Centre Management. Group II was to discuss the Work Programme of the Centre for 1982-1984 in the areas of Research and Development, Training and Advisory Services. The Reports of Group I and II form part of this Report.

In addition to the discussions in the plenary sessions as well as working group meetings, the participants benefitted from a visit to an MHG site (Quing Shan Reservoir) and a visit to the Small Hydro Power Equipment Exhibition in Hangzhou.

D. Report

All participants took part in the preparation of this Report. The Report was presented and duly adopted during the closing ceremonies on 17 July 1982. The meeting expressively recommended that the Report be presented to the UNDP and REDP and the Government of the People's Republic of China.

III SUMMARY OF COUNTRY PAPERS

1. BANGLADESH

In Bangladesh a reconnaissance was done in 1981 under the guidance of a Mini-Hydro Working Committee. The Committee recommended twelve sites which are estimated to yield 1275 KW. This is in addition to canal-drop prospect of 12000 KW on the Teesta irrigation project at a number of sites.

Priority order for development of SHG in Bangladesh are:

1. Creation of an exclusive office to conduct investigation, studies and design of MHG/SHG.
2. Immediate investigation, design and implementation of canal-drop hydro on the Teesta irrigation canals.
3. Detailed investigation and feasibility for 12 sites recommended by the committee and implementation of a pilot project.
4. Country-wide survey for mini-hydro and preparation of a Master Plan.

Priority order for regional and international co-operation are:

1. Inter-change of information among member countries and between national focal points and the Regional Centre.
2. Research:
   (1) Hydrological investigations and investigations related to hydraulic structure and hydraulics can be undertaken at national level. The national effort may be supplemented at the Regional Centre or in the network through interchange of information and utilizing better facilities of research where available.
   (2) Low cost construction methods and materials.
   (3) Low cost machine technology. This applies to all. But development of small output (100-200W) submersible type machines utilizing flowing water may be of special interest. Some developments have been seen in this respect which appear to be costly. If low cost machines can be developed

and produced these could be used in thousands of country boats and in many portable applications.

3. Training

A number of engineers from both Power and Water Development Boards may be trained in the fields of -

(1) Hydrology for MHG/SHG including hydropower study.
(2) Hydraulics structure for MHG/SHG.
(3) Hydraulic machine application.
(4) Selection of generators, speed controls, voltage control etc.

Two participants in each field would be sufficient to start with. Training in operation and maintenance may be done in the country with the help of manufacturers.

4. Advisory Services

This is required in connection with (1) definite project identification, feasibility and detailed design for the first set of projects (2) for country-wide survey and preparation of a Master Plan and (3) for specific problems in future:

Economic aid: Both for initial SHG development such as advisory service, procurement of machines, etc. and transfer of technology, the country needs financial assistance.

2. CHINA

Information

1. Edition and publication of a regional "Newsletter" beginning from 1983.
2. Convention of a regional information meeting.

R+D

1. Establishment of a pilot demonstration project on automation and telemechanization.
2. Study of Electronic Load Controller.
3. Optimal development of cascade.

3. FIJI

There is a need for:

a) An overall assessment of MHG potential, and

b) Systematic development of individual schemes as may be justified in each particular case with due regard to other sources of energy.

(No doubt, in due course and time, an exclusive office for that purpose will have to be established.

Therefore Fiji will seek:

a) up to date information regarding the state of art in this field (especially applicable to the Pacific Region);

b) help in research methods, investigations, data collection relevant to hydrology, geology, environmental and social impacts; advice on methods of increasing utilization of electricity in rural areas through links with developments in agro-industry and cottage industry; advice on efficient running and maintenance of isolated small electricity generation and distribution schemes by local bodies/co-operatives;

c) practical training of:
- managerial level (planning)
- engineering level (design and construction)

N.B. Training at the managerial and engineering level is very important as Fiji lacks badly an indigenous cadre in this field.

4. INDIA

Information Service

The country is well equipped in this service. There is good communication between various agencies undertaking development of SHG, supplies/manufacturers of the equipment, planners in this field, and also the research and development activities. The country also receives almost all international magazines and publications on this subject and information on this subject is up to date. The Central Electricity Authority which is an organ of the Central Government has good rapport with the various states and other

agencies who are responsible for actual execution of the SHG. They also advise and issue guidelines to the States.

R + D

The thrust of the R+D is on the manufacturers in the country. They have already developed sufficient number of hydraulic designs and suitable generating equipment to go with it. Some of them possess modern laboratories for taking up research in majority of items concerning improvement of the performance, of turbines and other electrical and mechanical equipmment.

Training

The country has already developed all types of SHG and a large development is presently underway. The technology has been developed to undertake all types of SHG with simpler means and using modern equipment especially for prime movers. The concerned states do possess trained personnel in the field of planning, preparation of feasibility reports, construction, commissioning and operation and maintenance. The stress has been on employment of local personnel, materials and simplicity of operation. Agencies needing know-how undertake visits to the existing developments and also freely exchange their views.

Advisory Services

The country is very well equipped to undertake advisory services in almost all aspects of small hydro development. It has already given this type of service to neighbouring countries. On the basis of the information gathered by the teams sent abroad a large number of feasibility reports have been prepared. Advisory services could be given in specific areas such as civil features, choice of E+M equipment, installation and commissioning of the equipment. The country can also give consultancy services in the designs of all civil features, specification of the equipment, control system, switching arrangements, etc.

5. MALAYSIA

Information

a) Storage of documents, drawings, video tapes, etc. from member countries for reference purposes.

b) Collection and dissemination of information pertaining to MHG-SHG.

c) Compilation of works from other bodies involved in this field.

d) Apart from needs for direct engineering information, subjects on socio-economic aspects, funding procedures and funding availabilities are also to be compiled.

Research and Development

The following are the areas where this activity can be concentrated on

a) Feasibility Studies and Analysis
This will include method of survey on energy utilization for estimation of project benefits, method of survey work and new techniques in hydrological, geological and use of computer aid for data analysis.

b) Design techniques in both civil and electro-mechanical portion of MHG-SHG.

c) Construction techniques including local fabrication of equipment.

d) Operation and maintenance.

e) Standardization for cost optimization and a more rapid programme execution.

Training in MHG-SHG

a) Training in hydrology for assessment of stress flow and assessment of a suitable site.

b) Survey work and basic geology.

c) Analysis work including power market analysis, demand projections and market survey and financial analysis.

d) Training in project management.

e) Training in operation and maintenance.

Advisory

a) Formation of a pool of experts and their registration for advisory/consultancy services to be made available to the participating countries on their request.

b) Exchange of experts on short-term basis for advisory, consultancy and training.

6. NEPAL

Information

Collection of and dissemination of publications of the Centre as well as of countries within and outside the Network as to the state of arts, design, equipments, etc.

Research and Development

Evolving low cost designs involving less costly and less weight intensive materials such as cement, steel, etc. for the construction of hydraulic structures, powerhouse, penstocks etc.
Research on using locally available materials.
Evolving simpler methods of hydrological analysis and geological assessment.
Evolving cheaper governing system.
Developing low cost hydro-mechanical equipments.

Training

- Conduct seminar/workshop for engineers in order to update the know-how as to the state of arts in methodology, design, operation, etc.
- Conduct training to middle level technicians in application methods in both civil engineering and electro-mechanical aspects.

Advisory Services

- Providing technical assistance for strengthening the national capability in survey, investigations, feasibility studies, engineering design, construction methods, etc.
- Providing job specific consultancy services.

7. PAKISTAN

The following areas would be of interest,

R+D

1. Design and fabrication/manufacture of turbines
2. Design and fabrication/manufacture of generators
3. Indigenous production of these

4. Frequency stabilization (Governor design)
5. Small powers system development

Training

1. Hydro mechanical design
2. Hydro Electro mechanical design

Advisory and Information

1. State of art
2. Enduse indication
3. Regular newsletter publication

8. PHILIPPINES

Based on the present status of the Philippine Programme, the areas most in need of strengthening are:

Information

Through the use of Newsletter or Technical Bulletins

1. Information on manufacture equipment available will be most useful for equipment planning and selection.
2. Methodology other countries are using in preparation of feasibility studies.

Research and Development

1. Low cost design of the different components of a Mini-Hydro system like penstocks, dams, etc.
2. Hydrologic methodology with very limited stream flow data.

Training/Seminar Workshop

1. Site inventory and selection
2. Planning and design of Mini-Hydro systems
3. Hydrology training on how to work using very little flow data
4. Operation and maintenance of power plants
5. Construction management.

Advisory Services

1. Policy guidelines for resolving issues such as water rights and watershed management.

9. SRI LANKA

The main thrust of the regional network system should be towards achieving interchanges between the network countries and the Regional Centre which would enable the maximum development of low cost SHG of adequate reliability within the individual country and site constraints. It is expected that the Regional Centre would basically integrate and disseminate the relevant techniques for SHG development supported by a continuing research and development programme. The Centre is also expected to provide direct and sponsored training together with an advisory service for the network countries.

A) Research and Development

1. Adaptation and innovation of existing technology to meet specific conditions.
2. Technological processes leading to cheap yet reliable diversion and waterway arrangements, penstock and associated equipment design, power house layouts and electromechanical equipment.
3. Scope for using indigenous materials and skills.

B) Training is an essential function for the success of SHG development plans in any country. In general, engineers with a good theoretical and practical background, who form the first level of trainee, require less formal training but more experience interchange and field visits. The second level of trainee is expected to be more field oriented and require an appreciation of the engineering principles of SHG development but has to be intensively trained on the field procedures.

c) Advisory Services

1. Provide continuously the state of the art in SHG.
2. Provide constructional details of SHG arrangements on request for various physical conditions, recommendations on layouts and material usage, reference prices, likely operational problems and remedial actions, arrangement, stopping and training etc. with comprehensive literature.

It is suggested that the Regional Centre should be arranged by a group of representatives from the ESCAP countries and relevant UN and non-UN organizations with direct interest.

10 THAILAND

Information Exchange

1. State of art of SHG-MHG in participating countries
2. Newsletter and Technical Digest
3. Experiences in the field of SHG-MHG

R + D

1. Low cost turbine (low cost)
2. Technology in the fabricate and construct of on site, low cost water conveyance for headrace and penstock
3. Low cost mechanical governor
4. Electronic load control
5. Hydrological model

Training (2 months)each

1. Training course for junior engineer (3-5 years of experience) in field of resource assessment, project formulation and planning, feasibility studies, design, construction, operation, utilization and socio-economic impact. The training course should be divided into 2-3 groups as follows:
   - 1.1 project formulation, planning up to feasibility studies
   - 1.2 design and construction
   - 1.3 operation, electro-mechanic aspect of project

) possible of combined

2. Study tour of senior engineer (more than 10 years of experience) to visit projects, laboratory, factories and institutes involved in SHG-MHG (3 weeks)

Advisory Services

1. expert advice on turbine design (1 week)
2. expert advice on governor design (mechanical) low cost (1 week)

(list in priority order)

IV GROUP REPORTS

Group I - Regional Networking System, Regional Centre and Management of Network

Concept of Networking

Interregional/Inter-country co-operation is the underlying principle for establishment of a network. It is essentially for technology transfer and technology development. Network consists of a group of institutions in different countries in the region engaged in a particular field of activity or research, design and development, demonstration acting as a group to exchange information, experience and knowledge to co-ordinate R+D and to minimize duplication, to undertake joint research, to offer training and advisory services to one another, to disseminate information and generally to advance a technology and its application. Every participating institution will have an important role in the network; for convenience of operation, a specific aspect of technology may be assigned to an institution which will be the focal point for that aspect; thus there may be several focal points in a network depending on the activities undertaken in the countries of the region. Each focal point establishes communication with every other institution, and maybe those outside the network, concerned with that aspect and disseminate information, data and research results obtained from them to all participants in the network.

The process of exchange and co-operation gives momentum to the network and its success depends entirely on the extent of co-operation. The network thus has to be self-evolving, self-containing and self-sustaining and the moment the process of exchange/give and take stops, the functioning of the network either fails or ceases to exist.

Need for Networking in Small-Hydro

In the wake of uncertainty of availability of fossil fuels in future, conservation of dwindling natural resources and demand for electric power as a key input to the increased productivity as well as improved quality of life, importance of development of small hydro, especially in the developing countries as a renewable source of cheap and reliable energy has been recognised. It is capable of being implemented relatively quickly and with

simpler means. Urgency for its development is being felt all the while. However, the developing countries have come across a large number of constraints in their attempt to get the activities going for this purpose as a result of which their natural resources are going untapped.

A few countries may not at present be adequately equipped to collect basic data and other perameters required for preparation of feasibility reports or pre-feasibility studies or even estimating their potential sources, while some others even after having collected the data we. a loss to prepare feasibility reports for want of knowledge for choi appropriate electrical and mechanical equipment or deciding the civil f ures. Some after having constructed few stations have felt that the number of units installed is either in excess or are not able to make full exploitation of the available water resources and also have difficulties in their proper operation and maintenance. Many of the countries have common problems and obstacles. Incidentally, technology in this field is quite advanced and quite a few countries in the world including some in the region do possess this technology or can gainfully develop it or have access for obtaining it. Such a position is very much conducive to start a network system in Small Hydro and thus has established a strong need to create one.

Role of the Network

The national focal points established in the various countries are expected to provide a large number of services. The national focal points will have to be identified by the governments of member countries. The focal points should be organizations who can co-ordinate the activities in this field within the country and can furnish the necessary inputs required to other focal points. These focal points would be organizations in the country which are actively engaged in the Small Hydro and would be doing major work and have already acquired some know-how in this field. These focal points are expected to provide the following services in the assigned aspects:

- Organise an information service (technical and general);
- Accept or recommend candidates for training from other focal points;
- Make available short-term advisory services;
- Undertake R + D projects depending on the facilities available to the focal points;
- Organise meetings for the benefit of the network;
- Establish links with institutions outside the network.

Any of the focal points with the assistance of the supporting organizations may also seek the assistance from other sources in a specific aspect, which considers that their contribution to the network would be beneficial to them at a later stage in a number of ways.

Supporting Organizations

For the Small Hydro Networking the following organizations will be supporting organizations

UNDP
UNIDO
ESCAP
REDP
RCTT
UNDTCD

These organizations could provide, among others;

- Guidelines and assistance;
- Modest supplements to the budgets of various elements of the network;
- Specialist services and training not available within the network;
- External costs of meetings, training and advisory services;
- Books and equipments as supplement to focal points' own resources.

Regional Centre for Small Hydro

The People's Republic of China has volunteered to set up a Regional Centre for Small Hydro as an extension of their national centre. In view of their having constructed a very large number of small hydro power stations and acquired considerable know-how, the suggestion was welcomed

by the participating countries and also the supporting organizations. This Centre is being established in Hangzhou. It has also been the consensus that the network to start with will have this Regional Centre as its first activity getting its inputs from the member focal points.

Scope for the Network

The network could have a large number of aspects under their activities. These are broadly listed below.

- Estimates of exploitable potential and energy demand
- Country-specific conditions in the field of hydrology geology, terrain, etc.
- Methodology of collection of data in the above fields
- Broad civil engineering features depending on a type of development
- Availability of the equipment and its specific utilization
- Feasibility studies; cost/benefit ratios
- Civil engineering work
- Promotion of equipment design capacities
- Promotion of acquisition of design and manufacturing capacities
- Local manufacture of equipment and spare parts
- Standardisation
- Distribution system and utilization of power
- Operation and maintenance
- Associated uses - e.g. irrigation, flood control, navigation, fisheries, etc.
- Promotion of industries and promotive activities using SHG
- Socio-economic aspects
- Training of personnel
- Design and development and demonstration and research
- Testing and evaluation of equipment/material
- Exchange of experience of peoples participation in construction of SHG
- Advisory services

Scope under the Interim Arrangements

The beginning of the network would be made with a modest budget and the activities limited to only certain aspects of the Small Hydro development. These are based on the common and urgent needs of the majority of participating countries. These would be:

- Information exchange;
- Training of personnel;
- Research and development in a few specified areas;
- Advisory services.

1. Information Exchange - Focal points will be collecting the information within the country and sending it periodically to the Regional Centre for dissemination. The information to be collected would be in respect of the development already taken place, development under way, proposed programme in near future, facilities available or being contemplated to be created, special development/achievement as they consider to have made and any other relevant information which they think would be useful for assimilation in the network. Based on such information received at the Regional Centre, it would prepare newsletters, state of art report, prepare compendiums on the valuable information dealing with certain aspects of mini hydro, and circulate them to the focal points from time to time.

The Regional Centre would also collect interesting developments all over the world in this field and include them in the newsletters.

Compendium reports would cover experience reports, certain countries would have brought out certain documents which may be in respect of the country-specific conditions and their methodology for tackling them. Such reports should be capable of being exchanged within the network.

Certain specific information commonly needed by the countries may also be collected. One of the items may be the same idea of the prices of the generating equipment developed for Small Hydro. Quite a few reputable/well known firms in the world have brought out pamphlets of the equipment and the range of prices is also published in technical magazines from time to time. Though the pricing information is usually available in the forms of graphs it can serve useful data for the project planners.

Another item can be bringing out inventory in respect of services available not only within the network but also outside it.
Technical bibliography may also form a part of information activity.

2. Training - Regional Centre is creating facilities for taking up training in this first phase of development. The levels at which training should be imparted as well as scope of the courses, etc. is a matter of working out details. This has been considered by Group II.
Later on, focal points of the network would entertain trainees in specific fields.

3. Research and Development - Some specific items would also be included in the scope of the Regional Centre to start with. These items should pertain to very common needs for facilitating constructional activities in the field of Small Hydro. The details of this programme have also been worked out by Group II.

4. Advisory Services - These services would be provided by the Regional Centre upon specific requests from the national focal points. These services would be available in certain aspects of the small hydro development. The specific items have been mentioned in the report of Group II.

This is a broad outline of the present scope of activities and on account of self-evolving nature of the networking involve on these lines in the course of its initial functioning. The Centre is expected to contribute towards strengthening the activities of the network. Regional Centre is primarily for the network and it is expected that it would occupy itself fully with the activities of the network. Programme of the Regional Centre should be so drawn up that it reflects the priority needs of the participating countries.

Management of the Network

(1) Focal Points - The basic elements of a network are its focal points. The government of each participating country will be requested to nominate a focal point which should preferably be the agency in the government concerned with SHG development; where more than one such agency exists, the government will be requested to nominate the agency most concerned with SHG development and performing the functions of a focal point for a national group of agencies concerned with SHG.

(2) Governing Body - In order to ensure that the work programme of the Network reflects the needs and priorities of participating countries, that the Network receives the active support of governments, that the provision of adequate resources for the Network receives attention at the highest level and that the Network functions as a truly regional co-operative activity, it is necessary that it should have a Governing Body consisting of representations of governments and supporting organizations; it is recommended that, to make deliberations of the Governing Body manageable, it should consist of a representative each of seven governments, which number should include governments with lead centre (for which purpose the Hangzhou Regional Centre will be regarded as a lead centre), representation of UNDP, UNIDO, ESCAP,RCTT, UNDTCD,the head of the Hangzhou Regional Centre and the Coordinator of the Network. Only representatives of governments will have the right to vote in deliberations of the Governing Body. The Governing Body may adopt its own rules of procedure.

(3) Technical Advisory Committee - A Technical Advisory Committee (TAC) will be necessary to formulate the work programme of the Network; this committee will consist of persons nominated by the national focal points of the Network and of representation of the supporting organizations (viz UNDP, UNIDO, ESCAP, REDP, RCTT and UNDTCD. The TAC may invite to its meetings persons of experience in the field of SHG.

4. Co-ordinator - The Network will need a Co-ordinator to ensure its smooth workii and to support the focal points in their work. He should lead a small secretariat which he will head.

Functions.

(1) The Governing Body will consider the work programme prepared by the TAC and approve, amend or modify it as it seems fit; it will consider the report of the Co-ordinator on the activities of the Network; it will examine resources available to the Network for implementation of its work programme including operating expenses as may be necessary; it will review the general structure of the Network and take measures for strengthening it; it may discuss any other aspects of the Network and make decisions and recommendations on all matters concerning the Network. The report of the Governing Body will be submitted to ESCAP.

(2) The TAC will receive from the Co-ordinator proposals for the work programme of the Network and recommend to the Governing Body a work programme. The TAC's recommendations will be submitted to the Governing Body through the Senior Co-ordinator of REDP.

(3) The Co-ordinator will be appointed by the Secretary General of the United Nations; he will function under the general guidance of the Senior Co-ordinator of REDP and will report to the Governing Body through him. He will have direct communications with the focal points of the Network and with institutions outside it concerned with SHG. His chief function will be to assist the Network to function smoothly and will assist the national focal points and lead Centres to further this objective. He will be a national of one of the participating countries in the Network.

The Group was of the opinion that since these suggestions for the management of the network needed time for reflection, observations may be sent to Mr. W.H. Tanaka, Head, Development and Transfer of Technology Branch, UNIDO, to reach him before 15 August 1982, and that any such observations so received will be issued as an Addendum to the Report of the Meeting, without prejudice to the Recommendations made in the Report.

The Co-ordinator of the Network will report to the Steering Committee through the Senior Co-ordinator of the REDP, receive the guidance of the Technical Advisory Committee, promote and co-ordinate the activities of the RN-SHP and assist and co-operate with the designated person in the HRC.

Group II - Regional Centre Work Programme

The extent of economical development of small scale hydropower generation (SHG) depends on the approach and technology adopted. The main thrust of the regional network system should be towards achieving interchanges between the network countries which would enable the maximum development of low cost SHG of adequate reliability within the individual country and site constraints. The basic function of the regional network centre (RNC) is the integrating and disseminating of the relevant techniques for such SHG development, supported by the benefits of a continuing research and development programme to be carried out by the centre. In addition the centre would also provide direct and indirect training together with an advisory service giving advice and consultancy for any specific SHG development problems posed by the network countries. Further details of these functions are given below.

1. Research and Development Work Programme

In general SHG technology is mature and what is relevant here is the adaptation and innovation of existing technology in most cases bringing perhaps non-conventional approaches to meet specific conditions. Useful research and development can be carried out under the following technical aspects.

1.1 Hydrological, Topological, Geological Feature Identification

This identification is essential for locating a hydropower development and determining the power and energy obtainable from the head and regularity of the flow available - Quite often historical hydrological data is absent in sufficient quantity for small streams and methods have to be developed to synthesize such data through correlation with neighbouring river flows and limited observations. Further development of these techniques is essential.

- Improvements in survey techniques for Topography and modern methods of head determination have to be harnessed for areas with poor cantographic material
- With the aid of minicomputers it is also possible to organize the hydrological and topological information in a data base which can then with the aid of modern software be used to formulate project

developments. Standardised procedures are essential for the purpose.

- Improving the extent to which limited geological investigations can enable the location of small scale hydro dams and power stations.

1.2 Diversion Dam Arrangement and Storage

- Criteria for run of river, daily regulation, long-term regulation
- Choice of concrete arch, gravity and earth dams for diversion, or even drop type weirs. Use of flesh boards with automatic fail safe arrangement and/or manual operation. Availability of skills and materials for local construction in remote areas.
- Bottom outlet arrangement and its effect on stability of dam, considering the sealing of sides and foundations. Scope for model tests.
- Silting control
- Criteria for using gates

1.3 Intake and Water Conveying System

- Desilting arrangements for intake and intake arrangement for erosion control
- Canal arrangement, criteria for flow velocity determination. Facility for overflow. Possibility for tunnel sections to shorten canal and reduce losses. Canal stability and seepage. Control of debris
- Headrace pipeline design.
- Forebay arrangement. Catering for surges in the pipeline. Forebay location. Slope from intake to forebay.
- Possibilities of using indigenous material for construction.

1.4 Surge Tanks and Penstocks

- Necessity of surge tanks. Prefabricated construction of surge tanks. Integrating with forebay and pipeline.
- Non-conventional materials for penstocks using indigenous techniques.

- Open penstocks and anchoring problems. Burried penstocks and erosion problems.
- Use of prestressed concrete. Quality control.
- Penstock joints simplification.
- Penstock transport. Use of cables, rails, animals.
- PVC penstocks, wood stave penstocks
- Pressure relief valve provision.

1.5 Electro Mechanical Equipment and Power House

- Extent of standardization
- Possibility of indigenous manufacture of equipment and/or their parts
- New types of governing for use with synchronous generators
- Asynchronous generators on the power system
- Asynchronous generators for isolated operation with capacitor banks
- Further adaptation for SHG of all turbine forms for use in different head and flow conditions
- Turbine efficiency improvement
- Cross flow and other types of turbine development for local manufacture
- Promoting of capacitor banks in system to decrease current rating of generator
- Excitation improvements
- Optimal choice of voltages for generation and distribution
- Standardization of electrical switchgear and busbars
- Operation of turbine without governor
- Evolution of simple power house construction, layout and tail race arrangement.

2. Training

Training is an essential function for the success of SHG development plans in any country. Several categories of personnel ranging from engineers with a good theoretical and practical background with development responsibilities to plant operators with limited technical knowledge are involved.

2.1 Such engineers in general form the high-level and require less formal training. It is important for them to study in depth relevant SHG literature in a comprehensive manner and spend short times with

feasibility study and project design teams, project operating sites and electromechanical equipment manufacturing sites. and produce detailed well illustrated reports for critical review by more experienced and trained engineers. The formal training to be given in the form of lectures at seminar/workshops for these high-level personnel at the RNC is expected to cover the following areas:

- Rural energy resources and electrical and mechanical power consumption
- Fundamental experience of SHG development
- Cascade development of a rivulet and planning a small scale power supply
- Exploration, survey and design work for an SHG project.
- The power and energy capability of the project and its justification
- Economic layouts and design for the civil and hydromechanical structures
- Manufacture and supply of electromechanical equipment
- Electromechanical design and layout
- Construction management
- Operation and maintenance of small hydro plant, its connected structures and a small power distribution system
- International co-operation in the SHG field.

The Seminar/Workshop for the high level personnel would have sessions of R+D experience exchange and lectures by visiting experts and even participants on local experience on specific topics. The high level training is expected to last about 3 weeks in the RNC with about 5 days of field visits in between.

2.2 The second level of training at the RC is for middle level personnel with adequate practical and theoretical knowledge. These personnel are actually "trainer trainees" who are expected to return and impart their training to others to create a multiplying effect of the training. This is obviously necessary because the RNC can only train a limited number of personnel each year. However, the RNC can extend its training function by the supply of comprehensive well illustrated

publications, both internal and external, and organization and sponsoring of training in the network countries, with counterpart support and visiting experts. All low level training has to be carried out within the country except in very isolated cases. The middle level have to choose one of the following two courses:

(1) SHG civil engineering aspects oriented course

(2) SHG electromechanical engineering aspects oriented course.

The choice depends on their background and the needs of the country. At present it appears that more emphasis is required on course (1). The courses would be broadly covering the following areas:

Course (1)

- Exploration and surveying involving flow and head assessment, judgement of geological conditions and power and energy obtainable.
- Planning involving siting of SHG development, determining storage, type of regulation, etc.
- Hydrostructure design involving the diversion arrangements, waterways, gates, valves, surge tanks, penstocks, power house arrangement, etc. and operation and maintenance involved.
- Social and economic aspects.

Course (2)

- Hydromechanical aspects involving the design, operation and maintenance of gates, valves, penstocks, turbines. Turbine types, basic designs, manufacturing principles, etc.
- Electrical equipment involving generators, transformers, switchgears, protection. The operation and maintenance of these.
- Installation of hydromechanical and electromechanical equipment. Identification of mechanical and electrical malfunctions and correction.
- Safety procedures.

These courses would be of 3 months duration with about 3 weeks of field visits.

In addition, it is also envisaged to have a course of similar duration for trainees with a very good SHG background for the purpose of

imparting technology transfer for the local manufacture of particularly hydromechanical and electromechanical equipment where possible. This implies that the centre would require certain manufacturing facilit and/or have direct unimpeded acce s to such facilities nearby

3. Advisory and Information Services

The advisory and information services form a very important function of the RNC mainly for the use of the network countries which have a lower number of personnel visiting the centre. The advisory/ information services are expected to be provided in the following areas:

Information Services

- Initial publication giving the state of the art of SHG technology in the countries of the region.
- Continuing newsletters giving new development in the field of SHG and areas for indigenous adaptations, lists of publications available from the centre and the countries of the region and also outside, availability of courses and experts, etc.
- Special publication on the end uses of mini hydro not only for electricity generation but also for mechanical shaft power including pumping.
- Library extending reference facilities for a comprehensive collection of commercial and non-commercial publications covering SHG including project reports, case studies, etc. on project and equipment development and R + D publications.

Advisory Services

- Providing constructional details of SHG arrangements on request for various physical conditions, recommendations on layouts and material usage, reference prices, likely operational problems and remedial actions, modes of operation possible, management and staffing, training suggestions, etc. with comprehensive well illustrated literatures.

- Project formulation methodology for external financing highlighting the uses, their valuing, cost inputs and cost analysis, etc.
- Providing design and operating experiences with particular models of turbine generators, typical test results, etc. and problems that may be encountered.
- Provide general consultancy services on special or specific problems.

ANNEX I

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ANNEX II

WORK PROGRAMME

11 July 1982 (Sunday)	Participants arrival and transfer to Hangzhou
12 July 1982 (Monday 8.00-9.00)	Registration of participants at Zhejiang Hotel Building No. (1).
9.00-10.00)	Opening Ceremony - Inauguration address and opening of the Senior Expert Group Meeting (Mr. Deng Bingli, Deputy Director, Department of Rural Electrification, Ministry of Water Resources and Electric Power). Welcome address (Mr. Hsu Hsiashih, Director, Water Conservancy Department of Zhejiang Province) Welcime address (Mr. Raheem, Chief, Division of Regional Programme, Regional Programme for Asia and Pacific, UNDP) Welcome address (Mr. A. Arismunandar, Senior Coordinator, Regional Energy Development Programme, ESCAP) Welcome address (Mr. W.H. Tanaka, Head, Development and Transfer of Technology Branch, UNIDO, Vienna)
10.15-10.30	Election of the Chairman, two Vice-Chairman, the Rapporteur and two Assist. Rapporteurs. (The Vice-Chairman and Assist. Rapporteurs will be in charge of Working Group I and II)
10.30-12.00	Presentation of country papers (10 minutes each)
14.00-16.30	General discussion
16.30-17.30	Film
13 July 1982 (Tuesday)	
8.30-12.	Group discussion Group I Regional Networking System and Regional Centre Management Group II Work Programme (1982-84) Research and Development: Training: Advisory Service:

		Information System
	14.00-17.30	Continuation of Group Discussions
14 July 1982 (Wednesday)		
	8.30-11.30	Continuation of Group Discussions
	11.00-12.30	Visit to RC-MHG Construction Site
	14.00-17.30	Study Tour to MHG Site (Qing-Shan Reservoir)
15 July 1982 (Thursday)		
	8.30-12.00	Plenary Session Presentation and discussion of Group
	14.00-17.30	Discussion results.
16 July 1982 (Friday)	8.30-12.00	Plenary Session Continuation of discussions
	Afternoon	Preparation of draft report
17 July 1982 (Saturday)		
	10.00-12.00	Plenary Session and Closing Session Adaptation of a draft report
	14.00-17.30	Visit to Small Hydro Power Equipment Exhibition in Hangzhou
18 July 1982 (Sund		Departure

ANNEX III

LIST OF DOCUMENTS AND COUNTRY PAPERS

1. Aide-Memoire

2. Philippine Proposal for Management of the Regional Centre in Small/Mini Hydropower Generation (ID/WG.376/1)
by: Zenaida A. Santos

3. Thailand Proposal for the Manag4ment of the Regional Centre in Small/Mini Hydropower Generation (ID/WG.376/2)
by: Prapath Premmani

4. A Status Report on MHG in Bangldesh and Need for International Co-operation
by S.T.S. Mahmood

5. Considerations on the Creation of a Regional Network System on SHG and Priority Tasks of the Hangzhou Centre in 1982/1984
by: Asia and Pacific Regional Research and Training Centre on Small Hydro Power, Hangzhou, P.R. China

6. A Lecturing Outline of the Asian and Pacific Regional Training Seminar - Workshop on Small Hydropower
by: Asia and Pacific Regional Research and Training Centre on Small Hydro Power, Hangzhou, P.R. China

7. Beginning of Hydro Electric Generation in Fiji Island
by: J. Abramski

8. Indian Proposal for the Management of the Regional Centre in Small/Mini Hydropower Generation
by: T.A. Deodas

9. Regional Network System for the SHG-MHG Activities for Member Countries of ESCAP Region
by Mohamed Zubir, Zainal Abidin and Hoesni Nasaruddin

10. Institutional Strengthening
by:Small Hydel Development Board, Nepal

11. Pakistan Country Paper
by:Asif Ali Sheikh

12. Draft Note for Discussions on ESCAP Regional Network System for SHG/MHG
by: P.N. Fernando

13. Asian and Pacific Technological Network for Small-Hydro-Power Generation
by:Regional Centre for Technology Transfer

14. Comments Regarding the Establishment of a Network System and a Regional Centre on Mini and Small Hydropower for the ESCAP Countries, taking into consideration the Experience of Latin America
by: Enrique Indacochea, OLADE

15. Regional Programme for Small Hydro Power Stations
by: Enrique Indacochea, OLADE

16. National Focal Points for Mini Hydro Power Generation
by: UNIDO

ANNEX IV

PROJECT CONCEPT

A. Information

1. PROJECT TITLE: Publication Provision

2. OBJECTIVE:

   (a) Constant data-flow on problems and solutions, developments and trends, technical activities and experiences of SHP in the member countries and elsewhere.

   (b) Dissemination of synopses from selected publications on SHP techniques.

   (c) Liaison with international, regional and country network/ focal points.

   (d) Preparation of relevant publications.

3. SCOPE OF ACTIVITIES

   (a) Contact and exchange with relevant agencies and institutes.

   (b) Review of publications, conference proceedings and literature and preparation of appropriate papers and digests.

   (c) Preparation of reports and guidebooks on selected topics of special relevance to the region.

   (d) Establishment of an information data bank covering the subject and available to the region and to corresponding institutions and agencies.

4. EXPECTED RESULTS

   (a) General support to the member countries.

   (b) Improvement in the information base available within the region.

   (c) Facilitating co-ordination of technical activities in the region.

5. EXECUTION: Regional Centre, Hangzhou

6. TIME SCHEDULE/WORK PLAN:

   1973 - non-periodical in the beginning but regularly, every quarter w.e.f. 1984.

7. ESTIMATED BUDGET:

Information

1. PROJECT TITLE: State-of-Art Identification

2. OBJECTIVES:

To compile the up-to-date level and extent of developments already achieved in the member countries and elsewhere covering the entire spectrum of this technology.

3. SCOPE OF ACTIVITIES:

Collection of data from the member countries and audit of international information in the field.

4. EXPECTED RESULTS:

(a) Dissemination of available knowledge.
(b) Support of further activities in M/SHG
(c) To help in identification of needs for further studies/ developments.
(d) Closer liaison within the region and international collaboration.

5. EXECUTION:

Regional Centre, Hangzhou, in collaboration with focal points.

6. TIME SCHEDULE/WORK PLAN: two years

7. ESTIMATED BUDGET:

Research and Development

1. PROJECT TITLE: Cross Flow and other Types of Turbine and Turbine Standardization

2. OBJECTIVES:

Simplify and adopt existing turbine types and new innovations for small hydro generation development situations and concentrate on a few models of each type to cover practical SHG to reduce costs.

3. SCOPE OF ACTIVITIES:

Detailed study of present turbine applications, ranges of availability from manufacturers. Detailed study of research progress of commercial suppliers and prototype developers concentrating on the materials and techniques used and consequent cost reductions and installation simplifications achieved. Particular interest should be focussed on the cross flow turbines due to the very promising results obtainable. Study present efforts at standardization and make improvements bearing in mind the practical applications and cost significance.

4. EXPECTED RESULTS:

Further improvement of turbines suited for SHG development, installation simplifciation and cost reduction.

5. EXECUTION:

A consultant will be recruited and will be located at the focal point which has, and agrees to provide, facilities and assistance for his work; he will establish contact with other focal points interested in the project and obtain such data and information as would be relevant for his work. He will submit his report in 30 copies to the co-ordinator who shall arrange for its dissemination to all focal points.

6. TIME SCHEDULE:

March 1983 to September 1983

7. ESTIMATED BUDGET:

1. PROJECT TITLE: End Use Indication

2. OBJECTIVE:

   2.1 To ensure that full power output be utilized at all times (day and night) to improve economic performance of SMP.

   2.2 Provision of suitable load, in addition to normal domestic load, in rural area. This load shall be linked to local agro-industry, cottage industry or other local activities. If such do not exist, provision of them shall be the integral part of design and construction of SMP.

3. SCOPE:

   Gathering of information regarding small equipment up to 5 KW that could be used to improve village life.

4. EXPECTED RESULT:

   Improved utilization and improved village life.

5. EXECUTION:

   Publication of case studies and study tours.

1. PROJECT TITLE: Geology

2. OBJECTIVE:

General guidelines/training with regard to structural requirements in areas prone to landslides and tremors.

3. SCOPE:

Basic knowledge of:

- Lithology (geological formation-stratography);
- Geotechnics (mechanical properties, stability, water levels);
- Geomorphology (accumulations of sediments and deposits and eroding effects).

4. EXPECTED RESULTS:

4.1 Basic competence of indigenous young engineer who would be involved in design and construction of SHG.

4.2 Adequate design and construction.

5. EXECUTION:

Training

Research and Development:

1. PROJECT TITLE: Diversion and Penstock Arrangement

2. OBJECTIVES:

Simplification and adaptation of present practices introducing more scope for indigenous materials and techniques but giving adequate reliability and efficiency.

3. SCOPE OF ACTIVITIES:

Study choice of concrete arch, gravity and earth dams, and drop type weirs for diversion. Use of flash boards. Study the availability of skills and materials for local construction in remote areas. Bottom outlet arrangements and effects on stability of the dam, considering the sealing of sides and foundations. Scope for modeltests. Silting control. Criteria for using gates and their choice. Sediment transport. Study use of non-conventional materials and their success for penstocks. Construction techniques and quality control. Use of indigenous materials and techniques. Open penstocks and problems, buried penstocks and erosion problems. Recommend simplifications for penstock joints, penstock transport, penstock testing and preparing anv leaks.

4. EXPECTED RESULTS:

Cheaper and simpler diversion and penstock arrangements with increased scope for utilizing indigenous materials and techniques.

5. EXECUTION:

A consultant will be recruited and will be located at the focal point which has, and agrees to provide, facilities to assist him in his work. He will establish contact with other focal points interested in the project and obtain such data and information as would be relevant for his work. He will submit his report in 30 copies to the Coordinator who shall arrange for its distribution to all focal points.

6. TIME SCHEDULE: January 1983 to September 1984

7. ESTIMATED BUDGET: 150,000 US$

Research and Development

1. PROJECT TITLE: Determination of Hydrological Database for MHG

2. OBJECTIVES:

   i Assessment of hydrological data requirements for MHG.

   ii Improvement of hydrological data determination

   iii Development of extrapolation and transposition techniques for extending database.

   iv Development of probabilistic methods.

3. SCOPE OF ACTIVITIES:

   i Determination of the present state of the art and of consequent R+D needs.

   ii Assessment of the applicability of the present flow measurement techniques with special reference to small and variable run off conditions.

   iii R+D for improvements and adaptation of existing techniques including development of instrumentation.

   iv Investigation of method of data assessment.

   v Computer studies for data extrapolation and establishment of data basis of probability calculations.

   vi Correlation studies covering groups of similar run off conditions.

4. EXPECTED RESULTS:

   i Detail information base for assessment of hydrological data needs and availability of known methods and measuring techniques.

   ii Improved measuring methods and measuring devices.

   iii Improved methods of data manipulating.

   iv Establishment of firm data bases.

5. EXECUTION:

   By the permanent staff of the Regional Centre assisted by experts from the participating countries and supported by short-term advisors supplied by multilateral/bilateral agencies.

6. TIME SCHEDULE: 2 years (1983, 1984)

7. ESTIMATED BUDGET:

   6 man-years from participating countries

   1 man-year of advisory services

   Computer sofware and measuring equipment US$ 250,000

Research and Development

1. PROJECT TITLE: Application of Indigenous Materials and Techniques for Manufacturing

2. OBJECTIVES:

   i Entrancing the ability of developing countries of the use of local materials and the manufacture of components for other projects.

   ii Enabling local industries to participate in the manufacture of electromechanical equipment.

   iii To reduce dependence on imported equipment and hence reduce foreign expenditure commitment.

3 SCOPE OF ACTIVITIES

   i Identification of material and equipment needs for MHG

   ii Identification of available indigenous materials which could be used for the manufacture of components for MHG both locally and abroad.

   iii Identification of local manufacturing facilities to be used for producing components for MHG.

   iv Determination of the ways in which local material and local manufacturing facilities can be used for purposes of import substitute.

   v Development of adaptation techniques for importing the suitability of local materials and manufacturing capabilities.

4. EXPECTED RESULTS

   i Greater contribution of local industry towards the provision of material and equipment towards MHG.

   ii Reduction of import requirement with consequent savings of foreign exchange.

   iii Reduction of investment requirement due to lower cost of local manufacture.

   iv Creation of local employment.

5. EXECUTION

   By the local team in the Regional Centre supported by advisors supplied by multinational and bilateral agencies.

6. TIME SCHEDULE: 2 years (1983, 1984)

7 ESTIMATED BUDGET:

Foreign advisors 4 man-years	$280,000
Travel and per diem	$ 30,000
	$310,000

Research and Development

1.	Project Title:	Optimal development and/or water dispatching of a cascade of a rivulet
2.	Objective(s):	Economically harnesting and developing a rivulet by cascading and maximizing the utilization of water resource.
3.	Scope of Activities:	1. To select one or two rivulets for study 2. Reconnaisance 3. Programming 4. Computation (computer aided) 5. Application
4.	Expected Result:	A programme of optimized development and/ or water dispatching of cascade of a rivulet
5.	Execution:	Regional Centre at Hangzhou
6.	Time Schedule/Work Plan	1982 - 1984
7.	Estimated Budget:	

Research and Development

1.	Project Title	Pilot project of automation and telemechanization for a rivulet's cascade.
2.	Objectives:	To study the technology of automation and telemechanization of SHP station and the questions of optimum design of rivulet's cascade development
3.	Scope of Activities	1. To select site of the pilot project 2. Design 3. Reforming of the project testing and operation 4. Installation of equipments 5. Analysis and study
4.	Expected Results	To provide a demonstration for the trainees of regional training course
5.	Execution:	Regional Centre in Hangzhou
6.	Time Schedule/Work Plan	The preliminary design will be submitted by the end of 1982. The project may be put into operation by the end of 1984.
7.	Estimated Budget:	The expenses of equipment and testing operation are obtained from UNDP $150,000

Research and Development

1.	Project Title:	Application of electronic load controller in mini hydropower generation
2.	Objectives:	To simply speed regulation and to cancel the equipment of governor in SHP
3.	Scope of activities	1. To select a mini hydropower station as a pilot station 2. Introduce a set of electronic load controller 3. Preparing one set of generations for fitting the test. 4. Demonstrating and testing the controller at the pilot station 5. Make a technique summary of the testing
4.	Expected Results:	To identify the application of electronic load controller in mini hydropower generation and to provide a demonstration for the trainees during the course of training
5.	Execution:	Regional Centre of Hangzhou
6.	Time Schedule/Work Plan	From 1982 - 1983
7.	Estimated Budget:	

Research and Development

1. Project title: : Adaptive design technology for low cost electronic load control.

2. Objective

2.1 To obtain the data on operation experience of electronic load control in the environment of developing countries

2.2 To assimilate and adapt design technology for low cost electronic load control which:

2.2.1 Easily be assembled in developing countries by maximum uses of local components.

2.2.2 Easily be maintained at project site.

3. Scope

3.1 Gathering and processing existing information

3.2 Define alternative specifications

3.3 Develop design methodologies

3.4 Design the circuits

3.5 Construction, testing and demonstration of prototype

3.6 Dissemination of result and technology to other member countries in the region.

4. Expected Result

Design, prototype operating result and dissemination of data on electronic load control.

5. Execution:

A consultant will be recruited and will be located at the focal point which has, agrees to provide, facilities and assistance for his work. He will establish with the other focal points interested in the project and obtain the data information as would be relevant to his work. He will submit his report in 30 copies to the coordinator who will arrange for its dissemination.

6. **Time Schedule:** March 1983 - October 1984

6.1 Operating experience	1 year
6.2 Adaptive design	2 months
6.3 Construction + testing	6 months
6.4 Dissemination	1 month

7. **Estimated Budget:**