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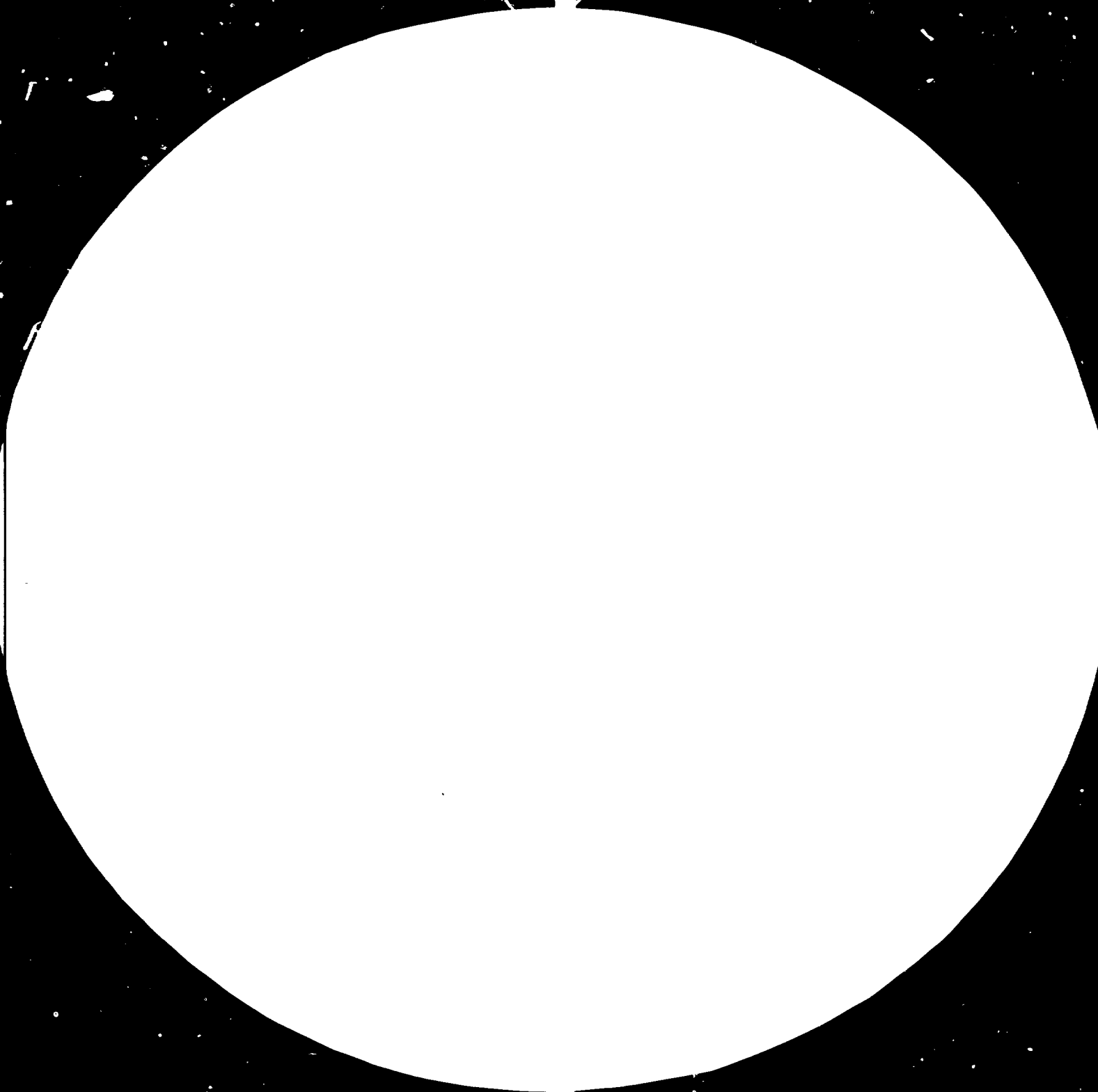

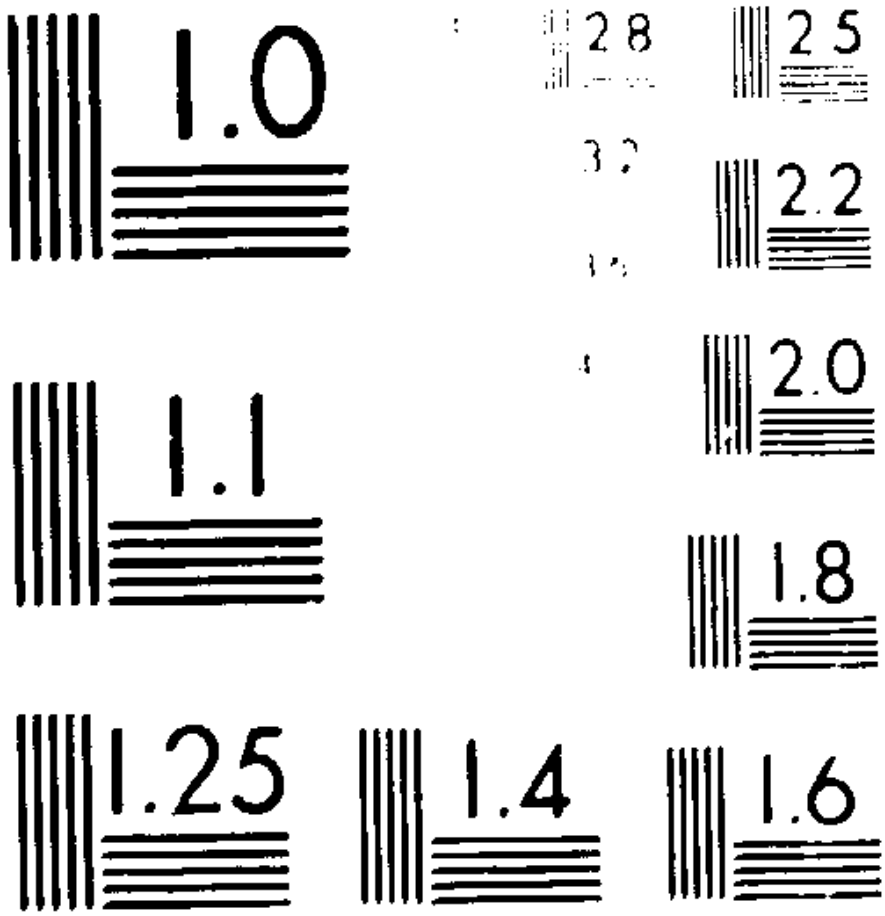
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Seminar-Workshop on the Exchange of
Experiences and Technology Transfer
on Mini Hydro Electric Generation Units

Kathmandu, Nepal, 10-14 September 1979

PROSPECT OF MINI HYDRO POWER DEVELOPMENT IN THE KINGDOM OF TONGA*

by

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* The views expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

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INTRODUCTION

Tonga is a sea Kingdom in the Pacific of some 169 islands between latitudes 15°s and 23.5°s and longtitude 173°W and 177°W and scattered over an area of about 140,000 square miles (36,000 km^2) of ocean. Total distance from north to south is about 470 miles while total area of land and major island-reefs is 289 square miles (750 km^2). Only 36 islands are inhabited. Tongatapu is the largest island and seat of Government. The area including an island of 'Eua to the south east is 135 square miles (340 km^2).

Climate is sub-tropical with high humidity, temperatures ranging from 51°F in the south to 92°F in the extreme north. Rainfall is generally high but not evenly spread throughout the year. The main rainfall is December to March, ranging from 67 inches in the south to 117 inches in the north. Cyclonic storms are infrequent.

Like any other developing countries, Tonga is relying entirely on imported fuel oil. The country possessed no indigenous fossil fuel and has very limited water courses in the form of streams.

The island of 'Eua which is situated to the south east of the main island of Tongatapu at approximately 25 miles, is the only place where there are fresh water springs. The island rises from a generally low western side to about 1,017 ft at its highest point. Eastern

side of the island has a steep escarpment bordered by a narrow coastal strip.

The population is increasing rapidly and this fact together with its good rainfall, native forest, and agricultural diversity, may give it greater economic potential than elsewhere in the Kingdom.

The history of public electricity supply in Tonga is short and only relates to the islands of Tongatapu and Vava'u in the north as apart from few private plants there is no other electricity service in the Kingdom. It was in 1949 when public electricity service was inaugurated in Tongatapu and not until 1970 in Vava'u under the Tonga Electric Power Board, which is a statutory Board, a corporate body with perpetual succession. The Power Board manages directly the planning, construction and operation of the Kingdom's electric power districts.

The power plants in the islands of Tongatapu and Vava'u are all diesel operated. Similarly, the planned introduction of electricity to other islands would be diesel operated and has been approved by the Australian Government to be financed under their bilateral aid in the Pacific region.

Since the fuel crises which dramatically changed the operation of the Kingdom's diesel electric plants, alternative energy sources have been seriously considered and the importance and urgency of the exploration has been stressed in a number of assessments.

A new diesel - electric power station and limited reticulation financed under the Australian bilateral aid will soon be built in 'Eua with initial installed capacity

of 110 kW to support the Government development programme at the area. In the event of a mini/micro hydro power project is technically feasible and a pilot scheme proves successful, its consequences can be beyond calculation. Also in view that Tonga is relying entirely on imported fuel, an impressive savings in overseas currency can be achieved.

PRESENT POSITION

Authorities concerned are aware of a possibility of hydro development in the island of 'Eua and it is presently at the early stage of consideration.

It is known that the necessary elements exist in the way of an elevated catchment area, adequate rainfall, streams and differences in ground level. What is not known is whether any suitable site for reservoir storage in relation to elevation, capacity, porosity etc.

Plan for this activity requires feasibility study and if it proves technically feasible, assistance will be sougnt for the construction of a pilot project.

As this scheme is not sufficiently advanced, no problem has yet been faced but it is anticipated that problem will be on the technical personnel owing to the Kingdom's lack of expertise.

Tonga has not been under the influence of overseas countries in the same way as other Pacific countries so, many of the conditions in these countries have little significance here when considering technical aptitude.

Another problem anticipated is financing of the project. The Board is facing financial difficulties in their development programme beyond its immediate control. Any capital investment in the development of electricity is beyond the financial resources of the Kingdom.

There are no facilities available for design, manufacture and installation required for mini/micro hydro plants.

RESEARCH AND DEVELOPMENT

No research and development work has yet been carried out but the following will be required on this area of work.

1) As there is no data currently available on the indication on the order of water flow and seasonal variations, survey of the site is necessary together with geographical - topographical aspects.
2) Operation of such plant is anticipated by non-semi skilled staff, so design shall be based on minimal maintenance.
3) The conception and layout of the project shall be very simple and unsophisticated.
4) Training programmes shall be concise at basic levels.

METHODOLOGY TO BE ADOPTED

It is suggested that discussion shall be in small groups of specific topics on the following:

1) Research and development
2) Current status of equipment available
3) Technical aspects of installation
4) Consideration of specialize manufacture of equipment

for member countries with large locally fabricated content.

PROMOTION OF THE DEVELOPMENT AND TRANSFER OF TECHNOLOGY

It is suggested that consideration should be given to the establishment of Pacific Regional Centres to serve as a liaison between the isolated member countries and to provide a medium for the anouncement by leading countries of recent developments of more than specialized interest.

CONCLUSION

Whilst we are very pleased to participate in this Seminar-Workshop and have the opportunity to present a paper on the Exchange of Experiences and Technology Transfer on Mini Hydro Electric Generation Units, we also would like to take this opportunity to bring to this seminar a subject of Interchange of Technical Information and Training within the Pacific Region.

By virtue of relatively isolated locations of many Pacific countries, there is little or no interchange of technical view points or discussion and approaches taken for technical training.

Although there are from time to time international conferences on electricity distribution these tend to be supported by developed countries with only few representations from developing countries. There is an obvious case for more regional cooperation, as most of the smaller countries within the Pacific region have similar, although not identical problems. Staffing with employees with a relevant background and training within a regional context is an area for further discussion.

Tonga has developed its provision of electricity mainly within its own resources together with assistance from overseas agencies. It is a process of developing techniques relevant to the country and closely scrutizing technological progress in developed countries. The common term for this, of course, is appropriate technology. With the rapid increase in technology it is sometimes evident that practices in developed countries are of little benefit to developing countries.

There exists a great potential for the interchange of ideas in the Pacific region and the Tonga Electric Power Board will be interested in playing a full part in any such discussions. Systems developed in Tonga for ensuring a reliable electricity supply may be of assistance to other countries experiencing in the Pacific.

Training and retention of qualified staff must be a common problem in the Pacific. Training programmes must be developed to suit the particular problems of development and operation in the Pacific.

It is recommended that discussion for assistance should be centred on the provision of training within the context of the Pacific region. This could be achieved in many ways:-

1) The establishment of a regional training centre to provide short specialist courses.
2) Financial assistance in setting up small training facilities within each power authority for basic and continuing education.
3) Interchange of personnel within the Pacific region to provide a broader depth of experience than can otherwise be gained within the limitations of one island.

To promote further understanding and an interchange of technical viewpoints, assistance should be given in the following fields:-

1) A regional fund available to assist power authority personnel to attend regional or international conferences. It should be borne in mind that many power authorities are not necessarily government departments, and therefore have to bear their own expenses, making extremely difficult to send delegates.
2) To provide promising nationals an opportunity to visit power authorities in other Pacific countries to discuss technical problems and to update their knowledge.