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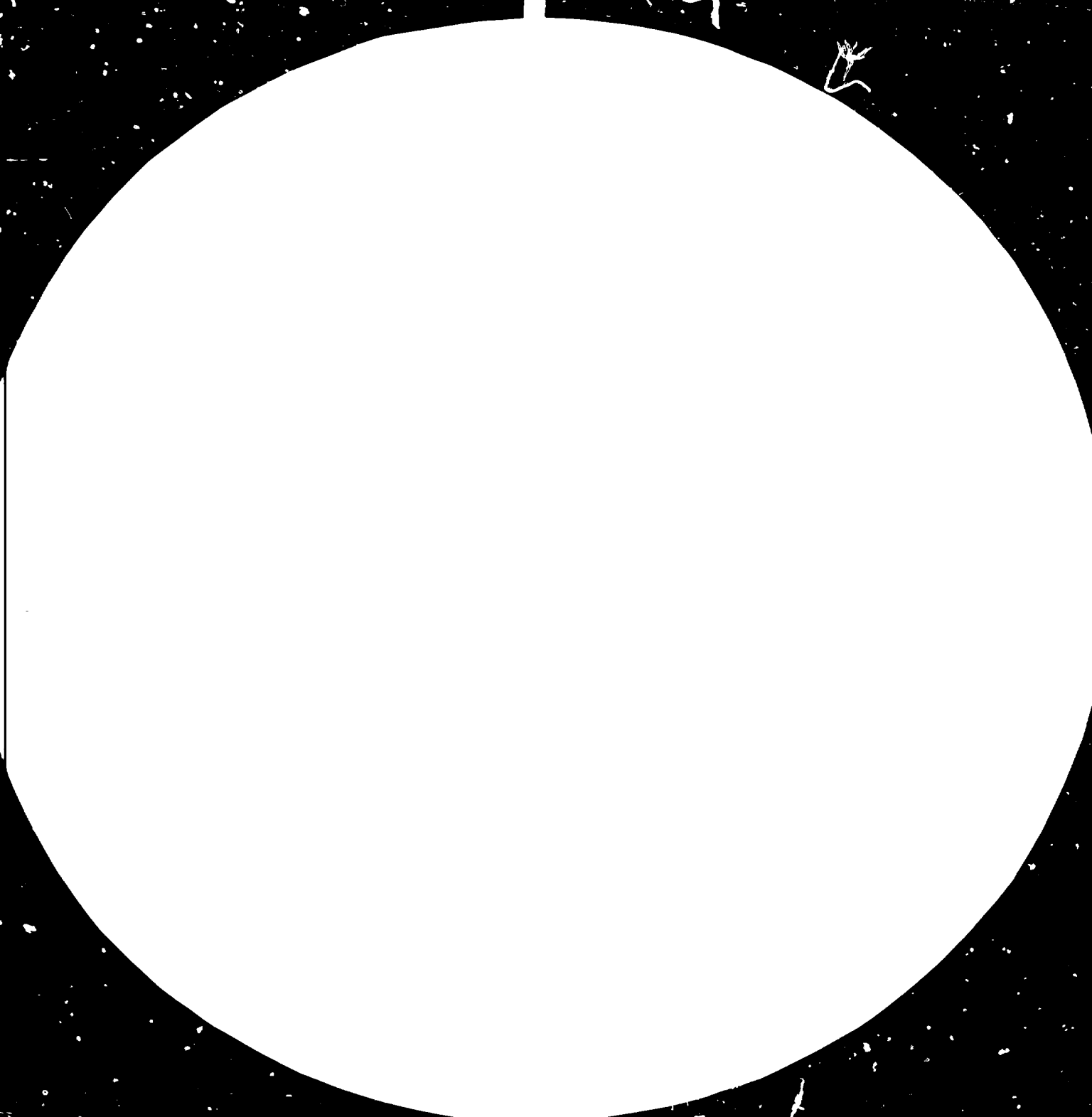
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3.2



4.5



5.0



Resolution test patterns are used to measure the resolution of a system. The resolution is the ability of a system to distinguish between two points that are close together. The resolution is measured in cycles per inch (CPI). The resolution of a system is the number of cycles per inch that the system can resolve. The resolution of a system is the number of cycles per inch that the system can resolve. The resolution of a system is the number of cycles per inch that the system can resolve.



09703



Distr.
LIMITED

ID/WG.305/44
19 May 1980

United Nations Industrial Development Organization

ENGLISH

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

Kathmandu, Nepal, 10-14 September 1979

MINI HYDRO POWER DEVELOPMENT

PROGRAM IN BURMA*

by

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INTRODUCTION

(1) Burma being a mountainous country endowed with plentiful rainfall possesses an abundant water resources potential. Over half the territory of the country is highland dissecting the land by its North-South trend mountain ranges which is the continuation of the Alpine-Himalaya belt. The geographic location is such that it enjoys the rain bearing South-West Monsoon wind resulting in heavy precipitation on the windward slopes and with lesser intensity on its leeward side. As a result, countless streams and riverlets with steep gradients generally traversing East-West direction are the tributaries of the country's main arteries, the Chindwin, Irrawaddy, Sittang and Salween rivers flowing down south and draining into the Bay of Bengal.

(2) Favourable topography and inexhaustible supply of water are suitable for water power developments and it is intended to prepare a comprehensive survey of the hydroelectric power resources of the country. The potential is roughly of the order of 24000 MW of which only about 2 percent has been exploited. This potential consists of sizeable magnitude projects and limited number of smaller scale (Mimi) waterpower developments. It may be mentioned that Micro or Mini hydropower projects are identified locally as Power Stations having an installed capacity of 1000 KW or less.

ORGANIZATION OF ELECTRIC POWER CORPORATION

(1) The Electric Power Corporation (EPC) under the Ministry of Industry No. 2 is the sole agency for electrical power generation transmission and distribution in the country. As such "EPC" undertakes the survey of potential electric power sources and their development to meet the demands of growing industries and other uses.

(2) The functions of the Electric Power Corporation prescribed in accordance with its Constitution are as follows.

- (a) Generation, transmission and distribution of electric energy.
- (b) Submission of plans and implementation of approved plans.
- (c) Release of water for the State organisations and for the public, regulation of water in the navigation locks.
- (d) Testing, repair and installation of electrical appliances.
- (e) Carrying out investigation works and construction works for the purpose of electric power development.

- (f) Complying with the existing laws and procedures relating to generation, transmission, distribution, sale and investment works and also regulations relating to safety measures.

ELECTRICITY SUPPLY SYSTEM

- (1) The Electric Supply System in Burma is divided into two parts.
 - (a) Area of supply from the National Grid and
 - (b) Non-grid area.
 - (i) In the area of supply from the National Grid, the bulk of power comes from Lawpita hydropower station whose installed capacity is 168 MW. This power station feeds Rangoon and Toungoo areas with 250 miles of 230 KV transmission line.

Two steam power stations, each 30 MW installed run in parallel with the Lawpita hydropower station to feed Rangoon Load centre and also act as a spinning reserve.

Lawpita power station also feeds the Northern part of the country up to Mandalay, Sagaing, Thazi and Chauk load centres with 314 miles of 132 KV transmission lines.

In addition a gas turbine power station at Kyunchaung with an installed capacity of 54.3 MW is inter-connected with the National Grid system at Chauk substation.

Another gas turbine power station at Myanaung having an installed capacity of 49.2 MW at present supplies the power requirements of Myanaung, Kyarkin cement mill and Prome area. A 66 KV transmission line is being constructed to feed Henzada, Bassein and Myaungmya towns. Steps have already been taken to connect Myanaung and Rangoon with a 230 KV line thus interconnecting this station with the National Grid.
 - (ii) In areas remote from the existing power grid system, 6 to 1000 KW diesel generating stations operate mostly as isolated stations but some relatively big stations operate as central stations to feed neighbouring towns and villages.

BASIC PRINCIPLES FOR DEVELOPMENT
OF MINI HYDROPOWER

(1) Electrification of an area plays a vital role for the activity and population in the area. It is the basic requirement for development of the community as well as for the advancement of the country. As the world is facing scarcity with fossil fuel, it is evident that means must be sought to conserve this form of energy to the extent permissible. This country though possessing natural reserves of fossil and other fuel, favours to limit its use excessively and substitute it with hydropower. Domestic needs urged the population in rural and remote areas to fell down trees resulting in rapid deforestation implicating not only loss of valuable timber but also impairing the stability of mountain slopes, increasing sediment transport, larger magnitude of flood occurrences and adverse changes in hydrologic regimes.

(2) Hence for nature conservation and primarily to cater for domestic needs and also to promote small scale cottage industries and other electro-mechanical workshops, relatively cheap and uninterrupted supply of electricity is urgently needed especially in far off remote parts of the country where accessibility is limited.

(3) As electrification of areas with concentrated activity - urban and industrial areas by means of power production plants of suitable size and means and by interconnecting grid power system has to a certain extent been carried out, the power supply system needs to be extended to periphery areas with sparser population and less concentrated activity, i.e. to rural areas.

(4) Emphasis on the electrification of small communities and rural areas are placed in parallel with the urban development plan such as these shall not lag behind in relation to the development of the supply services in urban areas. Moreover, attitude of the people living in such remote areas are eager to take an active part in the implementation of the power development plans that is to say, to effect electrification in practice.

DEVELOPMENT PLAN OF MINI HYDROPOWER
AND AVAILABLE RESOURCES

(1) In response to the needs of the community and in line with the country's development plan, Electric Power Corporation has formulated the following principal concepts for priority to develop relatively inexpensive mini hydropower as part of its rural electrification program.

- (a) The site must be technically feasible.
- (b) The area must be outside the periphery of the National Grid power system.
- (c) Accessibility is difficult and the area remote.
- (d) The community/area is least developed.

(2) Practically over the entire country it is possible to find water courses with suitable inflow and falls, especially in the mountainous areas where conditions are favourable for development of mini hydropower projects with a view to meeting the need for electricity in nearby populated areas or settlements and rural districts.

(3) On the west coast of the country the Arakan Yoma, Chin Hills and Naga Hills form a long chain of mountains with its streams and rivers plunging over falls and through narrow gorges. The western slope is drained into the Bay of Bengal. The streams and rivers on the eastern slope discharged into the Childwin and Irrawaddy Rivers. The central belt of mountains, the Pegu Yoma ridge with the least amount of rainfall carried down its run-off water into the Irrawaddy on its west and into Sittang on its east. The Shan Plateau which occupies the whole of the eastern limb of the country drains partly into the Irrawaddy, partly into Sittang and mainly into the Salween. The mountainous tail end of the country, the Tennasserim Yoma range drains its waters mainly into the Gulf of Martaban.

Often there is a choice between a number of water power sources and this wide spread availability of water power is particularly suitable for the electrification program of the country with its scattered population of our far flung territory.

(4) Since about beginning of 1900 hydro-electric potentialities have been studied by foreign engineers as well as by local engineers and a few small hydroelectric plants have been constructed and some are still in operation till date. Almost all these stations are primarily for use in nearby mining industries.

- (a) Mogok Hydropower Station (dilapidated)
- (b) Kun-Nyaung Hydropower Station (dilapidated)
- (c) Mansam fall Hydropower Station (in operation)
- (d) Wet-wun Hydropower Station (in operation)
- (e) Heinda Hydropower Station (in operation)
- (f) Tsaungte Hydropower Station (in operation)
- (g) Mawci Hydropower Station (in operation)

(5) Presently EPC has conducted investigation works, prepared feasibility reports on a number of mini-hydropower projects and a few projects are being studied in office. Total number of mini-hydropower projects studied and recommended for implementation or worthy of continuing detailed study amounts to 29 numbers. Besides the above mentioned 20 mini-hydropower project schemes, possibilities of harnessing hydropower at the irrigation outlets are being studied. Thus, before releasing the water into the conveyance canals, incidental hydropower can be generated which may be utilized for domestic purposes or for pump irrigation.

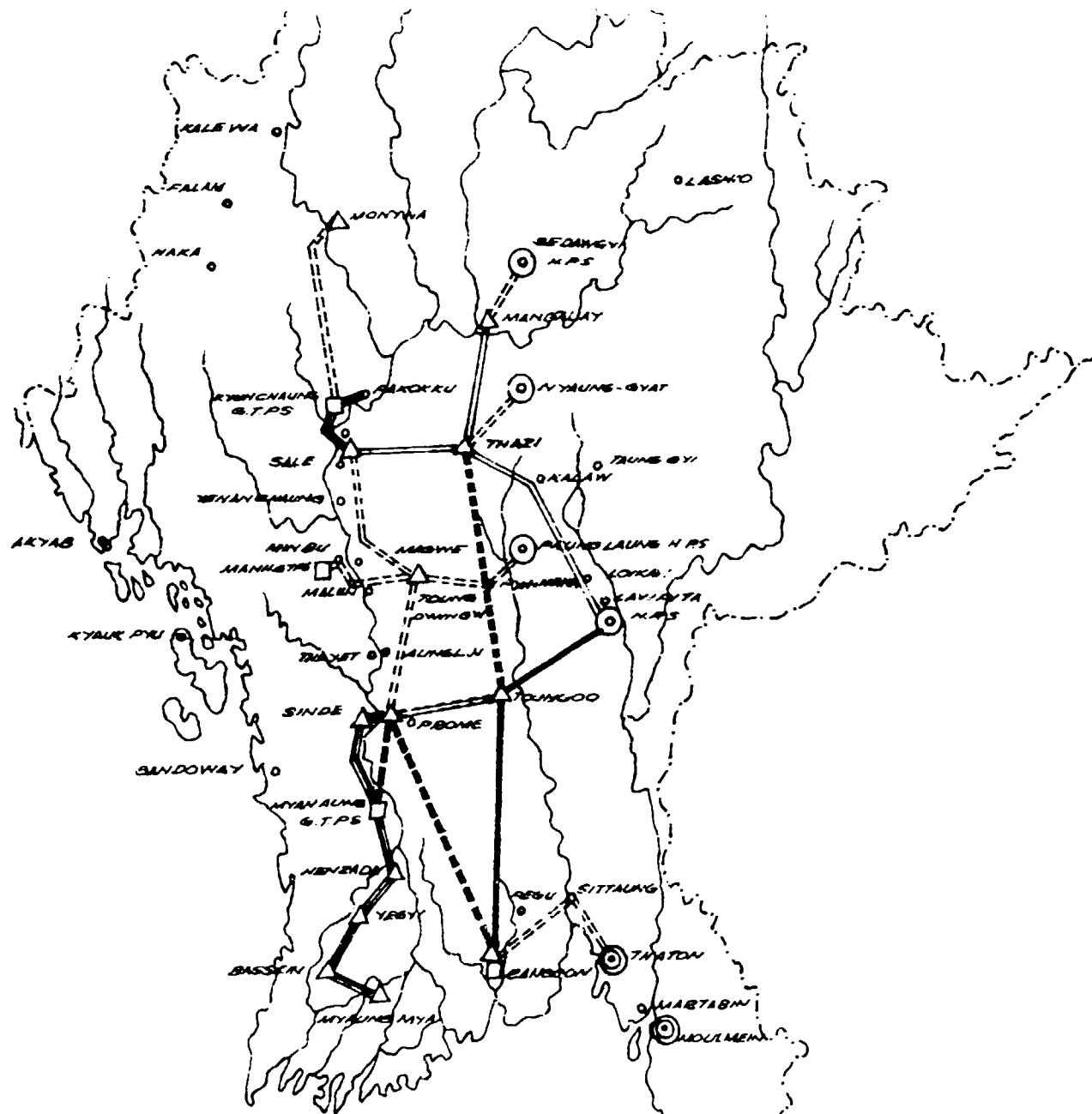
(6) It is the intention of the Corporation to carry out implementation of the proposed mini hydropower development projects with its own engineers. Electrical and mechanical machineries and equipment however shall have to be imported. In the course of time, small water turbines and generators are being experimented for local production in future.

CONCLUSION

(1) It is evident that in most developed countries, during the 1900, electrification of the country is characterized by a very large number of small water power stations which supplies the bulk of the power requirements. As the case may be, Burma has set forth to develop small (mini) water power projects as an initial step to rural electrification. Concurrently, planning and implementation of medium and large scale hydro and thermal power projects to be amalgamated into the National Grid power system are also underway. Unlike the heavy investments required for implementing large scale hydro and thermal power projects, mini hydropower developments need less investment. Such being the case mini-hydropower developments become quite attractive for developing countries.

It is noteworthy that intangible benefits can play far greater role in rural electrification than in urban and other active areas.

(2) Mention should be made that the priority of projects selected as outlined by the Electric Power Corporation's formulated principles mentioned in Part 5, paragraph 1, when combined with the rural area population's welcoming attitude and whose social system is very different from the attitude and social system of urban area population, possibilities of voluntary labour and local resources availability when implementing the plans are positively an asset to the successful development of the projects.



LEGEND

- 230KV TRANSMISSION LINE (EXISTING)
- 230KV TRANSMISSION LINE (UNDER PLAN)
- - - - 132KV TRANSMISSION LINE (EXISTING)
- 132KV TRANSMISSION LINE (UNDER PLAN)
- 66KV TRANSMISSION LINE (EXISTING)
- 66KV TRANSMISSION LINE (UNDER PLAN)
- ⊙ N.P.S. - HYDEL POWER STATION.
- G.T.P.S. - GAS TURBINE POWER STATION.
- ⊙ THERMAL POWER STATION
- △ SUB. STATION.

SECTION 1

TRANSMISSION SYSTEM OF BURMA (H.T. SYSTEM)

