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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

NORWEGIAN COUNTRY PAPER\*

21 NOV 1979

by

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MINI HYDRO ELECTRIC GENERATION UNITS;

BY - VINJAR, A.

To establish a platform for this Seminar I think we should remind ourselves about the rising oil prices. Only this year the OPEC prices have gone up more than 50 per cent.

It is also pertinent to refer to recommendations made at the last World Energy Conference in Istanbul Turkey in 1978 - that developing countries should be helped to rely as much as possible on renewable energy resources. Being Head of the Directorate of Electricity, in Norway I am dealing with all kind of questions related to the electrification of my country - the supply side as well as principle question of my country - the supply side as well as principle question regarding future consumption of energy. Work in some developing countries in the same field has helped me to see better how experience gained on the electricity field in industrialised countries may be transferred to developing countries. The reporting from Norway to this Seminar in Kathmandu has been done in this light. It has been co-ordinated through NORAD - the Norwegian Agency for International Development - which is represented at this Seminar by Mr. J. STORAAS, Head of Industries, Building and Construction Division.

From Norway three papers are presented to this Seminar Workshop:

Our first report is written by myself about the history of electrification of Norway covering a period of one hundred years. This report I have tried to sort out what I believe is of particular interest to developing countries and especially what lesson can be learnt from our own development - observations which may be taken into account in our co-operation with developing countries.

Norway is today a highly industrialised country, not least thanks to our water power. We have the highest consumption of electricity per capita probably in the world, although the similar figure of total energy consumption is more in line with other European countries. Electricity production is entirely based on waterpower which represent fifty to sixty per cent of the total energy consumption in the country.

Water power has played a dominant role in Norwegian electrification development. In 1945 we had about 1,000 water power plants spread out over the country. About 1500 of these were of a size less than 100 KW, i.e., small scale of the micro size.

The number of water power stations today is less than 700, while the number of bigger stations has grown considerably. The reason for this is a pure economical one seen from the point of view of the power station owners. Today a rehabilitation program of small scale power stations have started due to growing energy prices and concern for nonrenewable sources. A great number of such plants as well as a great number of new sites for small scale water power plant are under consideration.

The total economic water power potential of Norway is approx. 170,000,000,000 KWH (170 TWH) annual producibility. Some of this potential will be exempted from development due to conservation of natural scenarios and for environmental and ecological reasons. Up to now about 85 TWH (annual producibility) is in operation while about 15 TWH is under construction and a similar potential is in the planning stage. This means that we will be able to rely almost entirely on water power for electricity production up to the end of the century.

Energy conservation measures has become an important issue of the energy policy of our country.

Norway is on the lucky side as far as energy resources is concerned- having found oil and gas in our part of the North Sea and coal on Svalbord in the Arctic. We have some sources of forest products and peat. Possibilities may also exist for harnessing of energy from ocean waves and swells coming in to our long coast line. Research and development is being done on this field.

Electrification started by development of water power sites of suitable size to serve localities wishing to get electricity. Water power projects of almost any size could be found literally all over the country-thanks to the topography and hydrological conditions. This laid the ground for a very distributed engagement which grew by itself from the

very beginning. Industrial plants established around the country shortly after the turn of the century and which were based on water power fostered the interest for use of electricity as a convenient energy form.

It is generally accepted in our country that the diversified engagement by people in the districts represented a strong implementing potential for the electrification of each locality.

Naturally, electrification started first in the centres and spread out gradually. Up to about 1938 it became apparent, and in fact a political issue, that the remote areas were lagging so much behind that action had to be taken by central authorities. Financial support was granted to organizations mostly of co-operative character formed for the purpose of electrifying these districts. The necessary funds for this financial aid were established through a levy on each KWH consumed by any consumer, i.e. the existing consumers helped to establish electricity supply in remote districts. This financial support arrangement is still principally in force now for improvement of the electricity supply in these districts and to keep the prices down in area where distribution costs are high.

Those interested in our past and present energy and electricity policy are referred to my paper.

The second paper from Norway is prepared by the Norwegian Water Resources and Electricity Board:

"Hydro - Electric Power Technology in Norway, with special emphasis on small scale power plants". It contains several sub-reports besides an introduction by Mr. O. Gunnes, Director of the Water Power Research Department. Mr. Torodd Jensen, Senior Civil engineer from this department is present at this seminar. He is also author of some parts of this report. The report gives information - almost in a condensed textbook form of the following subject:

- Small scale hydro power plants
- Development of local industry.
- Control and maintenance of the hydraulic
- equipment in hydro power plants.
- Small sized hydro power turbines.
- Technical evolution and standardization.

Electrical equipment for small scale power plants.

- The generator
- Switchgear and Control system.

Water ways, dams and power buildings for small scale power plants.

- Hydrology of small catchments.
- Multi-purpose aspects

Proceedings regarding planning, official regulation and treatment and implementation.

Mr. Jensen and other members of our delegation will be glad to elaborate further the subjects treated in this report.

Finally - our third report is in the form of a case study prepared by the consulting firm Norconsult A.S. on the request of NORAD. I am delighted to present to you Mr. Erik B. FIDJE who participate in the top management of this consulting firm and who is presenting the case study at this seminar.

The study covers most of the questions appearing during the planning and reconstruction of a 1700 KW water power plant which in its original shape dates back to 1911.

We believe that this study is useful as a reference for engineers engaged in small scale water power technology irrespective of the size and character of the project.

Our papers may be presented more in detail in the group discussions later on during this seminar.

Mr. Chairman, participants.

Before I close, I would like to remind all of us that small scale water power is no purpose in itself. It must be regarded as a suitable means of production for electrification of rural areas. The electrification must be regarded as a mean to improve the socio-economic conditions for people living in the area.

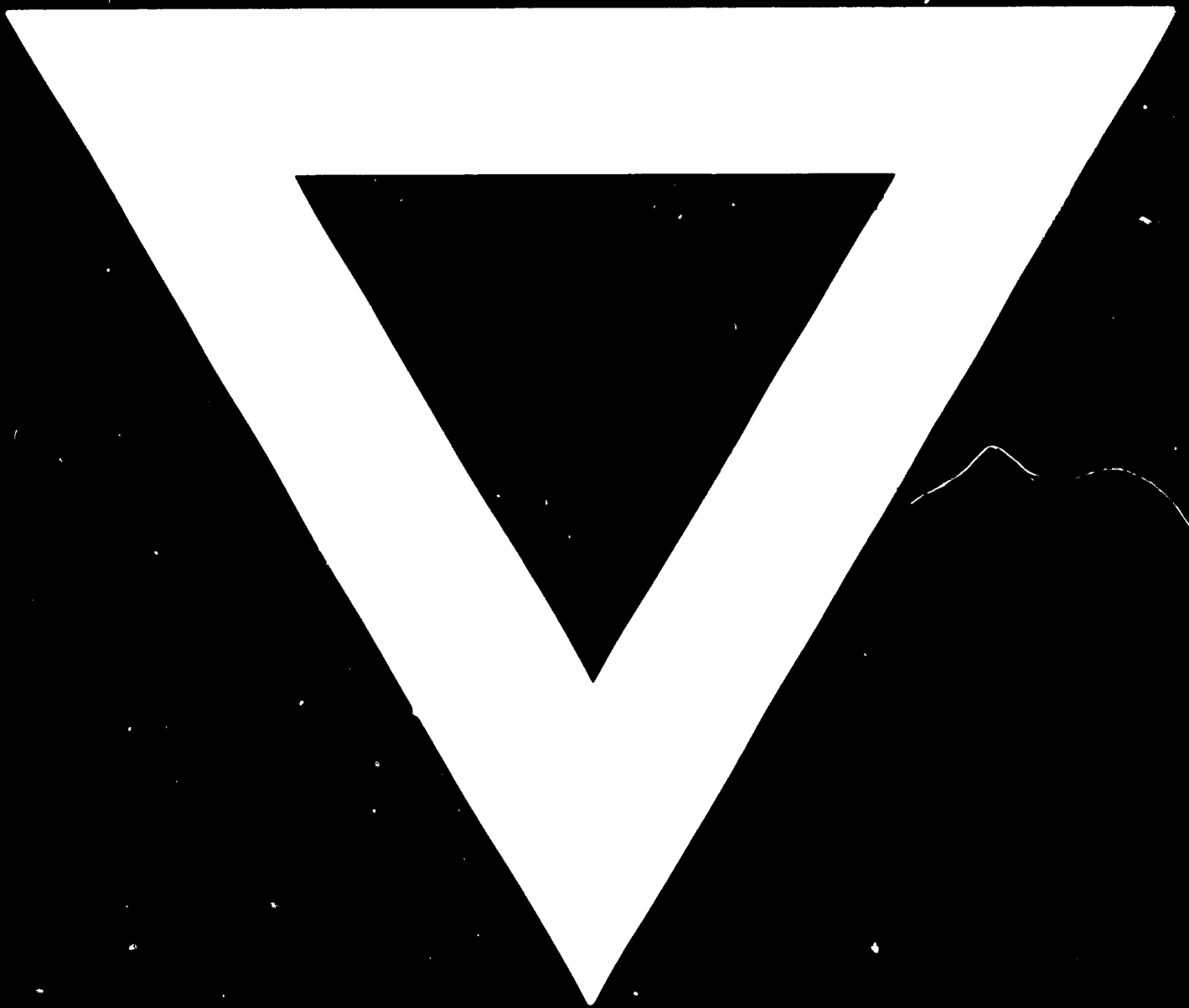
We should also remember that many rural areas have no potential for even small scale water power. Even though people living there have the same need for electricity. Electrification by means of small scale Water Power must therefore in most countries only be part of a general electrification policy.

Thank you for your attention.



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