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ADVANCES IN THE APPLICATION OF NUCLEAR ENERGY FOR PEACEFUL PURPOSES

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EGYPT

THE QATTARA DEPRESSION HYDROELECTRIC PROJECT AS A POSSIBLE APPLICATION OF NUCLEAR ENERGY FOR PEACEFUL USES

Introduction

1. The study and analysis of the utilization of electricity in Egypt has shown that, during 1975, 64% of the total electricity consumption was covered by hydro generation.

2. However, projections regarding the future indicate that by 1985 the expected share of hydro electro-energy will diminish to about only 38% of the total consumption. Consequently, this will necessitate a substantial increase of the fossil fuel consumption of thermal plants, which is estimated at over 50 million Egyptian pounds for the year 1985. Accordingly, the policy for the installation of future generating capacity into the unified power grid system is based on the maximum addition of nuclear power generation for base load requirements and gas turbines for peak loads, and the exploitation of all available hydro resources in the country.

3. The Qattara depression, which is a natural depression situated at a distance of about 75 km from the Mediterranean Sea in the Western Desert, offers one of the unique opportunities for a solar hydro scheme which will provide a substantial hydro-power generation addition to the power generation system in Egypt. This brief note is intended to provide information on this scheme, particularly in connection with the possible use of peaceful nuclear explosions for digging the connecting 75-km long canal between the Mediterranean Sea and the depression.

Geographic location

4. The Qattara depression is located in the Western Desert of Egypt, about 170 km west of Alexandria, with its northern rim some 75 km south of the Mediterranean coast. This depression forms a vast oval basin 300 km long and 150 km wide. Its eastern borders reach up to a distance of 250 km from Cairo. The area of the depression measures about 19 500 km^2 at sea level, with an average depth of 70 metres and a maximum depth of 134 metres below the level of the Mediterranean Sea. Another striking feature of this scheme is the existence of a natural reservoir at a height of 220 metres above sea level next to the depression, thus providing the possibility of a scheme for pumping storage from the depression to the reservoir during off-peak periods, and of its use for the vast generation of peak energy estimated at up to 10 000 MW.

Description of the scheme

5. The basic concept of the scheme lies in the utilization of the difference in elevation between the Mediterranean Sea and the depression for generating electricity by allowing water from the sea to flow into the depression through a hydroelectric power plant. For that purpose either a connecting canal with a width of about 280 metres is dug or twin underground tunnels are excavated. The natural solar evaporation of the water from the surface of the depression would ensure the continuous flow of water therein and maintain a constant level of water when reaching 50 metres below sea level, this being the stage when the steady balance between water flowing from the sea and evaporation from the surface of the depression is reached.

Stages of estimated power output

6. The development of power output from the scheme is planned to be realized in a series of successive stages through the combination of base and peak hydro stations from the depression itself and pumping storage to the neighbouring reservoir. The first stage of implementation according to the present planned schedule of construction, commissioning of a 700-MW capacity hydropower plant, is foreseen for the year 1986. Subsequently the hydro station will be operated as a base load station generating about 6 milliard kWh annually for the following ten years, after which the station will be operated as a peak load station providing 1200 MW approximately for six hours per day. It is foreseen that the second stage will be a completely independent pump

storage station of 3 x 400 MW units situated on the edge of the depression, thereby obtaining a peak of 2400 MW. Third and fourth stages are also envisaged for installing 4 x 500 MW units and 6 x 600 MW units respectively which will be able to meet the peak loads of the unified power grid system in the subsequent years, providing an estimated generating peak capacity of about 8000 MW to 10 000 MW.

7. With a head of 270 metres available on the rim of the depression and with the formation of a lake 23 times the size of Lake Constance in Europe, more pump storage stations could be installed during the 21st century to meet the future peak demands of the Egyptian unified power system.

Benefits of the scheme

8. The electricity generating project of Qattara will have numerous direct and indirect benefits which may be summarized in the following main points:

(a) Generation of vast amounts of electricity to meet the growing requirements of Egypt in the years ahead of up to 700 MW of base power and 10 000 MW of peak power could be achieved;

(b) Fishing and canning industries could be promoted in the newly-created lake. In addition the salt content will gradually increase to the saturation limit of 33%, thus providing the possible creation of chemical industries;

(c) Increasing rainfall as a result of evaporation, which will enable the surrounding desert to be used for agriculture and pasture;

(d) The facilitation of attempts to explore for oil in the depression by using off-shore equipment, since the weakness in the soil of the depression in its present state cannot withstand the weights and pressures of heavy oil drilling equipment;

(e) The creation of the environmental conditions for the establishment of tourist resorts around the huge artificial Qattara lake.

Steps taken by the Egyptian Ministry of Electricity and Energy to initiate the study of the project

9. As a result of negotiations entered into with the Government of the Federal Republic of Germany, an agreement was concluded to undertake the required Feasibility Study of the project with the joint co-operation and financial support of the German Government.

10. In accordance with this agreement signed between the Government of Egypt and the Government of the Federal Republic of Germany in July 1974, various steps have been initiated for the realization of the tasks embodied in the Agreement, including:

(a) Setting up of a steering committee under the leadership of the Egyptian Minister of Electricity and Energy comprising twelve members, with an equal number of Egyptian and German representatives, to supervise the various phases of the Feasibility Study;

(b) Establishment of a Board of Advisers comprising experts of international repute to study the various aspects of the project and to follow up the work done by the consultants executing the Feasibility Study and report thereon to the Steering Committee;

(c) On the 30th September 1975 a contract was signed between the Ministry of Electricity and Energy and a group of consultants named "Joint Venture Qattara" comprising the German firms Lahmeyer, Salzgitter, Deutsche Project Union in co-operation with Arab consulting engineers, Bundesanstalt für Wissenschaften und Rohstoffe, Harzie Engineering and C.E.R. Geonuclear for carrying out the Feasibility Study of the project;

(d) An independent authority called "Qattara Depression Authority" was established under the auspices of the Ministry of Electricity and Energy, which will undertake the responsibility for supervising the project and carrying out the technical, financial and administrative work necessary. Should the Feasibility Study come to a positive conclusion, this Authority will be responsible also for the execution of the project.

Particular aspects of the Feasibility Study

11. Among the main aspects covered by the Feasibility Study is the endeavour to establish whether the use of peaceful nuclear explosions and techniques will provide substantial economic savings when carrying out the project as compared to the use of conventional methods. Should the nuclear variant of the Qattara project be found applicable, it could then become the second major project of its kind in the world, as a similar project is being at present carried out in the Soviet Union.

Progress of work

12. The group of consultants has begun its activities on various aspects of the project. So far the following work has been undertaken:

(a) Invitations for tenders for boreholes, test shafts and tunnels have already been prepared;

(b) A contract for the removal of land mines remaining in the Western Desert since World War II has been concluded and work is now in progress;

(c) Surveying of the area has nearly been completed;

(d) A hydro-geological study is nearing completion;

(e) Additional power market survey data have been collected for power market evaluation;

(f) The final oceanographic study has been completed;

(g) Ecology studies and regional planning are in progress.

Co-operation with the IAEA

13. In response to an invitation extended by the Egyptian Ministry of Electricity and Energy, an IAEA mission visited the Qattara site in May 1976 in order to obtain first-hand information about technical aspects of the project and its present status as well as to establish close contact between the Agency and the competent Egyptian authorities for future collaboration in the various studies of this scheme. The report of the Agency's mission included a

number of main points and encouraging conclusions. The mission concluded that this project is being treated as a serious project by the Egyptian authorities, as indicated by its first priority among the main national projects and the creation of a special indepedent authority for the project known as the "Qattara Depression Authority".

Future progress

14. It is expected that the Feasibility Study referred to will be concluded during 1978. Further information on developments concerning the Qattara project will be circulated to Member States as they emerge.