POWER PROGRAMMES REVIEW

POWER AND HEAT REACTORS IN SWEDEN

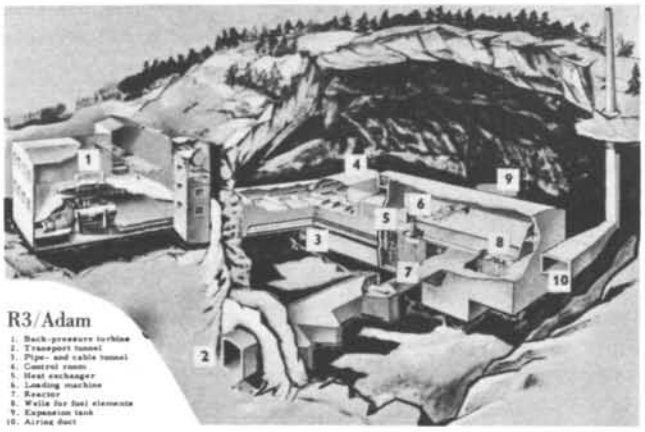
This is the third in a series of articles on nuclear power programmes in the Member States of IAEA

Although almost totally lacking in fossil fuel deposits, Sweden is rich both in developed and potential water power. Hydro power thus covers most of Sweden's need for electricity (increasing by approximately 6.5 per cent annually) and it is expected that further hydro-electric development will be able to meet the demand throughout the 1960's. As for the country's total energy needs, rising by an estimated 4 per cent annually, a very large proportion has, however, to be met by fuel imports, amounting to 65-75 per cent of the total energy consumption. These imports of fossil fuels amount to almost 20 per cent of the country's total import value.

The purpose of the Swedish atomic energy programme, therefore, is to arrive at reactor types which would make it possible to utilize nuclear fuel competitively with conventional utilization of fossil fuels, so as to check to some extent the ever-increasing dependence on the import of the latter fuels. The goal for the Swedish development work is thus twofold. First, efforts have to be made to develop a reactor system suitable for the construction of large nuclear power plants, and which will appear as an economically worthwhile alternative to building conventional steam or gas power plants in the 1970's, as the exploitable water power reserves come to an end. Secondly, there is a need for designing reactors of various sizes for heating purposes, suitable for economical use in competition with fossil fuels. In striving for this goal, attention is naturally focussed on the possibilities of utilizing the considerable domestic resources of natural uranium.

R3/Adam

The first reactor plans therefore aimed primarily at the supply of district heating with the generation of electricity as a by-product. It was first planned to build near Stockholm one reactor, called R3, to be used for both heat and power production, and another, to be called Adam, for heat only, in Västerås in central Sweden. The plans were later modified and the two projects have been combined. The combined power-heat station - R3/Adam - is now being constructed at Ågesta, a few kilometres south of Stockholm. During its initial operational period the reactor will have a thermal power of 65 MW. Ten MW of electricity will be generated in a back pressure turbine and 55 MW of heat will be delivered for district heating purposes. The output will later be doubled through the addition of further heat exchangers.



The R3/Adam reactor will be of the pressurized, heavy water moderated and cooled type. Its fuel will be natural uranium oxide canned in zircaloy, and it is expected to heat initially more than 10 000 homes in a newly built suburb of Stockholm. Construction started in November 1957 and it is planned that the station will go critical in 1962.

The Swedish Atomic Energy Company is responsible for the design and construction of the reactor, and the State Power Board for the remaining parts of the reactor station. The main contractor for the reactor is the large electric company Asea. The Electricity Board of Stockholm will build and pay for the turbine generator and the district heating network. The reactor station is built underground in a chamber, blasted out of rock.

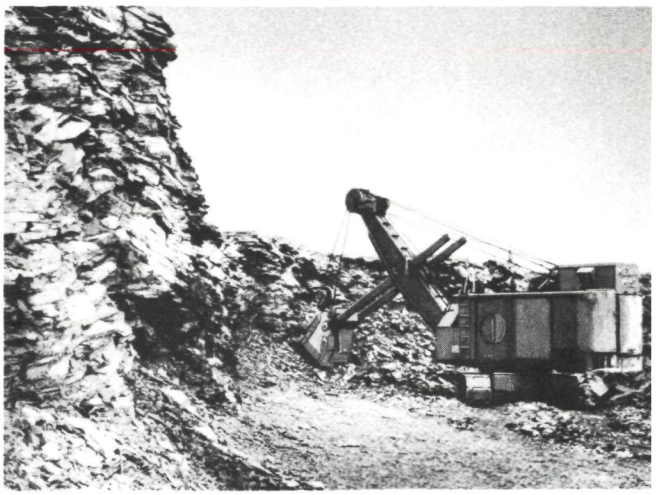
The first Swedish power reactor, R3/Adam, is not expected to become economically competitive. It will, however, give valuable experience for future reactors of the heavy water type and is thus an important step in the development of power stations for electricity production only, and particularly for the next step in the Swedish programme, R4/Eva.

R4/Eva

The other reactor project for which funds have been appropriated has been called Eva and will be purely for the generation of electricity. It will be located in central Sweden and have a capacity of 100 MW and be basically of the same type as R3/Adam. It is planned to have it ready in 1967. The Eva power station will also be built by the State Power Board, with the Atomic Energy Company responsible for the design of the reactor. A group of private industrial

concerns will undertake the construction and engineering work.

The Swedish power industry is considering the building of an additional nuclear power plant, based on an imported reactor, to be operated from 1965. The arguments in favour of this project are that it is desirable for the power industry to acquire experience from the construction and operation of such a plant as soon as possible, and before the R4/Eva can be completed; in addition, the Swedish fund of experience will be widened considerably through the choice of another type concurrently with R4/Eva. However, no definite decision in the matter has yet been taken; limited resources of technical personnel are the main reason for very careful consideration before a new system is introduced parallel to the natural uranium heavy water type.



Uranium-bearing shales in central Sweden

Special Characteristics

Mr. Harry Brynielsson, head of the Swedish Atomic Energy Company, has pointed out that three factors largely determine the Swedish reactor programme. They are (a) the energy situation in Sweden and the ever increasing import of fuels, (b) the existence of nuclear fuels in Sweden, and (c) the technical, scientific and industrial resources of the country.

The nature of the energy situation has already been indicated. As regards the nuclear fuel resources, it may be pointed out that the large deposits of shales in central Sweden contain uranium, and a small extraction plant has been in operation since 1953. The present output is approximately 10 tons per year. A bigger plant with an estimated annual output of 120 tons is under construction. It is planned to be in operation by 1964 and should be able to meet Swedish needs in the 1960's. One of the main reasons for having the present Swedish reactor programme based on natural uranium is of course the existence of this material in the country. The refining of uranium concentrate and the manufacture of fuel elements is being done by the Atomic Energy Company in Stockholm.

The research work is mainly carried out at the new research centre of the Atomic Energy Company, Studsvik. A materials testing reactor, a zero energy reactor and exponential assemblies, together with the necessary supporting facilities, are used in the development of the Swedish power reactor systems. An extensive research programme is also being carried out for the production of nuclear materials, like heavy water, and the processing of spent nuclear fuel.

A further special characteristic of the Swedish programme is the very close collaboration between the State, municipal authorities and private industry - an association which is reflected in the organization of the Swedish Atomic Energy Company and the implementation of the first projects.

The Swedish reactor programme has so far followed a strictly national line, centered round the natural uranium, heavy water reactor type, but development abroad is followed closely. Sweden can hardly afford to develop a variety of reactor types and the available opportunities for collaboration in international programmes have therefore been taken, as for instance in the OEEC projects concerning the boiling heavy water reactor at Halden, Norway, and the high temperature gas cooled reactor at Winfrith Heath, United Kingdom.

CONSTRUCTION OF THE LABORATORY OF THE
INTERNATIONAL ATOMIC ENERGY AGENCY
AGENCE INTERNATIONALE DE L'ENERGIE ATOMIQUE
МЕЖДУНАРОДНОЕ АГЕНТСТВО ПО АТОМНОЙ ЭНЕРГИИ
ORGANISMO INTERNATIONAL DE ENERGIA ATOMICA

FIRST LABORATORY · IAEA ·

Construction work on IAEA's functional laboratory at Seibersdorf near Vienna was inaugurated by the Director General, Mr. Sterling Cole, on 28 September 1959. In the presence of a distinguished gathering, Mr. Cole gave a formal start to the work by setting a concrete mixer in motion and pushing a wheelbarrow to pour concrete into a wooden trench (picture left, above). He also deposited into the cement a commemorative medallion (top right corner). Among those who spoke at the ceremony were Dr. Henry Seligman, Deputy Director General in charge of Research and Isotopes (middle, left), and Mr. John A. McCone, Chairman of the United States Atomic Energy Commission (left, below). The United States has donated $600,000 towards building and equipping the laboratory which will be ready towards the end of this year