

REACTOR CONSTRUCTION PROGRAMME IN JAPAN

In September last year, the Japanese Government requested the International Atomic Energy Agency to supply three tons of natural uranium for a research reactor, and the Agency has now arranged for its sale to Japan. The metal will be supplied in ingot form and after fabrication it will be used as fuel in a reactor of the natural uranium, heavy water type.

The uranium will be obtained from Canada and sold to Japan by IAEA. The Agency had invited tenders for its supply, and after considering the tenders received, the Agency's Board of Governors decided that the Canadian offer to the Agency of three tons of natural uranium free of charge should be accepted and that the selling price to Japan should be US \$35.50 per kilogramme. The price takes into account Article XIV/E of the Agency's Statute which says that the Agency shall establish a scale of charges (including those for storage and handling) for materials furnished to Member States, and that the scale shall be designed to produce revenues to meet expenses in connexion with materials acquired by the Agency and costs of materials and services provided by it under agreements with one or more members.

This is the first operation of its kind to be undertaken by the Agency, and the reactor for which the supply is being made will be the first in Japan to be constructed by Japanese scientists and technicians. IAEA's Board of Governors has given the necessary approval to the reactor project for which the Agency is providing assistance.

Initial Steps

Although fundamental nuclear research had been going on in Japan for a number of years, the country had no plans for the construction of nuclear reactors until 1955. The first Geneva Conference on the peaceful uses of atomic energy gave a fillip to Japanese plans and efforts in this direction, and early in 1956 the Atomic Energy Commission of Japan (the policy-making body) and the Atomic Energy Agency (the administrative organ) were established. Soon afterwards, the Japanese Atomic Energy Research Institute (JAERI), a semi-governmental agency, was set up as the central institute for research in this field. A plot of 750 acres of sandy land in Tokai-Mura (Tokai village) on the seashore, 100 km north of Tokyo, was chosen as the site for the institute. The JAERI's functions include the construction of nuclear reactors, studies on nuclear technology, nuclear physics, nuclear chemistry, applications of strong radiation, health physics and the related sciences, operation of a radioisotope school, etc. The institute's personnel is expected to exceed 1 000 by the end of this year.

The JAERI's programme does not include what may be called fundamental nuclear research, which is carried out in universities and research institutes. For

example, the Nuclear Research Institute of Tokyo University has a 50 MeV (million electron volts) synchrocyclotron, a 1 BeV (billion electron volts) electron-synchrotron and a variety of equipment for cosmic ray research, etc. In fact, the emphasis in Japan until recently had been on fundamental research, but now work has begun on various aspects of the practical application of nuclear energy for peaceful purposes. This will be clear from the brief account that follows.

The first important task of the JAERI has been the construction of research reactors. The first two research reactors have been imported from the United States. The first, which is called JRR 1 (Japanese Research Reactor No. 1) is of the water boiler type, with 50 KW thermal output. It has been in operation since October last year and has been useful in the training of scientists and technicians in reactor physics, in various experiments in nuclear physics, and in the experimental production of radioisotopes. The second, JRR 2, is of the CP-5 type with a thermal output of 10 000 KW. It will go into operation in the middle of this year. Its efficiency is expected to be high enough to serve the purposes of advanced research and testing.

Area in foreground marked with cross where the new reactor is to be built. JRR-2 is seen in the centre and JRR 1 behind



Meanwhile, Japanese scientists and technicians have been drawn to the idea of constructing a reactor themselves, so that they may gain knowledge and experience of reactor technology. The idea has crystallized in the plan for the construction of a "national" research reactor, fuelled by natural uranium and moderated and cooled by heavy water. The reactor is also meant for engineering testing and production of radioisotopes.

This is the reactor for which IAEA is supplying three tons of natural uranium. It will require six tons of natural uranium as fuel and twelve tons of heavy water as moderator and coolant. There will be 244 fuel elements and twelve cadmium control rods. The thermal output is expected to reach 10 000 KW.

The design of this research reactor has been carried out not only by technical experts of the JAERI, but also by those of many industrial firms in Japan. The completed design was sent for examination to the Atomic Energy of Canada, Ltd., who confirmed that it had no defects of a substantial character. Construction has now started and the reactor is expected to become "critical" by the end of 1960.

Fuel for New Reactor

Three more tons of uranium are still to be obtained for the reactor, since it will require a total of six tons. A number of uranium deposits have been discovered in Japan, although the total amount of the reserves has yet to be ascertained. An important mine has been located in Ningyô-Tôge, in central Japan. The deposit is of a horizontal sedimentary type; this is rather rare, but its exploitation is not difficult. The total amount of the ore is estimated at more than 1 000 000 tons with a uranium content of 0.05 per cent.

Supply of nuclear fuel is naturally one of the most important questions being tackled by the Japanese authorities. To deal with this problem, the Atomic Fuel Corporation, a government agency, was established in 1956. The Corporation is entrusted with

the task of exploiting uranium mines in Japan and developing the techniques of refinement. The task of obtaining three more tons of natural uranium for the new research reactor is one of its responsibilities.

Apart from the three research reactors mentioned above, the planned activities of the JAERI include the construction of a power demonstrating reactor of 10 000 KW electric output, a material testing reactor and facilities for experiments on breeder reactors.

Power Stations

Plans are also under way for the construction of nuclear power stations for commercial production of electricity. The total demand for electricity in Japan was 61.1 billion KWH in 1956. It is estimated that the demand will be of the order of 185 billion KWH in 1975. The generating capacity in 1956 was 13.1 million KW (8.7 million hydro and 4.4 million thermal). This capacity would be increased to 40.9 million KW by 1975 including 22.9 million KW hydro and 18 million KW thermal. The fuel necessary for this thermal power generation will amount to 45.3 million tons, about 4.5 times more than that consumed in 1956. As Japan's coal reserves are not very rich, this will mean increasing imports of chemical fuel, resulting in a considerable drain on foreign exchange. The exploitation of atomic energy for power production can be of great help in reducing this drain.

In the light of these facts, the Atomic Energy Commission of Japan has prepared a plan for nuclear power generation. Under this plan the total installed capacity in nuclear power plants is expected to reach 600 000 KW in 1965 and 7 000 000 KW in 1975. Japanese industrialists have already initiated active steps for nuclear power generation on a commercial basis, and a company called the Atomic Power Production Company of Japan was formed in 1957. Its aim is to initiate the installation of atomic power stations in Japan, starting with the import of a reactor of the advanced Calder Hall type, with 150 000 KW electric output. This is expected to be the first commercial power reactor in Japan.

Model of the first reactor to be built in Japan
by Japanese technicians JRR-3

