Soviets Report Fast Breeder Developments

The commercial introduction of nuclear fast breeder technology was the central question at the Salzburg conference of the International Atomic Energy Agency. The following is a summary of the presentation made by Petros Janc, Chairman of the Soviet State Committee for the Use of Nuclear Energy.

In the Soviet Union, the increases in energy demand will be entirely taken care of by construction of nuclear power plants from 1980 on. Besides fast breeders, new light water reactors will also be put into operation. A pressurized water reactor with an electrical capacity of 1000MW is planned. The decision to keep the maximum capacity under the 1300MW range of the Biblis type, is based on technical transport considerations. In Salzburg, the Soviet experts emphatically expressed their interest in close collaboration with the Federal Republic in this area. Talks with West German representatives indicated that this interest is by no means one-sided. The same was

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true for the British Steam Generating Heavy Water Reactor (SGHWR), which is similar in design to the Soviet modified graphite pressurized water reactor (RBMK). The RBMK will be constructed in blocks with an electrical capacity of 1000MW each, which can then be raised to 1500MW. The BN-1600 is foreseen as a compatible fast breeder model. It is supposed to have an electrical output of 1600MW and a doubling time of 6 to 8 years.

The Soviet Union has pursued research on fast breeders since the end of the 1940s. In the middle of the 1950s they constructed a number of small experimental reactors, BR-1 to BR-5. From the very outset, major emphasis was put on working out the inherent qualities of the breeder as an integral component of the development of energy technology. The high energy density of the primary energy medium is shown by the minimal fuel consumption of nuclear reactors. This crucial characteristic is most prominent in the breeder, where the production of Plutonium 239 represents the first successful "artificial" creation of a highly enriched "raw material" for energy. The span of time after which the bred material can be utilized to operate a second reactor of this type (the doubling time), is of fundamental significance and mainly depends on how efficiently the reactor breeds, and on what quantities of plutonium must be present in the total fuel cycle. If energy supplies are to be based primarily on nuclear energy, then doubling times must be achieved which are below the doubling time of electricity consumption (currently about 10 years). Accordingly, from the very outset high breeding rates and rapid reprocessing have been priorities for Soviet breeder research. In addition, the size of a fast breeder must be larger than that of the light water reactor, since otherwise additional reactors, which take longer to build than LWR's , could not be constructed at the necessary rate.

On the basis of Soviet scientists' experience with oxide fuels in the sodium-coooled BR-5 reactor, in 1964 it was decided to proceed with construction on the BN-350 industrial power plant. This reactor was designed for a thermal capacity of 1000MW, which means a two hundredfold increase over the thermal 5MW of the BR-5! The only serious difficulties, however, arose with material problems in the steam generator. At that location, the materials separating the liquid sodium at low pressure from the high-pressure steam are put under tremendous stress. Even the tiniest leaks become very quickly enlarged, creating the danger of an explosive reaction between the water and the liquid sodium. Therefore, five of the BN-350s six steam generators have already had to be replaced. For safety reasons, in every sodium cooled reactor there is inserted a second cooling system between the core and the steam generator.

Construction is almost completed on the BN-600 fast breeder reactor, which will then be the world's largest electricity producing reactor. Unlike the BN-350, this reactor is a "pool reactor," in which the sodium system, pumps and first heat exchanges are all located within one large reactor vessel. This design has turned out to be the simplest to construct for large-output reactors, even though the projected enlargement of the BN-600 design to a 1600MW electrical capacity, involves a reactor vessel whose diameter is 18 meters. Sizes on this order are practicable for fast breeders, since the pressures developed in the reactor vessel are not as great as in pressurized water reactors. A variant of the BN-1600 is also being considered, in which the diameter of the pool can be made as small as 8 meters by placing it on its side.

In addition to the LMFBR type BN-1600, the gas-cooled GCDFR is also being investigated for technical and economic viability. This reactor is designed for an electrical capacity of 1500MW, and will use nitrogen tetraoxide (N_2O_4) both as a coolant and as the working medium. Widely used already in industrial applications, N_2O_4 breaks down into $2NO + O_2$ when it has absorbed 442cal-kg, and so is quite able to achieve an efficient transfer of heat from the core. Aside from its broad spectrum of variant models and good technical safety features, this reactor type has the advantage of extremely high breeding rates, which could attain doubling times of from 3.5 to 6 years! A reactor of this type with an electrical output of 300MW is already completely designed. The Soviet Union estimates that by introducing the GCDFR five years after the sodium cooled reactor starts up, an almost 50 percent reduction in the consumption of natural uranium could be achieved.

The planned BN-1600 and the reliably functioning BN-350 are, of course, separated by technical barriers comparable to those involved in the step from the BR-5 to the

BR-350. But a wealth of experience has already been obtained from the construction and repair work done on the BN-350, and this is a reliable indication that the future problems can also be solved on schedule. Along with the construction of the new breeder, new industrial centers will spring up, which will alter the Soviet landscape even more than did the BN-350. This latter reactor was set up in Shevchenkov, in the middle of the desert bordering the Caspian Sea. In addition to electricity, it also currently produces 50,000 cubic meters of distilled water per day for the population of the desert city, which makes its per capita water consumption higher than it is in Moscow. "For nature-lovers," magnificent city parks are irrigated with the water distilled by the BN-350, as was emphasized by Mr. Trojanov at the end of his speech, followed by a prolonged ovation! Even the majority of the United States representatives, who do not want Carter to send them back into the technological desert, applauded enthusiastically.

For Third World It's Nuclear Power Or Death

The Third World's urgent need for the most advanced nuclear technologies was stressed by representatives of the Bangladesh Atomic Energy Commission at the recent conference of the International Atomic Energy Agency in Salzburg, Austria. These brief excerpts from a Bengali spokesman's presentation to the conference indicate Third World nations' turn from merely negative resistance to the Carter Administration's anti-nuclear stance toward an aggressive policy of rapid, well financed nuclear power development in the underdeveloped sector.

The accompanying diagram, also presented at the conference, counters "zero growth" rhetoric by showing the relationship between energy consumption and infant mortality and longevity for 130 countries.

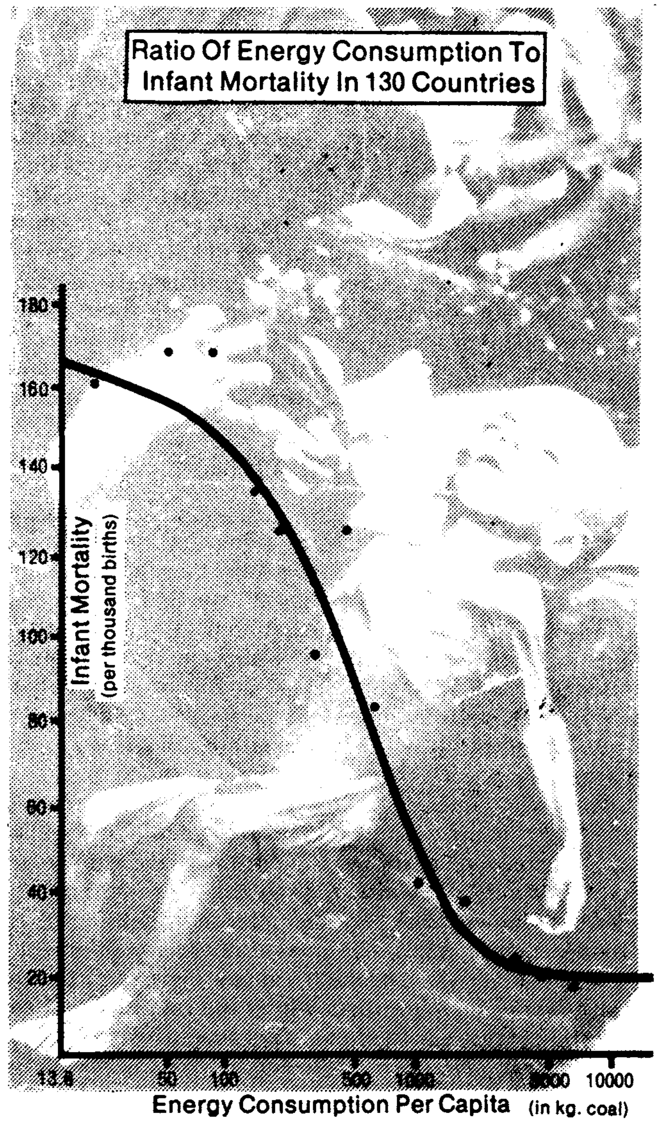
Problems Faced By Bangladesh In Introduction Of Nuclear Power Program (Excerpts)

Bangladesh has one of the lowest per capita (levels of) energy resources and consumption of energy. The per capita GNP of Bangladesh is also one of the lowest in the world. With a population density of 1,380 persons per square mile, it is one of the most densely populated countries of the world. Population is growing at an average rate of 3 percent per annum. The dominant sector of the economy is agriculture, contributing about 60 percent of the Gross Domestic Product. (And) Bangladesh is very poor in indigenous energy resources.

It is obvious that if Bangladesh is to grow economically and to build up a modest industrial base to improve its standard of living, it will require much greater energy resources than are now available locally.

In view of the limited indigenous energy resources of Bangladesh, nuclear power as an alternative source for power generation has been considered since 1961. However, the attempts to procure financing for the project were not successful. The oil crisis and the economic upheaval in 1974 played their deadly role in compounding the post-independence troubles of Bangladesh.

The growth of opposition to nuclear power in developed countries, particularly in Sweden and the U.S., has had its adverse affect on the public in Bangladesh. The views of anti-nuclear lobbies abroad tend to be accepted as the "truth." The slow-down in ordering for nuclear stations in the USA, Britain, and Sweden has been taken to mean that there are as yet unsolved problems in the utilization of fission power.



The sooner nuclear power receives wider public acceptance in the developed countries as a method of power generation, the better it is for Bangladesh in breaking the ground for its first nuclear power station.