letter from Jülich

Power and Politics

German nuclear research is breaking away from restrictions that tied it to French military goals

by John Lambert

The Germans got a late start in the nuclear reactor business—because of the Second World War and occupation-time prohibitions—but in the 10 years they have been in, they have made up for a lot of lost time.

Their main reactor research center, Kernforschungsanlage Jülich in the Rhineland, is concentrating on developing new high-temperature reactors suitable for civilian power uses. In the past Germany has cooperated with other European countries in such development, but French insistence on building reactors that would be useful for making warheads has torpedoed international cooperation; the Germans are beginning to go it alone.

Recently the first all-German reactor, a thorium high-temperature test reactor with a 15 megawatt (electric) capacity, at Jülich, began feeding energy into the public grid.

The unusual aspect of the reactor, a feature also used in Great Britain's Dragon installation and in the U.S. Peachbottom, Pa., plant, is the method of fuel supply. The fuel is contained in thousands of mobile graphite balls about five inches in diameter. In the center of the balls is the fuel—consisting of five grams of thorium to one gram of uranium 235—coated with pyrolytic carbon.

This system has proved to be relatively cheap: The coated particles retain radioactive fission products at working temperatures of 1,400 degrees.

In reactors designed to operate at lower temperatures, metal cans are used to retain fission products and prevent them from contaminating the surroundings, but such cans would melt in high temperature reactors.

At first, therefore, designers of the high-temperature reactors were reconciled to the need for large units to purify the cooling gas. Experience with Dragon shows, however, that with the pebble fuel the purifier can be quite small, since the pebbles release only about a thousandth of a percent of the fission products formed in them.

With the new fuel, the reactor can be refueled without interrupting operations, and thorium is both abundant and relatively cheap. The THTR has also achieved high coolant temperature for a nuclear power plant: 873 degrees C. Studies are going on with a view to developing helium turbines in a direct circuit to further increase the plant efficiency and to reduce capital cost.

Construction of the Jülich center began in 1958 and to date has cost 500 million German marks ($125 million). The idea was to bring together highly specialized scientists from different disciplines. There are now 17 institutes in the center, which is devoted to research into plasma physics, zoology and botany, and includes a 24-bed hospital specializing in cancer research.

The THTR test reactor was built by a consortium of Brown-Boveri of Mannheim and Krupp of Essen. Studies have now been completed for the construction of a similar power plant of 300 megawatts, using 675,000 graphite fuel elements with a recycle rate of 500 spheres per hour and requiring a more rapid method of burn-up.

Jülich scientists are collaborating in the gas-cooled, high-temperature Dragon reactor project at Winfrith Heath, England, and with the United States. Euratom people were also involved in the work of the Jülich center, contributing $20 million in the last few years to the balled fuel project. However, because of the inability of the six member governments of Euratom to agree on what projects should be given priority, all contracts between Euratom industries and national research centers were terminated at the end of last year.

The country perhaps most responsible for this paralysis in Euratom is France. As far as the development of reactors is concerned, France has gone her own way, at first concentrating on gas-graphite reactors using natural uranium, which produce a high quantity of plutonium necessary for the French nuclear armament program.

Then French scientists began work on fast breeders, hoping that they would be able to commercialize them by 1975. But it is now generally agreed by scientists in Europe that fast breeders will not be on the market before the year 2000, although the U.S. program is aiming at the late 1980's and Japan is even talking about the 1970's (SN: 9/28, p. 310, 328). Rudolf Schultern, director of Jülich's Institute of Reactor Development, is convinced that France will return to high-temperature reactors, on which up to now the British and the Germans have been concentrating, or to the proven light water reactors used in the United States—both of those use enriched uranium. The gas graphite reactor now operating in France is uneconomical for civilian uses and it is unlikely that French consumers will be prepared to pay a much higher price for energy than their foreign competitors. It is therefore believed that the French will sooner or later begin to cooperate with their Euratom partners and with Britain in the development of reactors with a better commercial potential.