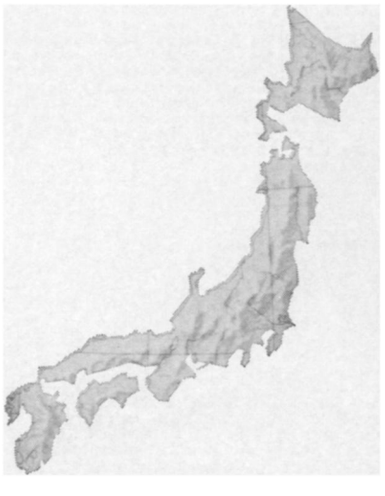
LETTER FROM TOKYO



Steel and nucleonics

Japan's steel industry looks to the atom for a substitute for coke

by Stuart Griffin

The Japanese steel industry, struggling to keep its momentum as a coming leader in world trade, is pushing development of nuclear power as the key to future success.

To a country that lacks natural resources, nuclear energy represents both a potentially economical power source and a way of obtaining the cheap high temperatures that other nations supply from coking coal.

Anticipating the role of nuclear energy in iron and steelmaking, the semi-official Iron and Steel Institute of Japan has established an atomic energy division whose current research includes such projects as the operation of private nuclear power plants by steel mills and the direct application of nuclear energy in iron and steel making.

The Government's Ministry of International Trade and Industry, in conjunction with the Science and Technology Agency, is pushing the research. Local coal resources, mostly low quality, are already being exploited to the full, and the development of hydroelectric power has approached its maximum potential. The rate of the nation's economic growth makes it apparent that the import of oil and other energy sources must be substantially boosted or other energy sources developed.

Yawata scientists, backed by those at other big iron-steel firms such as Fuji, Kawasaki, Kobe Steel, Sumitomo and Japan Steel and Tubing, are looking to nuclear power to substitute for hard-to-come-by imported coking coal.

They observe that of the 60 million tons of coking coal required to produce 100 million tons of crude steel, Japan is able to supply only 10 million tons from domestic sources.

At present, thermal electric power from coal in Japan costs 0.8 cents per kilowatt. For thermal power plants in the 500,000-kilowatt capacity range, using heavy oil, costs are about 0.6 cents. According to MITI estimates, a 500,000-kilowatt capacity nuclear power plant would, by 1975, produce power at less than 0.6 cents per kilowatt.

In view of these advantages, the Atomic Energy Commission plans to raise Japan's commercial nuclear power generation capacity to between 30 million and 40 million kilowatts by 1985.

Japan currently has only one commercial nuclear plant in operation: the 166,000-kilowatt reactor at Tokai Village, 75 miles northeast of Tokyo. But six more power plants are building, and are due to come on line in 1973-1974. They have capacities of 322,000, 400,000, 425,000, 784,000, 325,000 and 500,000 kilowatts.

In these power plans, the steel industry has an essential role. By the 1970's, Japan's annual steel production is expected to reach the 100-million-ton level. Steel plants will grow correspondingly larger, with yearly output capacities of between eight million and ten million tons.

According to the Japan Iron and Steel Federation, in 1966 it required 540 kilowatt-hours of electric power to manufacture a ton of crude steel. This means that the steel industry consumed approximately 15 percent of all Japanese electric power production.

Major Japanese steel mills meet their electric power requirements partly by purchasing it from electric companies —that is, the nine firms which have regional shares of the country as determined by the Government—and partly from jointly owned thermal power plants.

Conversion of these plants from thermal power to nuclear power, according to officials of the Yawata Iron and Steel Co., Ltd., the nation's leading firm, would result in a saving of about $5,125,000 a year for a steel mill producing seven million tons annually.

Even more exciting is the prospect of using nuclear power directly in the production of steel.

The nuclear reactor contemplated by the Japanese steel engineers would be cooled by helium gas, and moderated with graphite. The fuel would be either uranium or thorium, contained in spherical fuel particles coated with carbon (SN: 11/25/67, p. 518). The gas, heated to 1,000 degrees C., would be used to reduce the iron ore directly. Recovered gas would then be used to drive a gas turbine for power generation, and then, reduced to 300 degrees C., employed for seawater desalination. The afterheat could be used for air-conditioning houses.

Ordinary nuclear reactors, in which a coolant such as pressurized or boiling water is circulated past radioactive fuel elements, would not be satisfactory, because the coolant itself picks up some radioactivity and would transmit it to the iron ore being processed. With the carbon-contained spherical fuel particles, however, the coolant gas is not exposed to radioactivity, and so would not contaminate the iron. Similar nuclear steel reactors are being developed in Germany (SN: 1/11, p. 36).