done of industrializing the developing sector, Japan will have to go well beyond the most optimistic predictions of 6 to 10 gigawatts production capacity per year.

Note on sources: *The author is grateful to Mr. Toru Namiki of the Japan Electric Power Information Center in Washington, D.C. for his help in summarizing in English the MITI 45-year plan.*

For the history of the Japanese fusion and nuclear program, see articles in the August 1981 issue of Fusion *magazine and the July 1984 issue of* Fusion Asia *magazine.*

Fusion: 'If the U.S. won't do it, we will'

The Japanese expect to reach fusion breakeven next year—getting more energy out than that required to start the reaction—in the big JT-60 tokamak reactor. And they expect to commercialize fusion energy beginning in about 2010.

A Fusion Experimental Reactor (FER) is now under discussion with a demonstration reactor expected in about 2000. Other magnetic confinement devices are proceeding in experimentation,

versity and the tandem mirror Gamma 10 machine at Tsukuba University.

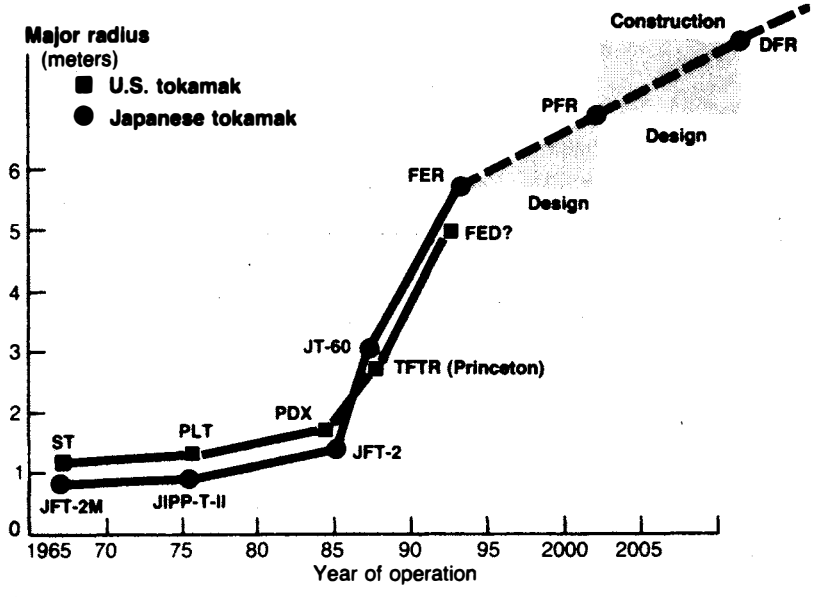
There is also a full range of inertial confinement experiments centered at the Institute of Laser Engineering at Osaka University that are making notable progress both theoretically and experimentally using a variety of drivers from glass lasers to ion beams to particle beams. A variety of innovative and promising experiments are under way, from new target designs to a combination of magnetic and inertial fusion.

In May 1978, Japan's Prime Minister Takeo Fukuda surprised President Carter with the announcement at a New York City foreign policy forum that Japan was prepared to spend $1 billion in a joint research program. The Japanese had decided in 1975 that fusion was "the energy resource of the 21st century," and as with nuclear energy, they embarked on a research and development program to commercialize the technology. When the United States declined Japan's offer (under the direction of Energy Secretary James Schlesinger), Japan continued full speed ahead on its own.

Japan's total fusion budget was a high of 44 billion yen in 1981 and is slightly lower in 1986, 36.6 billion yen, comprising 13% of Japan's total energy R&D budget. (A direct dollar comparison with the U.S. budget is difficult, because these Japanese figures do not include salaries and administration.) This kind of funding commitment to a broad-based research program has left the United States, once the world leader in fusion, behind in the dust, with U.S. fusion scientists reduced to pushing back their schedules because of funding cuts and "choosing" which alternative program should be chopped out of the budget first.

FIGURE 5

Comparison of U.S. and Japanese tokamak devices



SOURCE: Fusion magazine and the Japanese Atomic Energy Research Institute

Japan expects to reach breakeven with the JT-60 tokamak in 1987, putting it ahead of the budget-strapped U.S. program's Tokamak Fusion Test Reactor (TFTR) at the Princeton P sma Physics Laboratory. Japan plans to put the Fusion Experimental Reactor (FER) on line in the 1990s, followed by a Prototype Fusion Reactor (PFR) and then a Demonstration Fusion Reactor (DFR) in the early 21st century. The future of the U.S. magnetic fusion program beyond the TFTR is clouded by funding cuts and lack of a firm commitment from the administration.