DOE PANEL MAKES CASE FOR HEATING UP FUSION ENERGY RESEARCH IN 1990s

In ordinary times a report on nuclear fusion policy would be placed on the bookshelves of Department of Energy officials and forgotten—like dozens of similar reports on the subject over the past 30 years. But the times are not ordinary. Events around the Persian Gulf have forcibly brought home the political, economic and social vulnerabilities of the US, lacking as it does an overall strategy for ensuring adequate supplies of fuel for energy uses. Accordingly, the interim report of DOE's Fusion Policy Advisory Committee, sent to Energy Secretary James D. Watkins on 23 July, struck a timely chord at the outset: "The committee believes that the context in which fusion policy must be placed today is remarkably different from that of the past."

Indeed it is—and not only for reasons of geopolitics and energy sources. The issue of controlled fusion research has rankled scientists and politicians for nearly two years—ever since Robert O. Hunter Jr, while he was DOE's director of energy research, proposed to rearrange the budgets for magnetic fusion research and inertial confinement programs and to postpone construction of the $800 million Compact Ignition Tokamak at Princeton University. The furor over fusion soon became a *cause celèbre* in political circles, reaching to President Bush and resulting in Hunter's resignation last October (PHYSICS TODAY, January 1990, page 49). His departure left conundrums about the direction and cost of the program that Watkins sought to resolve by appointing a 19-member committee under the chairmanship of H. Guyford Stever, who once served as director of the National Science Foundation and, at the same time, science adviser to President Ford. Watkins directed the committee to "provide its best judgment on the optimal way to structure the overall US fusion program" and, while doing this, to "feel free to address the question of whether or not there should be a competition between magnetic and inertial confinement" for DOE's constrained R&D funds (PHYSICS TODAY, April 1990, page 43).

In its first report, the Stever committee urges that both programs proceed in parallel—though each is at different stages of development and each requires a unique technology. "Fusion research programs worldwide have made steady progress during the last decade," says the report.

"For both approaches there is confidence that the processes occurring are sufficiently understood to take the next step toward large-scale fusion energy production."

Fusion face-off

In saying this, the committee disagrees in part with Hunter's argument that better understanding of basic plasma physics is needed for success. It also takes issue with Hunter's plan to create a rivalry between the approaches for funds and facilities. "While MFE is now further advanced towards achieving its scientific goals, the physical separation of driver and fusion reactor may ultimately prove to be an important advantage for IFE. . . Competition is proper and desirable, but at this time the competition should be directed towards the rapid attainment of specific goals in each program and not toward the elimination of one alternative."

Instead, the committee recommends separate strategies. For MFE, the committee sets its sights on building and operating a demonstration power plant by 2025 and a commercially profitable electricity station by 2040. "The dates are approximate," the report declares, "and will be met only if assured and stable funding is provided." The current budget for magnetic fusion is $320 million, which is down from fiscal 1989's $345 million. DOE requested $325 million for fiscal 1991, which begins on 1 October. The increase isn't enough to cover the cost of inflation and isn't intended to begin the construction of the Compact Ignition Tokamak. The committee puts it bluntly: "The present MFE budget and the science and engineering programs sustained by it are inadequate for attaining the stated goals." To get started toward the goals, the budget will need to be doubled from today's level in the next five to seven years.

Within this decade, the committee suggests, MFE should initiate four major new facilities: The Compact Ignition Tokamak for burning plasma in high magnetic fields; the International Thermonuclear Experimental Reactor, more familiarly known by its initials as ITER; a 14-MeV neutron source for testing materials at high magnetic fields, and a steady-state hydrogen plasma experiment.

IFE's highest priority, says the committee, is the study of target physics, leading to a demonstration of fuel pellet ignition—a recommendation also made recently by a National Research Council panel headed by Steven A. Koonin of Caltech. Work on this is now underway at several labs with support from DOE defense programs, preliminary to constructing an experimental Laboratory Microfusion Facility, which could generate fusion yields greater than 30 microjoules to simulate both nuclear weapons effects and commercial power capabilities. The committee believes that a heavy-ion accelerator is the most promising driver, but because its development is still far off the committee recommends exploring krypton-fluoride lasers and light-ion accelerators as drivers. A suitable driver should be available for an engineering test reactor by about 2000, when the committee believes DOE will be able to judge whether to proceed to an IFE demonstration power plant that could be running in 2025.

Fusion scientists are bound to be attracted by the panel's reasoning. Watkins, however, has doubts. "I am concerned," he wrote in a letter to Stever, "that the report, in laying out the ideal path for developing fusion energy, may raise expectations in the scientific community that such a path will be easy to implement in the current budgetary environment. . . this is not likely to be the case." He then raised some tough new questions for the committee so that he could make, he said, the "hard choices." He asked if fusion could ever be made commercially competitive with other power sources and if international collaboration and industrial involvement would speed up development.

—IRWIN GOODWIN ■