Fusion Panel Drafts a Wish List for the '90s

Energy Secretary James Watkins' hand-picked panel is telling him to think big as he reshapes the fusion energy program

BY EARLY THIS YEAR, the U.S. fusion energy program had sunk into a political morass. The program had been leaderless for more than a year, plans to build the next big machine had been put on ice, and a proposal to restructure the effort had prompted a furor in the fusion research community and on Capitol Hill (*Science*, 23 June 1989, p. 1434). To get out of the mess, Energy Secretary James Watkins turned to a time-honored bureaucratic tactic: He appointed a blue-ribbon committee to give its "best judgment on the optimal way to structure the overall U.S. fusion program."

The committee, which began its work in March, is now putting the finishing touches on its recommendations. It is drawing up a multibillion-dollar wish list for the 1990s that could include as many as four new major experimental fusion research facilities in the United States. The panel will also call for the research budget to be doubled (in constant dollars) from its present level of $320 million over the next 5 to 7 years.

Just how enthusiastic Watkins and the White House's Office of Science and Technology Policy (OSTP) will be about these costly recommendations remains to be seen. Watkins has been openly critical of the R&D program at times. And OSTP officials have expressed concern about the management of the research endeavor and questioned plans to build new facilities such as the $900-million Compact Ignition Tokamak (CIT). What is clear is that without a strong signal from the Administration, Congress will be reluctant to get behind any expansion of the fusion program.

But neither the political complications nor the expense and technical risk have deterred the panel from calling for an aggressive effort. The committee, which is chaired by H. Guyford Stever, former foreign secretary of the National Academy of Engineering, is blunt in its assessment of the American fusion program's needs.

In a near-final draft of its report, hammered out at a meeting on 29 June, the panel argues that greenhouse warming related to the burning of fossil fuels, expanding populations, limited resources, and public concerns about the safety of nuclear fission require that the United States remain "firmly committed to the development of fusion." The committee, whose 19 members were drawn from nuclear engineering companies, an electric utility, aerospace firms, fusion laboratories, and research universities, stresses that at this point fusion appears to be relatively safe and is one of the few energy options that is essentially inexhaustible. For these reasons, they say, the United States should set its sights on building an electricity-producing demonstration reactor by 2025 and a commercial fusion power plant by 2040.

There's also the inevitable appeal to international competitiveness: The United States is already losing its world lead in developing the technology, the panel says, noting that "it is quite likely that the magnetic [confinement] fusion efforts of the European Community exceed, and that of Japan equals, those of the U.S."

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>
> —Draft panel report

Magnetic confinement fusion is the primary focus of current research efforts. These are centered on tokamaks, large doughnut-shaped machines that use strong magnetic fields to confine 100-million-degree burning plasma. But the panel, citing achievements in laser-based inertial confinement fusion (ICF) R&D conducted by the Department of Energy's nuclear weapons division, recommends starting a parallel civilian program in laser fusion that might one day rival the magnetic fusion effort. Its goal would be to produce a steady stream of miniature fusion reactions triggered by the compression of tiny capsules containing deuterium and tritium.

Robert O. Hunter, the former director of DOE's Office of Fusion Research, floated a similar plan last year. But he upset the fusion research community by arguing that the new laser effort should be accommodated within the existing budget. No way, says Watkins' panel: "Present funding levels are inadequate even to utilize fully existing U.S. facilities and talent let alone the expanded efforts needed to meet the above goals and also participate in international programs."

A year ago, Hunter was arguing that more basic physics studies are needed before new experiments are built. But the advisory committee takes issue with this approach, stating that "fusion is now technically ready" to move ahead. "It's time to accelerate the program to determine whether we really have something," says E. Linn Draper, Jr., a panel member and the chairman of Gulf States Utilities.

With magnetic fusion considered the more mature technology, its experimental needs dominate the committee's proposed agenda of research projects, which could easily cost $3 billion. These include:

- Moving ahead with the CIT Tokamak, a machine that would allow physicists to study burning plasmas for short periods and to possibly achieve ignition—the point at which the fusion reactions produce more energy than is required to get them started.
- Construction of a facility to develop reactor materials that resist damage from the highly energetic neutrons produced by deuterium-tritium fusion reactions.
- Setting up a new tokamak research facility that runs on pure hydrogen rather than deuterium and tritium, which makes the machine itself radioactive.
- Building an ICF ignition experiment, an undertaking that might be done relatively cheaply by modifying the Nova laser at Lawrence Livermore National Laboratory.

In addition, Watkins' advisory group recommends that the United States participate in the second phase of the design of the $6-billion International Thermonuclear Fusion Reactor (ITER), a test reactor that should provide crucial information about the technical and economic viability of magnetic fusion. DOE is scheduled to conduct exploratory talks later this month in Vienna with the other participants—the Soviet Union, the European Community, and Japan.

Still to be decided is the priority that the panel will give to its list of projects. There may also be a debate over schedules, with some members such as Harold Forsen of Bechtel National pushing for tighter deadlines for building a fusion reactor. Despite such differences, committee members appear to be in agreement on one key point: fusion will not be a viable energy option "without major changes in the way the program is managed and funded."

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