state & society

Panel advocates more basic research throughout DOE

A strong component of basic research is needed in each technical division within the Department of Energy. This was a principal recommendation of a panel set up by the Office of Science and Technology Policy to advise on the scope and quality of basic research in the DOE. The panel also proposed that the budget for basic energy research in universities be increased, so that the DOE's future research program can be more evenly distributed among the DOE laboratories, industries and universities.

The Working Group on Basic Research in the Department of Energy, headed by Solomon J. Buchsbaum (Bell Labs), was organized last December by OSTP as part of an overall examination of basic research in the mission agencies of the Federal government. Because advisory committees exist for the DOE's programs in high-energy and nuclear physics, these areas were excluded from the panel's study.

Basic research deficient. An imbalance among basic research, applied research, technology development, engineering and demonstration is "hurting the mission of the DOE," according to the panel. In particular, "nearly all the programs outside the Office of Energy Research are focussed on the solution of near-term problems and are not adequately supported by needed longer-term, fundamental work . . . . In almost every existing program, especially in the solar and fossil-fuel areas, there is inadequate knowledge upon which to build a viable, large-scale energy-supply system compatible with environmental requirements." Also, some program managers act with "excessive sensitivity . . . to perceived political pressures."

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The deficiency in the level and scope of basic research in the DOE, the panel suggested, can be attributed at least in part to the series of short-term reorganizations to which the DOE's programs have been subject in recent years. Many of its programs were inherited from predecessor agencies or mandated by the Congress. Buchsbaum told PHYSICS TODAY that the department has not yet been able to organize these programs into a coherent whole appropriate for the mission of the DOE.

In particular, according to the panel, the department has acquired or adopted a "misguided" emphasis on short-term demonstration goals that are clearly not yet attainable. The Working Group noted that "a propensity by administrators to manage research programs in detail, in a manner analogous to that used in demonstration programs, results in serious interference with the performance of research in the DOE laboratories, the universities and industrial organizations." Adherence to rigid timetables has made it difficult to readily incorporate new discoveries.

The panel observed that many line program managers neither emphasize nor have an appreciation for the relevance of basic research to the ultimate completion of long-range program goals. The man-

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Foster group urges more engineering, more physics of fusion

The primary objective of the overall Department of Energy fusion program should be to determine how practical fusion would be as a source of energy, according to an advisory panel set up by the Fusion Review Committee of the DOE R&D Coordination Council. Working from this objective, the Ad Hoc Experts Group on Fusion, headed by John Foster (TRW), former Director, Defense Research and Engineering in the Department of Defense, advocated a change in balance in DOE's fusion program to reduce risk. The panel recommended that the department give more attention to downstream engineering problems and, within the magnetic-confinement program, while continuing to press for plasma burn in tokamaks, increase its efforts in non-tokamak approaches. The panel also observed a lack of adequate emphasis on the development of high-efficiency drivers in the inertial-confinement program.

Balance. A change in the balance and content of the fusion programs was needed, according to one panel member (Solomon J. Buchsbaum, Bell Laboratories), because the current working plan, calling for rapid growth, was developed several years ago under different economic conditions. The panel, however, did not make any specific funding recommendations, nor did it make any judgment as to whether the total fusion budget should be increased or decreased relative to the other energy programs.

One of the most salient recommendations of the panel, according to Foster, was a major increase of emphasis on engineering problems. He told PHYSICS TODAY that the panel members were "not reasonably comfortable that if any of these physics approaches were to achieve its scientific objectives, we could then make it, in an engineering sense, to a practical reactor. It seems to us that it is really quite timely to address that question—to see whether or not a viable marriage can be found between the range of physics options that are being examined and the engineering alternatives for a practical reactor."

Noting that the fusion programs were

quite properly begun by and are still run by physicists, with a primary interest in physics questions, Foster told us that the panel felt that there "really is a need to have some equally competent reactor-engineering people make a very in-depth examination with the physicists of the physics–engineering marriage aspects."

The magnetic-confinement program, the panel observed, rests primarily on two approaches: tokamaks (60% of the magnetic fusion budget) and mirrors (20%). Such a great emphasis on tokamak experiments, they warned, "constitutes an unnecessarily high risk. . . . While tokamaks are currently the most advanced scientifically, they seem on the surface to be the most complex of the possible alternative approaches to fusion from the standpoint of engineering into an energy product."

Given current fiscal constraints, the DOE, the panel suggested, should consider the possibility of closing some of the "present profusion" of tokamaks, if this will help maximize information obtained from others. The panel did not specify any facilities in particular, but Edwin Kintner, the director of the DOE's magnetic-fusion energy program, told us that the facilities that have operated the longest (such as the Princeton Large Torus and the Alcator A) would be considered for closing first, though any decision would be tempered by the amount of useful results still being obtained from a particular device.

The panel advocated maintaining a vigorous backup program that would include mirrors and various alternative concepts such as field-reversed pinches, long solenoids, Linus and multipoles. The DOE should push "aggressively" the Tandem Mirror Experiment and the Mirror Fusion Test Facility, scheduled for completion, respectively, in 1979 and 1983. Kintner told us that the operating budget of the mirror programs (approximately $20 million in FY 1978) would increase by 10 to 20% over the next two years, if present plans are approved.

The DOE should also support several alternative magnetic concepts, according to the panel, but they did not identify the ones to be emphasized. They did say "significant breakthroughs" might occur in the use of "advanced" fusion fuels, and the use of devices (using deuterium–tritium fuels) that might considerably simplify the engineering, construction and maintenance of a practical reactor. The panel urged the DOE to allocate several million dollars per year for the testing of a limited number of alternative approaches (approximately three or four, according to Foster) over a period of four or five years; they would then be upgraded or dropped. Kintner told us that if current plans are approved, the current funding ($10 to 12 million in FY 1978) for alternative concepts will nearly double over the next two fiscal years; at present

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these projected funds are not earmarked for any particular concepts.

The panel recommended additional support (possibly from the DOE's Office of Basic Energy Sciences) for basic research in plasma physics "to develop the understanding and the tools needed in applications to the fusion program."

The inertial-confinement program has not devoted sufficient attention to the development of engineering technology and high-efficiency drivers, according to the panel. They noted that Lawrence Livermore Laboratory has made considerable progress in recent years toward a scientific feasibility experiment involving glass lasers, but these have a limited efficiency and repetition rate.

The panel praised the work of the target-design group at Livermore. It suggested that a second strong group be established at the Los Alamos Scientific Laboratory, which is exploring the potential of CO_2 lasers for inertial-confinement fusion.

The panel advocated that any further significant funding for large facilities such as Nova at Livermore and Antares at Los Alamos be delayed until present facilities and experiments demonstrate the predicted performance; they did, however, agree that such advanced facilities should be capable of providing the higher energies. The panel recommended not only a continuation of the experimental programs with Shiva (Livermore) and the Eight-Beam System (Los Alamos), but also an expansion of them provided these laboratories overall receive additional funds.

Sandia Laboratories has a program using intense beams of high-energy electrons and light ions as a driver. The panel described the work as valuable, but observed that considerations of driver requirements and the coupling of driver energy to the target are not well integrated; they suggested that a special and a continuing review by experts in these areas be undertaken.

Program management. The panel advocated a common management for the magnetic- and inertial-confinement fusion programs, if and when commercial energy, rather than weapons technology application, becomes the dominant factor behind the latter program. The Fusion Review Committee did not ask the panel to make an assessment of the present military importance of this program.

The panel urged greater participation by industry, universities, the utilities and its suppliers in the fusion programs.

Several Congressmen recently expressed concern at rumored prospects that the magnetic fusion program would experience a sharp reduction of funding and that DOE would transfer it into the Office of Energy Research. John Deutch, director of the OER, told us that he was not in favor of either suggestion and indicated that both rumors had probably developed from a review of the fusion programs that he had undertaken for Secretary of Energy James Schlesinger.

Deutch also told us that the panel's report did have a significant impact upon his review and would have a significant impact on the direction of the program in the FY 1980 budget. The directions will include: a primary emphasis on early scientific demonstration (presumably at the Tokamak Fusion Test Reactor in the early 1980's); more vigorous development of non-tokamak fusion technologies; the performance of some preliminary engineering work needed to make the next step toward an engineering test facility; and a reduction of emphasis on the earliest possible date to get the first experimental power reactor. —CBW

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agers have given inadequate support both to potentially "innovative" research and to long-term programs that would supply fundamental data bases critical to the development and engineering programs.

Increase in non-OER basic research. With the establishment of the OER, the DOE now has a "highly visible, identifiable" sponsor for innovative ideas, according to the panel. They argued, however, that the management and support of all basic research within DOE should not be centralized within the OER. Rather, each Assistant Secretary should assume responsibility for the funding of a strong component of basic research that is appropriate for his program objectives. In addition, each of these officials should undertake the recruitment—from universities, industry and the national laboratories—of a staff experienced in the management of basic research. To provide coherence to the total research effort, to spur research in neglected areas and to

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