Future Grows Dim for Fusion

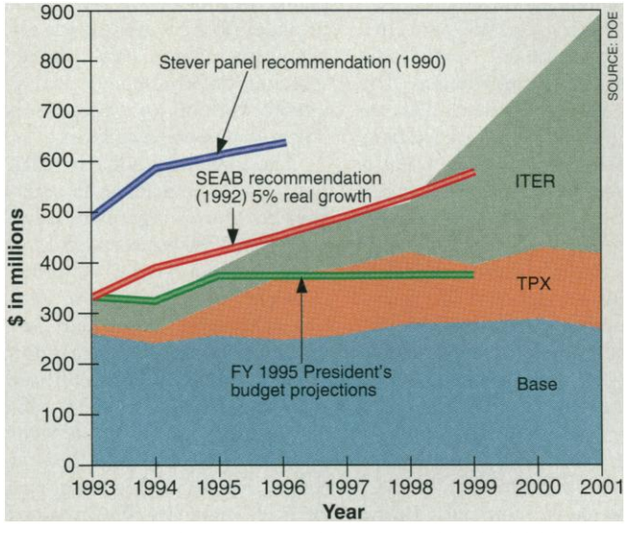
The Department of Energy has sketched out the next generation of fusion projects—but a budget buzzsaw is likely to leave them in tatters

This week, at a conference center outside Washington, D.C., a group of Department of Energy (DOE) officials and laboratory directors has been laboring in secret to come up with a way to prevent the U.S. fusion program from falling into the fiscal abyss. The challenge is daunting: If DOE carries out its plans to build two new projects and continue an ongoing research program, the $373-million-a-year magnetic fusion budget would have to be nearly tripled by the start of the next decade. The likelihood, however, is that it will be cut, perhaps severely, as part of a promise by both the Clinton Administration and Congress to trim billions from the federal budget.

The bleak funding prospects have sharpened the debate over whether, after nearly half a century and an investment of more than $10 billion, the government should continue to bankroll research intended to make fusion a commercially viable source of power by about the middle of the next century. "I've seen the writing on the wall for a long time," says Anne Davies, the chief of the fusion program in DOE's Office of Energy Research (OER), who convened this week's meeting to review options facing the program. "This could be more than a sea change—it could be a tsunami," says Guyford Stever, a former presidential science adviser and director of the National Science Foundation, who chaired a 1990 fusion advisory panel.

The fusion program has managed to avoid massive cuts in previous years despite being an easy target for political humor—"Fusion is the energy source of tomorrow, and it always will be," jokes one Administration official. But this year may be different. The November election of a Republican majority in Congress jolted the Clinton Administration into a frenzy of cost-cutting measures that will fall heavily on DOE. Energy Secretary Hazel O'Leary has pledged to chop her department's $18 billion budget by more than $10 billion over the next 5 years, including a $1.2 billion gouge in applied research. Within OER's $3-billion-a-year budget, says its director, Martha Krebs, "that puts at risk primarily fusion."

The most vulnerable programs are three critical elements of the U.S. magnetic fusion program: the Tokamak Physics Experiment (TPX), the International Thermonuclear Experimental Reactor (ITER), and the research base that supports studies ranging from basic plasma physics to the development of materials that would be used in a working fusion-power plant. The $742 million TPX will be designed to control the complex flow of plasma, test ways to recycle particles and disperse heat, and demonstrate continuous operation of a tokamak. At the end of the year DOE officials want to start work on the machine, which would be built at the Princeton Plasma Physics Laboratory and be completed by 2001. ITER, involving scientists from the United States, Europe, Russia, and Japan, is an $8 billion to $10 billion machine that would reach ignition for long periods and show the feasibility of a host of technologies. A conceptual design is due in 1998, with completion—at a site not yet designated—a decade later. And DOE officials say the $250-million-a-year base program is needed to fill in major technological gaps such as how to build the blanket modules to cover a tokamak and convert the energy of neutrons into heat. (Another part of DOE manages the smaller inertial confinement fusion effort, an alternative approach that uses lasers to ignite brief pulses of fusion.)



Tight squeeze. A flat budget—which may now be wishful thinking—is a far cry from what previous panels have recommended for DOE's fusion program.

To do all that would require a budget of nearly $1 billion a year by the turn of the century. But "it's fair to say that's not going to happen," notes DOE Undersecretary Charles Curtis. Last month Curtis showed members of DOE's Fusion Energy Advisory Committee charts depicting a stagnant budget for fusion into the next century. Under such a scenario, the program's base would have to be cut by more than half, to about $112 million in 2000, Curtis says, to pay for TPX and initial ITER costs that begin to balloon in 1996. But even this does not take into account the huge design and construction costs of ITER, which by itself would consume more than the current budget.

Just holding the overall fusion budget level may prove a herculean task, however, given White House pressure on agencies to reduce spending before Congress does it for them. Administration and university sources have told *Science* that DOE has asked for level funding in 1996 for magnetic fusion, but that the White House last week was considering figures from $300 million to as low as $200 million. Clinton's budget plan is expected to go to Congress in early February.

The dismal budget prospects prompted this week's meeting to provide the Fusion Energy Advisory Committee with a set of budget options for the next few years, the first step in a process that is expected to take several months. Davies would not speculate on what alternatives could emerge from the group of fusion experts, but the exercise almost certainly will pit researchers who insist more research is necessary against those eager to begin building the big machines.

"It's hard to believe you can build TPX and ITER on a flat budget," says Richard Hazeltine, a physicist at the University of Texas, Austin, and a member of the ITER steering committee. "It's just short of ridiculous." Hazeltine says there is talk of trying to do ITER more cheaply by breaking it up into three smaller machines that would be upgrades of current facilities—one in Japan, one in Europe, and one in the United States. But Davies says this doesn't make technical sense. ITER Director Robert Aymar agrees. "You could get some results through upgrades, but nothing that would really show fusion power is feasible," he says.

As they plan for hard times, fusion advo-

cates of all stripes are looking to their allies in the Administration and Congress to prevent a bad situation from becoming even worse. In particular, they are hoping for ammunition from a review of the fusion program by the President's Committee of Advisors on Science and Technology (PCAST). The review, which has been delayed by haggling between White House and DOE officials over its scope, is due to be completed in June or July—about the same time that more exact cost data on ITER are ready. "In the best of all possible worlds, they could say go ahead with TPX and ITER," says Krebs.

Even if they do get support from PCAST, however, Congress could be a hard sell. Krebs is counting on support from New Jersey lawmakers in the upcoming budget fight, but she'll have to do it without a key advocate, former Representative Dean Gallo (R–NJ), who died last year. Supporters are also likely to face some powerful opponents: A bill co-sponsored last year by Representative John Kasich (R–OH)—now the chair of the budget committee—called for major cuts to the fusion program. "Everything is going to be under the microscope," says Bruce Cuthbertson, Kasich's press secretary.

Other influential Republicans, like Representative Robert Walker (R–PA), the new chair of the Science Committee, could serve as a bulwark against deep cuts in the budget. But Walker, who advised Kasich last year on science issues, has never been an advocate of fusion: His real interest lies in promoting hydrogen as an alternative energy source. "We need to take a look at the money we're spending in the fusion area," he told reporters last month. Walker also says he's concerned about the recent increase in the cost of TPX. But Rush Holt, deputy director of the Princeton lab, says that the $160 million increase over 1993 estimates—a rise of 28%—was caused mostly by funding shortages that have delayed the start of construction, rather than poor management or technical uncertainties.

Davies argues that fusion should be a natural for the new Republican majority. "It exactly fits what government should be doing," she says—investing in a venture that is too risky for industry but one that promises significant gains for society. But, she acknowledges, "the situation is very serious, and it is high time we start preparing ourselves for the worst. Then we just hope it doesn't turn out that way."

–Andrew Lawler

THE NEW CONGRESS

Agency Chiefs Seek Help With Budgets

The standing-room-only crowd was prepared for fireworks. But at last week's 3-hour hearing in the House Rayburn Building—the first meeting between the new Republican-dominated House Science Committee and science agency chiefs—there were mostly soft words and promises of a bipartisan effort to protect research in the months ahead.

"There is a mutual willingness to cooperate here," Representative Robert Walker (R–PA), the new panel chair, told *Science* afterward. "I think we can have the kind of dialogue that will ensure we achieve a common voice." Added Walker's predecessor, Representative George Brown (D–CA): "In many respects, we're all on the same wavelength."

The common foe uniting the two sides is the budget-cutting frenzy sweeping both the White House and the Republican majority (see p. 164). Walker is not immune to such sentiments: He wants to pull the plug on efforts like the Commerce Department's $430 million Advanced Technology Program (ATP), for example, and limit the growth of applied research programs at the National Science Foundation (NSF). But he says he intends to fight proposals to cut the government's overall investment in science and technology. And his status as the second-ranking Republican on the powerful Budget Committee gives him influence in what steps the new majority may take.

House Speaker Newt Gingrich (R–GA) "is very much in favor of keeping a strong presence in the sciences," Walker emphasized, adding that Gingrich made Walker a leader on the Budget Committee in part for this very reason. The committee chair, Representative John Kasich (R–OH), is working on a budget plan that would reduce federal spending dramatically to pay for tax cuts. This plan, which will be written into a budget resolution, will play a major role in setting the Republican agenda by giving the Appropriations Committee very specific directions to follow in carving up the 1996 budget.

To ward off spending cuts, however, Walker will need the support of the Clinton Administration, which will submit its 1996 budget request to Congress in early February. "The difficulty will be if the Administration comes forward with a whole load of science cuts," said Walker. "It will be very, very difficult for me in the Budget Committee to defend programs the Administration has said are not priorities."

RICK KOZAK

Science summit. Last week's hearing featured, from left: Commerce Secretary Ron Brown, science adviser John Gibbons, NASA's Daniel Goldin, EPA's Carol Browner, and NSF's Neal Lane.

John Gibbons, the president's science and technology adviser, pledged his support at the hearing, telling the science committee that "we'll stand and fight with you" to resist budget cuts. Like Walker, Gibbons can also use some help. Administration officials say he has had limited influence over the budget requests, despite a presidential report last summer that proposed increasing the nation's spending on science to 3% of the gross national product from its current level of 2.6%.

Although collegiality was the watchword at last week's hearing, there were some differences of opinion between Walker and the science chiefs—in addition to Gibbons, the panel heard from National Aeronautics and Space Administration Administrator Daniel Goldin, NSF Director Neal Lane, Environmental Protection Agency Administrator Carol Browner, and Commerce Secretary Ron Brown. Walker wants to loosen environmental regulations, encourage private sector research and development through tax breaks, and withdraw funding for applied research programs designed to benefit U.S. companies directly. None of the agency chiefs endorsed these ideas, but neither did they want to appear openly antagonistic toward their new congressional masters. "The devil lies in the details," warned Gibbons. "We have common goals, but ultimately we have to see whether we have common ideas about where we put our resources." Commerce's Brown was a little more forthright: He pledged to fight efforts to kill ATP, denying that the program "picks winners and losers" and arguing instead that it simply lends a hand to small entrepreneurs with good but risky ideas.

Specific disagreements aside, the Republican takeover will be a boon to science, promises Walker, who becomes quite animated when discussing the subject. "We are certainly not looking to hang science by any stretch of the imagination," he told reporters. "Science is going to be strengthened by a lot of the decisions that will be made in the next couple of years."

--Andrew Lawler