Congress authorizes faster magnetic-fusion program

The Magnetic Fusion Energy Act, which President Carter signed into law last month "represents a remarkable consensus of Congressional opinion over the appropriate pace of magnetic fusion research," according to John Clarke, deputy associate director for fusion energy at the Department of Energy. It provides for an accelerated program of research and development of magnetic fusion technology with the ultimate goal of having an operating magnetic fusion demonstration plant before the end of the century.

Rep. Mike McCormack (D-Wash.) first introduced a precursor to the final Act last winter. DOE argued against the McCormack bill, saying that it was unrealistically ambitious (PHYSICS TODAY, May 1980, page 114). It would have required, for example, completion of the Engineering Test Facility by 1987. Last February, DOE convened a panel under the chairmanship of Solomon Buchsbaum (Bell Laboratories) to consider the pace of the magnetic fusion program. That panel reported in June that "the US is now ready to . . . [explore] the engineering feasibility of fusion power" (PHYSICS TODAY, August 1980, page 21). But instead of the ETF, the panel proposed a more modest Fusion Engineering Device. The final draft of the fusion bill, actually a compromise between McCormack's and another bill introduced in the Senate by Paul Tsongas (D-Mass.), calls for completion of an FED by 1990, which DOE considers reasonable.

The Act states that progress in magnetic fusion is currently limited only by available funds, and not by technical barriers, and so calls for a doubling within seven years of the present funding level for magnetic fusion and a 25% increase in funding in Fiscal Years 1982 and 1983. This would bring the 1982 level to about \$500 million, and Clarke told us that the budget DOE submitted to the Office of Management and Budget for FY 1982 is not inconsistent with this objective.

The bill cites some specific research areas that should be stressed, including plasma confinement, alternative confinement concepts and materials.

To implement the needed engineering development, the law directs the Secretary of Energy to develop a plan for the creation of a national fusion engineering center, which would accelerate fusion technology development by concentrating and coordinating the major engineering devices and associated activities. The Secretary is also instructed to set up something akin to the old standing committee AEC had for magnetic fusion.

Whether the intent of the bill will be followed through with the necessary appropriations in the coming years will in large part depend on the new Congress, but the 96th Congress passed the legislation with strong bipartisan support in both houses. —MEJ

John Deutch (left), formerly of DOE, and Sen. Paul Tsongas (D-Mass.). Tsongas introduced the fusion energy bill (see story at left) in the Senate; an interview with Deutch appears below.

Deutch reflects on energy policy

Until his resignation as Under Secretary of Energy last spring, John Deutch was what one might call the "czar" of energy research in the US, responsible for an \$11-billion research and development program. With the creation of DOE in 1977, Deutch, then chairman of the chemistry department at MIT, was hired as director of the Office of Energy Research. While director, he headed an interagency review group on nuclear waste management, negotiated the implementing accord between the US and the People's Republic of China on cooperation in high-energy physics, assisted in a domestic policy review on solar energy, participated in the Foster Committee's review of fusion programs and created the Energy Research Advisory Broad. Deutch also led the Administration's effort to establish a synthetic-fuels corporation. Last year Deutch was named Under Secretary of Energy. He has also served as Acting Assistant Secretary for Energy Technology.

Deutch is now back at MIT, but he has remained active in national energy affairs. We recently spoke with him in Cambridge, and his replies to our questions follow:

How effective is DOE in managing basic research?

Let's look at basic research in the Department of Energy. We can divide it into four parts. One is in high-energy physics, the second is in nuclear physics. My own view is that the record over the past four years in both those areas shows that in fact the Department of Energy did a very fine job.

Now let me turn to the other two areas of basic research. The third one is the Basic Energy Sciences program, which is run by the Office of Energy Research. There we enjoyed, for a three-year period, average annual increases of 20%, I believe, with requests in the President's budget even larger than that. The Basic Energy Sciences program has strengthened in many ways. There were some things we were never able to accomplish; I wanted very badly to see a basic engineering program put in place, but we could never get the support in Congress to accomplish that.

Now the fourth area is in a way the most difficult, and in a way the most important. That is where the technology programs themselves undertake the fundamental work that supports their technology development efforts; that is, not in the Office of Energy Research but under the assistant secretaries for fossil, solar, nuclear and so on. Here the record is extremely mixed. There are places (for example, the photovoltaics program, the magnetic fusion program, the weapons program and the naval reactors program) where there was reasonable, if not quite impressive, basic and applied research integrated into the program activities. There are other parts of the Department in this critical fourth area where that integration has not taken place at the pace that I believe is desirable for the proper development of the technology.

Do you think DOE is the right agency to fund high-energy physics?

In my view it would be a serious mistake to shift high-energy physics out of the Department of Energy. I did not start with that point of view. I thought that in terms of the merits of the program, it would be more logical to have it in the National Science Foundation. But NSF does not have the experience in the management of large projects that DOE has. And that requires quite an infrastructure; it's not just having people in Washington, but it means having field offices with experience in construction management. (In fact, if I recall properly, in the fiscal '80 budget, the Office of Management and Budget asked, and I agreed, to take over one of the NSF construction projects, the Michigan State cyclotron.) So in these areas which are so large-facility oriented, because we have both the laboratories and the experience running the construction projects, while it may not make great sense in principle, it does in practice.

Finally, there are some rather practical Congressional attitudes that I think we need to be much more sensitive to. And I frankly believe that the high-energy physics community agrees with this view. The committee responsibilities are chaired by individuals who have a long-term familiarity with the subject, and that is remarkably important. To have the programs under the responsibility of people like Scoop Jackson, Bennett Johnston and Don Fuqua, is just, practically speaking, very important and they have all been, more than is widely recognized, critical and important supporters. I don't believe you can point to that kind of sponsorship for NSF, Don Fuqua being a notable exception.

How did the so-called Deutch floor for funding of high-energy physics come into being? (PHYSICS TODAY, September, page 121)

The first or second week that I was in the Department of Energy, in October 1977, there was an outstanding budget issue—the first $23 million for construction of Isabelle. There was, at that time, also a very strong drive for more funds for Fermilab (the Energy Saver–Doubler project there). The decision to undertake these projects had to be made with a great deal of reluctance in DOE and at OMB because it appeared at that time that there was roughly a $250-million price tag associated with Isabelle and around an $80-million price tag associated with the Energy Saver–Doubler program. There was also concern that insufficient resources in the high-energy physics program were being allocated to operations in contrast to construction. Furthermore, in October of 1977 there was an enormous amount of attention placed on energy R&D needs.

So my problem, as I saw it, was first to make a judgment about whether either of those two projects should be supported (and, I might say, at the time I was inclined not to do so) and secondly, to put together a program that would demonstrate that we could complete both these programs without completely busting the budget. With respect to the first, very much as a result of my conversation with outstanding physicists and with HEPAP, I became convinced that it was worthwhile to support these projects sooner rather than later. And secondly, I was able to put together a minimum program which demonstrated that over a five-year period—with the exception of a jump in Fiscal '80—it was possible to do these two projects with a real $300-million floor.

With the support of the high-energy community, I was able to convince Jim Schlesinger (and I might say OMB was delighted knowing that they had guideposts for a three- or four-year program) and it got put into the 1979 budget. The important thing is that it is a floor, and we did manage in fiscal '80 to find additional resources to go over the floor. For example, we accelerated the completion of PEP. What was not intended was that it would be a continuous floor. It was a one-time five-year program during the period needed for the completion of these facilities. And quite frankly, it does not, in my view, deserve to be pushed beyond that time period, which I guess will end in Fiscal '84.

The one mistake I did make was I insisted on having the discussion in terms of real dollars, that is, without including inflation. What we did not recognize, and this has been a source of terrible problems for the community, was the enormous jump in the inflation rate and the differential between the cost increases the labs were going to experience, particularly because they buy so much power, and what the average allowable inflation rate would be for the purposes of figuring the budget. I think that made the arrangement more difficult than it otherwise would have been. On balance, however, I think it's a good example of sensible research planning because it did serve the fundamental purpose of demonstrating that you could have multiyear stability.

My great worry now is whether the high-energy physics community recognizes how important it is that these two projects come in on time and at cost.

Why is that?

It has always been the history of the high-energy physics community that the projects they have done have been on schedule—for a very important reason: The builders of the facilities were also the users; so they had an incentive for rapid completion at low cost. But I worry very much about the difficulties currently being experienced at Brookhaven with the Isabelle superconducting magnets. Because one of the great selling points of the high-energy physics program and high-energy physics projects is that they're not going to be trouble; they are going to produce important results and they are not going to be an unexpected drain on the budget, as history bears out—PEP was that way, Fermilab was that way.

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Has high-energy physics been getting increases commensurate with inflation?
OMB sets the inflation rate used in budget preparation, except for construction projects. It is true DOE-wide that the inflation rate that OMB sets is less than the cost increases that are being experienced. But let's say the high-energy physics community experienced a cost increase of 17 or 18% because of the rising cost of power. And let's say the DOE's weapons program had also experienced a cost increase of 17 or 18%. OMB's number might be only 10%, because that was established government-wide. It's very difficult to recognize this inflation differential for the high-energy people and not for the weapons people, or the fossil-fuel people, or the solar people. And we shouldn't be too charitable to the high-energy community. If they experience cost increases of 15%, but the average inflation rate for the country is 10%, what it reflects is that they are buying goods and services which are going up faster than inflation. They're not supposed to be insured against that.

If most energy programs are experiencing 17% cost increases, and OMB hands down a figure of 10%—
—then you've got a problem.

Is that a common problem?
Yes, that's always the case. OMB is trying to stick with low numbers so as not to fuel the inflation rate. If OMB handed down an inflation rate of 17%, then all of the aggregate demand for government goods and services would go up that much.

Why did your office disagree with Rep. Mike McCormack's plan to speed up the pace of magnetic fusion research?
Here's the really critical point: There is time to do the fusion job right. Fusion research (and I am speaking about magnetic fusion only) is principally, although not exclusively, directed toward some electricity-generating technology. But the short-run problem in the US is not new electricity-generating technologies because we have available coal-burning and fission once-through nuclear reactors. To be sure, there may be desperate problems associated with the use of both these technologies, but they are available to us.

Furthermore, if you look at the energy research and development budget, you find that 70 cents of every research and development dollar is going towards electricity-generation technology.

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In the long term, in my view somewhere in the period 2010–2025, we will need a new electricity-generating technology. I would like there to be the opportunity for this country to choose between breeders, fusion and appropriate solar technology. Now that's the sort of time scale where commercialization is going to have to begin seriously.

My concern was and is, given the time scale on which we require fusion and this fact about the fraction of the dollar that is going to electricity generation, that we may make a premature commitment to another large facility or more than one facility, without the assurance of adequate resources for the underlying technology development. Now, Mike, as I understand it, has a more optimistic view about the pace at which this should go forward. It is based on his estimate of the amount of resources that will be available and voted in Congress, and the technical readiness of fusion. However, I note that Congress has recently passed a magnetic-fusion energy development bill which I strongly supported. (See the story on page 61.)

Do you think President Carter's goal of 20% solar by the end of the century is realistic?
I have consistently argued against fixed quantitative goals for energy policy. I have argued against the 20% goal for solar energy; I have argued against the fixed goal of, say two million barrels a day by 1992 for synthetic fuels; I have argued against a fixed goal for the number of nuclear reactors that one wants to have on line. I do that because I believe that the energy future is highly uncertain, not only with respect to technology, but with respect to economics, and that it is in fact counterproductive for the Federal government to say that we are aiming for a goal, without allowing for developments in the marketplace.

DOE has expanded its involvement with foreign governments over the past few years, hasn't it?
I don't think you can point to an agency that has accomplished more in the last few years than DOE in international science and technology. DOE has managed to produce an energy research and development agreement with Japan that was really a landmark agreement. We also were most successful, and I believe we still are, in working out a cooperative agreement with China. We have increased our efforts with the European Community and with Mexico.

Is there more than just good will behind these agreements?
Remember that the Chinese produce 2 million barrels of oil per day, and they are exporting about 300 000 barrels per day to Japan. In the context not only of broad political interests with China, but with regard to our energy policy, I think that the contribution the science and technology agreement makes is absolutely critical. By no means should one say that the balance sheet on S&T cooperation should be evaluated on S&T grounds alone. I would say that the Chinese R&D agreement is part of a broader overall relationship with China on energy matters, including the development of coal, petroleum and hydroelectric power. The case with Mexico is similar. We are about to enter into an era where not only the US, but the rest of the countries of the free world, have a major energy relationship with Mexico, and an energy science and technology agreement has to be seen in that broader context.

Do you have general reflections about your experience at DOE that we haven't yet covered?
The major point is that as long as there is public uncertainty about what to do on energy, it is inevitable that an Executive department, such as DOE, will reflect that uncertainty. Few people, I think, can appreciate the difficulties of designing and implementing a research and development program when there is that absence of consensus. —MEJ□