

DOE budget cuts fusion and boosts basic research

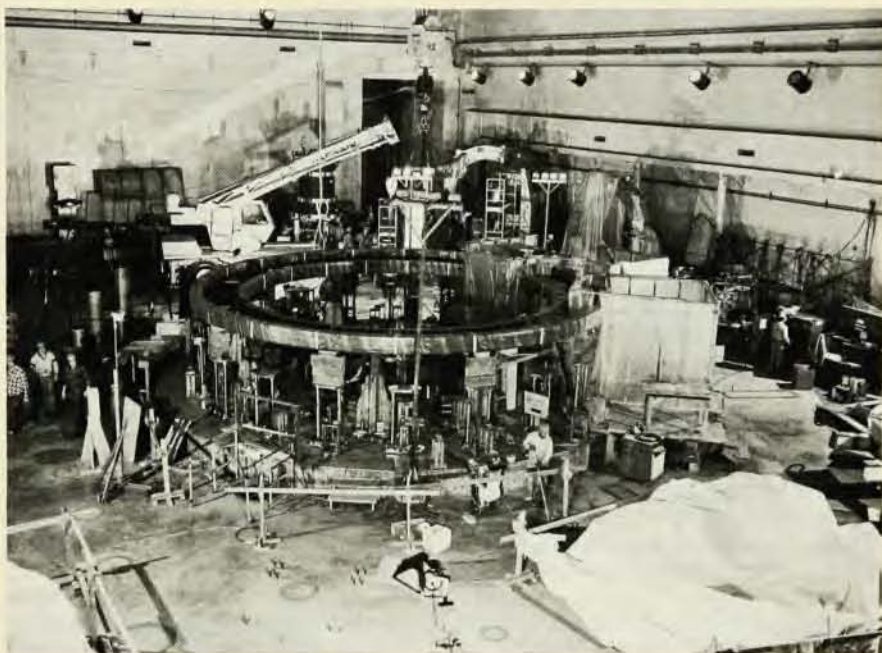
The FY 1983 budget request, submitted by President Reagan to Congress in February, assumes that his plan to dismantle the Department of Energy will receive Congressional approval. Reagan's plan proposes transferring DOE research activities to the Energy Research and Technology Administration within the Department of Commerce, with funding for ERTA increasing to \$8.444 billion from \$8.271 billion in FY 1982.

The budget request reflects a change in priorities. Funding for energy programs, which include magnetic fusion, nuclear fission, fossil fuel, solar, geothermal and energy-conservation research, decreases from 29% to 27% of ERTA funds for FY 1982. Although support for defense activities (comprised primarily of nuclear weapons research and materials production) increases to 47% from 36% in FY 1982, funds for inertial confinement fusion research included in this support decrease from \$209.1 million in FY 1982 to \$118.8 million in FY 1983. General science research, which includes support for high-energy physics, nuclear physics, life sciences and nuclear medicine applications, increases to 5% of the ERTA budget from 4% in FY 1982. Operating funds are up in almost all areas, with corresponding cuts in construction and capital equipment budgets. See the table for details.

Fusion. Both magnetic and inertial confinement fusion budgets are cut in the FY 1983 request. Magnetic fusion is reduced by \$10 million from \$453.8 million in FY 1982 to \$444.1 million, and inertial confinement research funds are almost halved.

What is being cut in the magnetic fusion budget? Construction funds are being reduced 61% and capital equipment is reduced 6%. Operating funds are being increased 2%.

Part of the change represents completed construction. The construction budget for the Tokamak Fusion Test Reactor at Princeton will go to zero, and TFTR will receive \$97 million for operating expenses. At the Large Coil Test Facility at Oak Ridge, construction will be completed with \$6 million



Tokamak Fusion Test Reactor at Princeton is scheduled to be completed by the end of this year at a capital cost of \$314 million. In this February photo the large poloidal field coils are being connected in place. Other major components, visible in the background, are three toroidal field coils to the right of the exit and the inner support structure to the left.

appropriated in FY 1982; LCTF is slated for no new construction money in FY 1983 and \$3 million for operating. The Fusion Materials Irradiation Test Facility at Oak Ridge, slated to be deleted from the FY 1982 budget but reinstated by Congress with \$14 million in funding, receives no new money in this request for FY 1983. John Clarke, deputy head of DOE's magnetic fusion research division, told us that \$4 million from FY 1982 funding will be used to finish R&D and design work with the intent of restarting construction of the FMIT when funds permit.

The Elmo Bumpy Torus-Proof of Principle project is also being cut from a \$25 million investment, scheduled for FY 1983 to permit vigorous construction, to \$4 million. According to Clarke, the \$4 million will allow essential R&D to continue, but it will become a FY 1984 budget decision whether or not to go ahead with construction.

These cuts come at a time when fusion

research was scheduled to be accelerated under the impetus of increased Federal funding mandated by the Magnetic Fusion Energy Act, passed by Congress (with only seven dissenting votes in either House) in October 1980 (PHYSICS TODAY, November 1980, page 61). The Fusion Act calls for a 25% increase in magnetic fusion for FY 1982 to \$500 million, and an additional 25% increase in 1983 to \$625 million, to be followed by increases to double funding levels in the next seven years. The FY 1982 budget was \$50 million below this level, and the cut requested for FY 1983 would put funding \$180 million below the projected goal.

Asked what were the reasons for the fusion budget cuts, Alvin Trivelpiece, Director of Energy Research at DOE, told us "National economic conditions do not make it possible to have programs that are going to grow substantially, but we will continue to support high-risk, long-term R&D as a policy."

He cited increased support for high-energy physics research as an example of this policy.

Edwin Kintner, formerly director of DOE's magnetic fusion research division, resigned from his DOE position in December over fiscal policies for fusion research. Cuts to the fusion budgets, according to Kintner, were made for basically two reasons: He told us, "One reason is that people are afraid that if there is success with fusion research there will be less thrust to continue with the breeder reactor. Another reason is the Administration's reduced concern for energy supply research, reflected in the gutting across the board of all but the nuclear programs." The FY 1983 request would increase the Clinch River Breeder Reactor budget 108.2% over FY 1982 levels, while magnetic fusion is cut 2% and fossil, solar and other alternative energy research budgets take cuts ranging from 24% to 84%.

Kintner said that his division in DOE had previously accepted a compromise—10% increases for magnetic fusion in FY 1982 and FY 1983, in lieu of the 25% increases for those years called for by the Fusion Act of 1980. Restitution for the slowdown was to be made when Reagan's economic policies brought deficits down and the budget into balance in 1984. Last summer, further cuts for FY 1983 were requested by the Office of Management and Budget, Kintner explained. He actively engaged in negotiations with OMB in an effort to keep the program initiatives intact and to prevent further cuts. His efforts did not succeed. Compounding what Kintner described to us as "the loss of every significant initiative over the last five years," an OMB directive instructed Kintner to reduce the budget for the Mirror Fusion Test Facility at Livermore by \$40 million, and to distribute those funds over the entire fusion budget. The cut was later reduced from \$40 million to \$25 million. Thus MFTF-B will receive \$40 million in construction funds in FY 1983, down from the scheduled \$65 million. (Total cost for its construction was estimated in 1980 at \$226 million.)

The cut to the MFTF-B precipitated Kintner's resignation, he told us, "on principle, because I opposed OMB ignoring the point of view of the program director and removing the thrust of a strategy for research support that had been worked out over many years."

The MFTF-B cut is part of a general cancellation of many of the directives in the Fusion Act. The budget for the Center for Magnetic Fusion Energy goes to zero in FY 1983. The Center was slated by the Fusion Act to be used to support research in preparation for developing a Fusion Engineering Device and to evaluate the feasibility of expanding the FED program. The FED

DOE physics-related research

	FY 81 (Budget authority in millions of dollars)	FY 82 \$364.50	FY 83 request \$429.00
Total high-energy physics (see table on page 20)	\$352.20		
Nuclear physics			
Medium-energy physics	46.00	50.60	53.10
Heavy-ion physics	39.06	41.81	39.70
Low-energy physics	11.58	12.26	12.40
Nuclear theory	7.00	7.70	8.15
Construction	11.30	12.00	7.70
Capital equipment	9.87	9.51	9.90
Total nuclear physics	124.81	133.88	130.95
Basic energy sciences			
Nuclear science	20.46	22.67	30.64
Materials science	89.08	96.19	108.70
Chemical science	59.72	63.67	70.00
Engineering, applied math, geosciences	24.10	25.00	31.05
Advanced energy projects	6.35	7.40	8.30
Biological energy research	7.25	8.50	9.50
Construction	3.50	.60	3.40
Capital equipment	14.53	16.39	18.15
Program direction	2.50	2.90	3.10
Total basic energy sciences	227.49	243.33	282.85

program, also scheduled to be accelerated by the Fusion Act, will not be expanded in FY 1983.

Clarke told us that he would try to maintain the priorities outlined by the Fusion Act of 1980—to bring the technology along in order to establish engineering feasibility for fusion, and to generate a broader scientific understanding of magnetically confined plasmas. Asked the reasons for the cuts, Clarke told us that "there was no scientific justification for these cuts, and no technical reason for delaying construction." He said the cuts were made due to budgetary constraints imposed by economic conditions.

When we asked Trivelpiece whether the OMB had dictated the DOE fusion research cuts he told us that "the decision was made in interaction with the OMB. It is somewhat unrealistic to think that OMB and the Office of Science and Technology Policy decided

and handed down budget decisions. That is simply not true."

Inertial-confinement fusion. The budget decrease for ICF research in FY 1983 includes both a reduction in operating expenses from \$122.4 million in FY 1982 to \$104.0 million, and a reduction in construction from \$75.7 million in FY 1982 to \$2.8 million.

Richard Schriever, director of the inertial confinement fusion office at DOE, informed us that the decrease in operating funds "represents a slowing down of the pace of progress, but we will still be doing significant experiments in each of the areas." The reduction in construction in part represents the completion with FY 1982 funds of three projects—the Antares High Energy (CO₂) Gas Laser at Los Alamos, and the Target Fabrication Facilities at Los Alamos and at Livermore.

According to Schriever, the most striking change in the construction

DOE fusion research

	FY 81 (Budget authority in millions of dollars)	FY 82	FY 83 request
Magnetically confined fusion			
Confinement systems	92.20	124.40	181.00
Development technology	59.00	61.60	74.30
Applied plasma projects	65.80	67.42	73.30
Planning projects	120.90	130.60	76.00
Center for Magnetic Fusion Energy	3.50	9.10	0.
Program direction	3.10	3.90	4.00
Capital equipment	36.90	42.00	39.50
Construction	98.40	119.10	46.00
Total magnetic fusion	393.50	453.80	444.10
Inertial confinement fusion			
Operating	139.70	122.40	105.00
Capital equipment	12.60	11.00	11.00
Construction	56.50	75.00	2.80
Total ICF	208.80	209.10	118.80

funding was that no additional funds were requested in FY 1983 for the Nova neodymium glass laser and target irradiation facility at Livermore, scheduled for completion in 1985. (Estimated to cost \$195 million, this project has already received \$141 million and was scheduled to receive the bulk of the remaining \$54 million in FY 1983 to meet its construction schedule.) The elimination of FY 1983 funds would allow installation of only two laser beams of the ten beams included in earlier designs, but would include harmonic conversion to permit experiments with shorter wavelengths (green). This would represent a reduction in energy capabilities to 20 kilojoules from the 250 kilojoules planned for the facility originally authorized by Congress. Schriever told us that DOE is carefully reviewing the various options for Nova, and technical considerations indicate that Livermore "should now proceed with construction of a ten-beam Nova, capable of focusing about 100 kilojoules of energy (red) on target; such an option would include laser color conversion for the second (green) and third (blue) harmonics. Proceeding with this option will require additional funding in the future."

High-energy physics. For FY 1983 an increase is requested to \$429.0 million from \$364.5 million in FY 1982 for high-energy physics research (see page 20 of this issue for details).

Nuclear physics. Enloe Ritter, head of the DOE nuclear physics division, said the heavy-ion budget includes a major reduction in research on the Brookhaven Double MP Tandem Van de Graaff and the Berkeley Super Hilac facilities.

The Argonne Tandem Linear Accelerator System construction project (an extension of the existing superconducting linac), is a high priority for heavy-ion nuclear physics cited by Ritter. This facility will receive its final construction appropriation of \$3.7 million in FY 1983, to be spent as construction proceeds over the next three years. In contrast to Brookhaven, whose nuclear research funding is being cut 5% overall, Ritter said Argonne will receive a small increase to keep the scientific staff and the laboratory facility healthy, in preparation for this accelerator coming on line in 1985.

In identifying scientific priorities, Ritter indicated that three facilities were recognized by DOE as unique in the world: In addition to the Bevalac at Berkeley, he listed the Los Alamos Meson Physics Facility and the Bates linac at MIT. LAMPF and Bates and outside users of these facilities will receive 85-90% of the medium-energy budget of \$53.1 million, but precise allocations between them have not yet been made. Ritter expects LAMPF to operate 20% below levels achieved in

FY 1981 and Bates to operate at about FY 1981 levels. This estimate may prove somewhat optimistic if electric power costs exceed DOE projections.

Responsibility for the National Superconducting Cyclotron Laboratory construction project at Michigan State University is being transferred back to NSF, which initially had responsibility for its construction (PHYSICS TODAY, August 1981, page 21). Prior to the decision to transfer, DOE had planned \$6.8 million for this project in FY 1983.

Solid-state physics. The FY 1983 budget request for basic energy sciences is up from \$243.3 million in FY 1982 to \$282.8 million, almost entirely reflected in an increase in operating funds from \$226.3 million to \$261.3 million. Completing the \$6.8-million swap mentioned above, the Stanford Synchrotron Radiation Laboratory is being transferred to DOE from NSF, and is budgeted at \$6.8 million in FY 1983. SSRL funding is for machine operation only; research funds will come from various sources, including a small amount from DOE.

According to Richard Kropschot, director of DOE basic energy sciences research, if you deduct the SSRL, the budget increase "represents no growth, but we are keeping up with inflation." The operating budget is up about 15%. Kropschot said this was in part to meet research needs for three facilities that have recently come on line—the Combustion Research Facility at Sandia, the Intense Pulsed Neutron Source at Ar-

gonne and the National Synchrotron Light Source at Brookhaven, now in the final stages of completion. Using these facilities are not his only priority, Kropschot said, but they are a high priority.

The costs for running these machines have increased more than the growth in Consumer Price Index, he said, and have taken up more and more of his budget each year. Kropschot estimated that full utilization of NSLS, budgeted for FY 1983 at \$4.8 million, would cost about \$10 million, and full utilization for SSRL would cost \$6-7 million, and thus full utilization would require a more generous budget than this year's.

The DOE FY 1983 budget faces its normally lengthy budget process, compounded by the need for Congressional approval of Reagan's plan for DOE. Guy Fiske, Under Secretary of Energy, speaking at a budget briefing on 6 February, explained that a new budget request will be needed if Congress does not approve Reagan's proposed transfer.

John Dingell (D-Mich), chairman of the House Committee on Energy and Commerce, spoke about the cost of the transfer at an 18 February hearing of this committee. He stated that unless savings to taxpayers were demonstrable and an increased effectiveness for energy policy would result from these changes, the plan should be rejected. Fiske, asked about the reduced costs for DOE, said "the savings were the result of changes in energy policy and are not due to the reorganization." —JC

Pope sends warning of nuclear dangers

Pope John Paul II recently sent delegations from the Pontifical Academy of Science to convey to the leaders of the US, the USSR, England, France and the UN a statement warning that "conditions of life following a nuclear attack would be so severe that the only hope for humanity is prevention of any form of nuclear war" and recommending "that nuclear weapons must not be used at all in warfare and that their number should be progressively reduced in a balanced way."

The statement was prepared by a working group of the Academy that is studying nuclear weapons.

A delegation visited President Reagan on 14 December. Its members were Victor Weisskopf of MIT and Howard Hiatt, dean of the Harvard School of Public Health, both members of the Academy and of the working group, and David Baltimore of MIT and Marshall Nirenberg of the National Institutes of Health, both members of the Academy who could not attend the working meeting held in Rome. They were introduced to the President by William Wilson, the President's Envoy

to the Holy See, and Archbishop Pio Laghi, the Apostolic Delegate in the US.

After introductions, Weisskopf explained the purpose of the Academy and its working group on nuclear war. Hiatt described what effect a one-megaton bomb would have detonated over the White House. According to US Arms Control and Disarmament Agency reports, at once 600 000 people would be dead; another 800 000 would be severely wounded. More than half of the physicians in the area would be killed or too seriously injured to treat the wounded. Citing the medical care the President received following the attempt on his life in March 1981, Hiatt estimated that a dozen patients in the President's condition brought simultaneously would have overwhelmed the resources of George Washington University Hospital. Further, in the event of a bombing that hospital would have been destroyed and survivors would require much more medical support than the President needed. Medical capacities would be exhausted immediately.