

Carter has tried to persuade Congress to drop the Clinch River Breeder Reactor, and Congressional moves to restore the program to the budget have gained strength from this latest international show of support for the breeder.

Research on light-water reactor safety is emphasized in the 1981 budget, as is isotope separation and waste management. The FY 1981 commercial nuclear waste budget of \$289 million includes funds for the President's recently announced nuclear waste management policy, which would provide a permanent repository for radioactive waste by the mid-1990's. The budget provides for further expansion of research begun in 1980 of non-salt geologic media for potential terminal isolation of nuclear waste. Carter has terminated, however, the Waste Isolation Pilot Plant near Carlsbad, New Mexico, which was to have housed defense nuclear wastes in a salt bed. The defense wastes intended for that facility will be placed instead in the first commercial waste-disposal facility. The Carlsbad site will be considered along with other sites for the first licensed facility.

Other programs. Carter has labeled conservation the highest priority in the DOE budget, claiming that energy savings of up to 50% are possible over the next 30 years. 1981 will be the first year in which the budget devoted to conservation activities surpasses \$1 billion.

Fossil-energy programs also exceed the billion-dollar mark for the first time in the 1981 budget request. \$1.1 billion will be spent in 1981 on research, development and commercialization of domestic resources of coal, oil and unconventional natural gas. Included in the budget is \$175 million for a Solvent Refined Coal plant at Newman, Kentucky, \$190 million for the SRC II plant at Morgantown, West Virginia, and \$55 million for a High-BTU Synthetic Pipeline Gas plant. Construction funds for these three demonstration facilities constitute 40% of the FY 1981 request for coal research and development.

Although an increase of 29% was originally planned for solar applications, only a 7% increase is allowed under the President's revised budget, and solar technology will increase even less—a mere 2%.

The President's budget amendment

DOE physics-related research

(in millions of dollars)

	FY 1980 (current plan)	FY 1981 (estimate)
High-energy physics		
Fermilab	67.8	75.0
Brookhaven	38.9	43.2
Argonne	9.8	7.5
SLAC	49.2	57.8
Berkeley	11.5	12.0
General R&D	41.8	45.9
Capital equipment	36.0	39.0
Construction	69.5	73.6
Program direction	0.6	0.9
Total high-energy physics	325	355
Nuclear physics		
Medium-energy physics	41.7	45.5
Heavy-ion physics	33.6	36.0
Nuclear theory	6.1	7.0
Construction	14.8	13.3
Other capital equipment	8.2	9.4
Program direction	0.2	0.3
Total nuclear physics	105	111
Basic energy sciences		
Nuclear sciences		
Nuclear research	12.0	13.3
Nuclear data measurements	4.9	5.2
Nuclear data compilation and evaluation	2.4	2.6
Heavy-element chemistry	3.4	3.7
Isotope preparation	8.0	8.6
Capital equipment	1.3	1.4
Total nuclear sciences	32.0	34.8
Materials sciences (including solid-state physics)	97.0	98.0
Chemical sciences	65.0	72.3
Engineering, mathematical and geosciences	21.3	28.7
Advanced energy projects	5.2	7.5
Biological energy research	6.3	8.7
Other capital equipment	0.1	0.1
Program direction	2.3	2.4
Total basic energy sciences	229	252

also killed a new \$3-million program to establish goal-oriented university research centers around the country. The centers were to have conducted research that fell between DOE's basic and applied research categories.

What will happen to this now quite lean budget on Congressional Hill remains to be seen, but all indications so far reveal that members of Congress are willing to go at least as far as the President in tightening the fiscal reins. —MEJ

Budget for fusion also rises 9%

The combined budgets for magnetic and inertial-confinement fusion would go up 9% between 1980 and 1981 under the President's proposed budget for the Department of Energy. The additional money will be used to increase support of concepts beyond the tokamak and to deepen our understanding of the physics issues of inertial confinement.

Magnetic fusion. The FY 1981 budget for magnetically confined fusion is \$396 million, 11% higher than the 1980 level, but 2% lower than the level announced in January. For several months a storm has been brewing over the most appropriate pace for the magnetic fusion energy program. The House subcommittee on en-

ergy research and production, under the chairmanship of Mike McCormack (D-Wash.), has been arguing that the time is ripe for a fast-paced fusion development program that would have as its goal an on-line electric power demonstration plant before the year 2000, at least ten years earlier than the current DOE schedule would permit.

McCormack has publicly asked the President to declare the development of magnetic fusion energy a major national priority and establish as a national goal the construction of a magnetic fusion electric generation demonstration plant before the end of the century. To accomplish this goal, he is calling for an in-

Deutch leaves DOE

John Deutch, who joined DOE in 1977 as director of the Office of Energy Research and who was named Under Secretary of Energy last year, has resigned from the Department. Deutch has returned to MIT, where he was a professor of chemistry before joining DOE. He told us that he will also continue to assist the Carter presidential campaign on energy matters.

crease in the 1981 magnetic fusion budget to \$500 million and has introduced (with 150 cosponsors) a bill in the House to this effect. McCormack's program would require almost immediate construction of the Engineering Test Facility. Current DOE plans are to initiate the ETF program in 1984.

McCormack's subcommittee has also passed on to the full committee a DOE authorization bill that amounts to \$450 million, \$50 million above Carter's request.

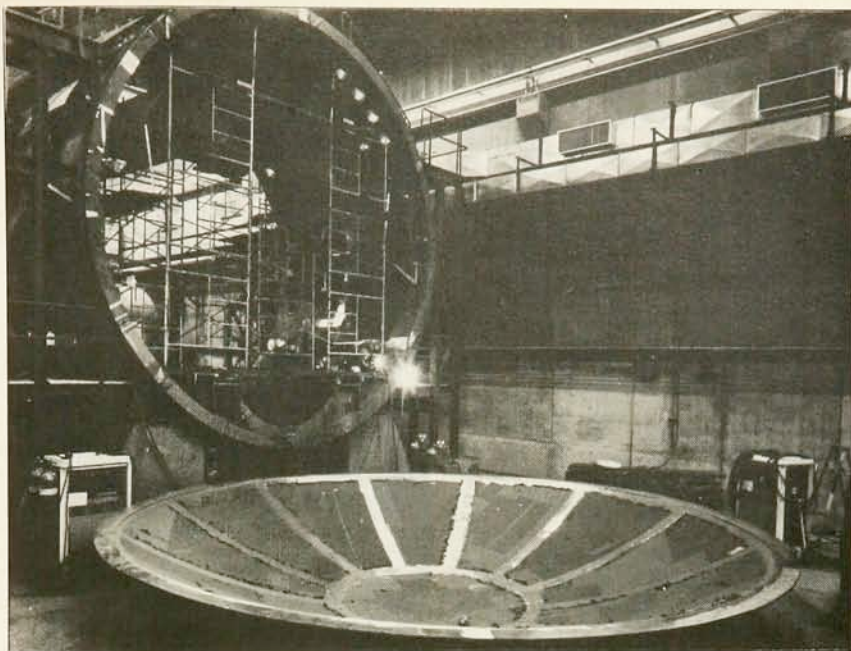
The Office of Energy Research recently asked a subpanel of the Energy Research Advisory Board to consider the pace of the magnetic fusion program. That group, headed by Solomon Buchsbaum (Bell Laboratories), is due to report in June.

The magnetic fusion program appears to be entering a new stage, one with less emphasis on large construction projects and more on making use of the facilities that exist. By 1982 all major magnetic fusion experiment construction should be finished, with the completion of the Tokamak Fusion Test Reactor and the Mirror Fusion Test Facility (MFTF-A). "Almost every time we think of a new problem, we find we have a facility that can be modified to work on it," John Clarke, deputy associate director for fusion energy, told PHYSICS TODAY. One such project under consideration is the MFTF-B, a tandem-mirror experiment proposed by the Lawrence Livermore Laboratory, which would be a major extension of MFTF-A. Despite favorable reviews, no decision has yet been made to go ahead with it.

DOE made a policy decision on magnetic fusion this year to continue new initiatives in plasma research despite inflation and despite a modest budget increase. "This meant reducing operations on some of our older facilities, such as Alcator A (MIT) and the Princeton Large Torus, perhaps before their time, to make room for the new initiatives," Clarke told us. The Department also redirected \$3-4 million worth of university contracts away from such areas as rf heating and linear magnetic systems toward more promising areas like diagnostic development and spheromak research, he said.

The national magnetic fusion computer center at Livermore will receive \$14 million for its first full year of operation in 1981. In addition, the computers located at the user service centers will be upgraded.

A major new initiative begun in 1980 was the Elmo Bumpy Torus. That program, funded at \$8.9 million in 1981, will absorb most of the \$7-million increase planned in the mirror fusion program. Now in the works is a proof-of-principle design for the EBT. DOE took four proposals submitted by industry for an EBT proof-of-principle experiment and combined the best features of each to



Target chamber of the Antares CO₂ laser-fusion system now under construction at Los Alamos. One end dome lies on the floor in front of the chamber. Experiments with Antares Phase I are expected to begin sometime in 1983. The glow on the chamber rim is from a welder's torch.

create what it is calling its EBT reference design, or EBT-P. The original version of the 1981 budget included \$10.9 million for EBT-P development and construction, but Carter has reduced that figure to \$7.4 million, stretching out the EBT-P schedule by 5 months. Also in the 1981 mirror fusion budget request is about \$25 million for MFTF-A R&D and construction.

A new concept in magnetic fusion that will be receiving increased attention in the near future is the compact toroid, a generic term under which DOE has grouped such design concepts as field-reversed theta pinch, field-reversed mirror and the spheromak. The ultimate goal of compact toroid research is to produce fusion reactors that are smaller than existing machines and that lack external field coils, simplifying their external design. Approximately \$7 million will be spent to develop this concept in 1981, primarily at the University of Maryland, Los Alamos, Livermore and Princeton. An additional \$1-2 million will be budgeted for theoretical work on the concept.

DOE expects to establish a new Institute for Fusion Studies in FY 1981 at the University of Texas. Marshall N. Rosenbluth, of the Institute for Advanced Study and the Princeton Plasma Physics Laboratory, has been named director. Similar in concept to the Institute for Theoretical Physics at the University of California, Santa Barbara, the fusion institute will have a staff of about two dozen at any one time, roughly half of whom are permanent. The institute will also house the US component of the joint theoretical institute with the Japanese that was es-

tablished in the US-Japan agreement in fusion signed last year. The institute will begin with a budget of about \$1 million.

Other magnetic fusion experiments funded in 1981 include: PDX (Princeton), \$13 million; Alcator C (MIT), \$5.7 million, and ISX-B (Oak Ridge), \$9.1 million.

In inertial-confinement fusion, work is now proceeding on conceptual designs for power reactors that would incorporate the various driver technologies now under development, and experiments on materials properties are leading the way for the first weapons technology applications. The President's budget reductions did not affect the inertial-confinement fusion program, which is funded at \$202 million.

Following a critical review of laser experiments, especially the Nova upgrade of the Shiva laser at Livermore, by an ad-hoc experts review group (PHYSICS TODAY, September 1979, page 106), DOE will provide \$52 million for glass laser research in FY 1981, 18% more than 1980. This will just "maintain the momentum of the program," according to DOE. No additional funds have been requested for continuing construction of Nova in 1981, but there is considerable interest among members of the House Armed Services Committee, which authorizes funds for inertial-confinement fusion, in seeing Nova completed on schedule. According to Melvin Price (D-Ill.), chairman of the Armed Services Committee, there is every reason to believe that Nova will provide neutron fluxes that can be used in nuclear weapons physics experiments in the laboratory.

In addition, Nova is the prime candidate, says Price, to achieve significant thermonuclear burn, which will allow simulated nuclear weapons effects testing to be done in the laboratory. "I consider it imperative that construction funds be appropriated in FY 1981 to keep the project on schedule," Price said.

Glass lasers at Livermore and at KMS Fusion, Inc (in Ann Arbor, Michigan), have been converted to short-wavelength (0.5-micron) operation. DOE is currently contemplating wavelength conversion down to one quarter of the characteristic neodymium-glass laser wavelength. This would permit the simulation of beam-target interaction for the very short-wavelength gas lasers, such as krypton fluoride, years before such lasers could be scaled up to comparable beam power on target.

Although the major glass laser experiments are conducted on the Shiva laser system at Livermore, smaller glass lasers are in operation at the University of Rochester and the Naval Research Laboratory. Livermore will act as a lead laboratory, coordinating the experimental work done on these machines with its own.

DOE plans to spend 40% more on CO₂ gas laser experiments in 1981, bringing that budget to \$41 million. Construction is continuing at Los Alamos on the Antares High-Energy Laser Facility, a carbon-dioxide gas laser that is to produce 50-100 terawatts in pulses of one nanosecond or one quarter nanosecond duration, respectively. The FY 1981 budget request for Antares is \$14 million.

Construction of a major upgrade of the Particle Beam Fusion Accelerator at



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Sandia, denoted PBFA II, will receive \$5 million in 1981 and is proceeding on schedule. Sandia is working on a more powerful design for PBFA II than was previously envisioned, based on new developments in the component technology. The particle-beam driver budget is up 25% in this budget, to \$15 million. During FY 1981 major experiments at the 30-TW, 1-MJ level will be conducted on PBFA I. If final focusing conditions are successful, this facility will allow significant thermonuclear burn (energy gain of 1-10%) to be achieved during FY 1981 or FY 1982.

Other ongoing construction projects in inertial-confinement fusion include target-fabrication facilities at Los Alamos (\$7 million) and at Livermore (\$5.5 million).

The budget for advanced driver development, sharply increased in 1981, includes funds for scaling experiments on rare-gas halide excimer laser test beds and heavy-ion fusion research at the Lawrence Berkeley Laboratory, Argonne and Brookhaven. But DOE may have some trouble convincing the Armed Services Committee to begin a \$15-million program in heavy-ion fusion because the immediate justification for such a program in terms of national defense is not entirely clear. "If a heavy-ion system is considered a potential candidate for energy production, the program should be supported by a committee other than Armed Services," says chairman Price. Members of the House Science and Technology Committee have expressed considerably more enthusiasm for heavy-ion research, and they may try to fund some of that work through their committee.

—MEJ

Grants available for data-base compilation

A new interagency grant program intended to foster the collection and evaluation of useful scientific data is being established with \$500 000 supplied by the National Bureau of Standards, NSF, DOE and the Office of Naval Research. Administered by the NBS Office of Standard Reference Data, the program will emphasize the development of critically evaluated data bases for topics such as the thermodynamic properties of pure and mixed substances, the energy levels of molecules, atoms and nuclei, the rate constants for chemical reactions and the optical properties of solids.

Proposed projects under this program are expected to have a well-defined goal and to yield results in one or two years. It is open to researchers in any organization, academic or otherwise, nonprofit or commercial. Those interested should contact the Office of Standard Reference Data, NBS, Washington, D.C. 20234.

NSF budget cut delays millimeter-wave telescope

President Carter has sent to Congress an amendment to his Fiscal Year 1981 budget proposal that would reduce the overall budget by \$15 billion, and this has meant some unavoidable cuts in the budgets of several agencies funding physics research. The National Science Foundation was originally slated to get \$1.1 billion, a \$155 million increase over 1980 (PHYSICS TODAY, March page 134). But, under Carter's amendment, that increase would be reduced by \$74 million.

Because basic research, especially in the physical sciences, occupies such a favored status these days, both in the Administration and in Congress, the bulk of the cuts will be made in science education, applied science and innovation programs. Only \$1 million will be taken from the \$73.5 million physics budget, and the burden will be pretty much evenly distributed over elementary-particle physics, nuclear physics, atomic, molecular and plasma physics and theoretical physics, so that no one program should feel too much of a pinch. A \$1.3-million reduction in the materials-research budget will bring the increase for the materials-research laboratory

back down to a level that may just compensate for inflation. Proposed increases for the National Magnet Laboratory and the synchrotron radiation facilities will not be affected, however.

The astronomical sciences budget will be reduced 2% to \$58.9 million. This will mean deferring the detailed design of a 25-meter diameter, millimeter-wave telescope. The remainder of the astronomical sciences budget will not be significantly affected.

Among the other reductions requested by Carter are \$17.4 million from the engineering and applied sciences budget, \$10 million from science education programs, \$14.3 million from the new facility improvement grant program (eliminating this program completely), \$5.1 million from the industry/university cooperative research program, and \$2.7 million from international programs.

The amount of new money that will be allotted to NSF to help stimulate industrial innovation (PHYSICS TODAY, January, page 116) has also been cut back considerably.

—MEJ

in brief

Nobel Prize winner Philip W. Anderson describes various aspects of basic scientific research in a film recently released by Bell Telephone Laboratories. The film, called "A Fundamental Scientist," is available on loan from Bell Telephone Company film-lending libraries and can be purchased for \$125.00 from M.G.S., 619 West 54th Street, New York, N.Y. 10019.

A new bimonthly journal, *Surface and Interface Analysis*, is now being published. A year's subscription costs \$120.00 and can be ordered by writing Heyden & Son, Inc. 247 S. 41st St., Philadelphia, Pa. 19104.